Participatory Educational Research (PER)
Vol. 8(1), pp. 248-264, January 2021
Available online at http://www.perjournal.com
ISSN: 2148-6123
http://dx.doi.org/10.17275/per.21.14.8.1

Examination of Turkey's PISA 2018 reading literacy scores within student-level and school-level variables

Hasan Yücel Ertem*
Department of Educational Sciences, Zonguldak Bülent Ecevit University, Zonguldak, Turkey
ORCID: 0000-0001-9058-641X

Article history
Received:
17.06.2020

Received in revised form:
12.09.2020

Accepted:
16.09.2020

Key words:
PISA 2018;
Reading literacy; ICT competence,
Student behaviour,
Hierarchical linear modelling

The purpose of the current study was to investigate both student-level and school-level factors influencing reading literacy of students in Turkey by using PISA 2018 data. The study focused on reading literacy since the main subject of PISA 2018 was selected as reading literacy. The design of the study is a correlational research examining the relationship between student and school variables and reading literacy. The stratified random sample consisted of 6890 15-year students from 186 different schools. Data coming from PISA 2018 dataset were analysed by Hierarchical Linear Modelling (HLM) at student and school levels. Student-level variables of disciplinary climate in test language lessons, enjoyment of reading, information and community technologies (ICT) competence, parental emotional support, perceived discriminating climate, and perceived cooperation significantly predicted reading literacy, while reading literacy was also predicted by school-level variables of proportion of parents involved in the school, shortage of educational material, student behaviour hindering learning, and teacher behaviour hindering learning. Fifty-seven percent of variance between reading literacy scores of the students were caused by differences between schools. Student-level variables which are disciplinary climate in test language lessons, enjoyment of reading, ICT competence, parental emotional support, perceived discriminating climate, and perceived cooperation significantly predicted reading literacy. On the other hand, school-level variables predicting reading literacy significantly were proportion of parents involved in the school, shortage of educational material, student behaviour hindering learning, and teacher behaviour hindering learning. By considering results of the current study, collaboration between school stakeholders is recommended to increase performance of the students.

* Correspondency: hyertem@gmail.com, phone: 0 536 317 03 81

Introduction

Considering historical developments in the world, there are different periods shaping humans' lives. While physically forceful people had established dominance on weak ones in earlier eras, qualified people with some skills have gained the control over unqualified ones in the knowledge era. In other words, physical force replaced with knowledge and education has become the core of this power balance. Communities turning this power on their favour give crucial importance to education. Barro (2013) states that developed countries are aware of the fact that education system is a key factor for economic growth. Therefore, they make huge investments for their education quality. In order to determine educational quality, some indicators are usable like scores coming from international exams that give opinion about the quality of education. Not only providing feedback on educational quality but also making comparisons with other countries are possible through the results of these exam. Thereupon, countries get a chance to shape their educational systems.

International surveys like Program for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Progress in International Reading Literacy Study (PIRLS) have become popular in recent years. PISA is organized in each three years by Organization for Economic Cooperation and Development (OECD). PISA is scored in terms of reading, science, and mathematics literacy. For each PISA implementation, a field is chosen as main subject by turns hence participants and analysists focus on this subject. Although countries and economies concentrate on mean scores of reading, science, and math literacies, this survey has a significant potential since big data are shared in order to analyse relationships between many variables. In other words, PISA presents data mine for researchers to investigate any relevant relationships. These relationships show results not only pertinent to educational development but also related to economic, social, and cultural facts.

Literature on PISA has a substantial body of scholarly work. In European region, Reparaz and Sotes-Elizalde (2019) investigated parental involvement over PISA scores in Germany and Spain and they found that even though there were great efforts for parental involvement, not all factors of involvement enhance higher achievement in science for both German and Spanish context. In the study by Hwang, Choi, Bae, and Shin (2018) PISA scores of 10 countries were analysed and the research results showed that there was a link between equity and teacher instructional practices and that frequency of student-centred method was positively related to closing the gap in science and math literacy between low and high socio economic status. Oliver, McConney, and Woods-McConney (2019) examined the efficacy of inquiry-based instruction on science by using PISA 2015 scores of six countries and they concluded that inquiry-based instruction associated with science literacy significantly. Considering reading literacy in PISA 2009, Lee and Wu (2012) found out that Information and Communication Technologies (ICT) availability at home improved reading literacy with the mediating effect of engagement in online reading activities whilst solitary ICT availability had a negative impact on reading literacy. These studies in the literature provided empirical evidence of the cognitive opinions like positive inputs lead to positive outputs in education.

Turkey has been participating PISA since 2003. Researchers in Turkey analysed PISA results in a widespread perspective using different variables from ICT to teacher education. These studies can be summarized as two groups: studies investigating factors related to achievement and comparison studies. Aytekin and Tertemiz (2018) compared PISA results of Turkey and South Korea in terms of economic indicators and they found that the reason behind South Korea's higher scores was related to economic development model based on exportation. Another comparison was performed by Yavuz and Çetin (2017) who found that problem-

solving competency was related to abandon, teacher morale, and mathematics competition in Turkey whereas obstacle and family donation were determinants of problem-solving competency in Serbia. Özkan, Özer Özkan, and Acar Güvendir (2019) examined professional development of teachers and teacher behaviours hindering learning for Singapore and Turkey context and they concluded that one of the reasons why Singapore got greater scores than Turkey did was meeting the professional development needs of teachers. That said, there are also comparison studies considering changes in PISA results for different periods (Bozkurt, 2016; Erdem-Kara & Tat, 2019; Özmusul &Kaya, 2014). On the other hand, a study by Yurttaş Kumlu (2018) showed that usage of information and communication technologies had a positive impact on Performance in PISA. According to Yorulmaz, Çolak, and Ekinci (2017), student performance was related to justice and effectiveness in usage of educational resources rather than amount of them, which was concluded with an analysis of PISA 2015 dataset.

Nature of data in PISA makes it difficult to assess nested data in two or more levels. Thence, Hierarchical Linear Modelling (HLM) is preferred by many researchers to eliminate disadvantages of aggregation and disaggregation methods in traditional analysis techniques (Tat, Koyuncu, & Gelbal, 2019). Since 2010, the number of studies conducting HLM has begun to increase. Acar and Öğretmen (2012) examined PISA 2006 science scores by multilevel analysis methods and found that school resources increased performance on science. Özer Özkan and Acar Güvendir (2014) conducted a multi-level study to check the relationship between socio economic factors and math achievement in PISA 2009. The authors revealed that father education, resources owned, and developmental level of city where the school is placed predicted students' math achievement significantly. In another study, Aksu, Güzeller, and Eser (2017) found out that student-level factors like gender, motivation, and self-efficacy and school-level factors like school income, number of math teachers, and number of students in school predicted math literacy in PISA 2012. Considering PISA 2015, Üstün, Özdemir, Cansız, and Cansız (2019) investigated factors influencing science literacy via HLM and manifested weekly science learning time as the strongest student-level factor and science specific resources as the strongest school-level factor.

Significance of the study

The current study has significance in terms of research, theory, and practice. In terms of research, the current study is one of the first study scholarly examining latest PISA i.e. PISA 2018, which tested 600000 15-year old students from 79 countries and economies. The main subject of the PISA 2018 is reading literacy which is defined as "understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society "(PISA, 2019). Turkey attended in PISA 2018 with 6890 15-year students from 186 different schools. Turkey got 466, 468, and 454 mean scores respectively from reading, science, and mathematics literacy, all of which are lower than OECD average, viz. 487, 489, 489 respectively. The researcher of the study did not come up with a study on PISA 2018 in the literature of Turkey while literature review part of the current study was performing. Thus, a gap in the literature is believed to be filled.

Theoretical significance of the study is based on trends in PISA literature. Three main trends draw attention: comparison with other countries, comparison with previous periods, and determination of student-level and school-level factors. Among these respects, the present study will produce a model concentrating on the relation of both student-level and school-level factors with academic achievement. This model will not only serve on theoretical discussions but also will be evaluated as empirical evidence for educational outcomes.

Considering practice, policy-makers and educational leaders may consider factors influencing literacy. Turkey, as a developing country, could not catch up with the quality of education in developed countries. Although Turkey has significantly developed in certain points like educational quantity such as the number of higher education institutions, number of teachers, and schooling rates, educational quality like academic achievement cannot reach the level of other OECD countries (OECD, 2017). Thusly, it is time to think about ways to set a balance between educational quantity and educational quality. Reforms on education system and strategies to ameliorate learning environments could assist to set a bridge between these via improving academic achievement in international exams.

Purpose of the study

The current study aims to investigate both student-level and school-level factors influencing reading literacy of students in Turkey by using PISA 2018 data. Why the researcher selected reading literacy as the focal subject is that PISA committee chose reading officially as the main subject of PISA 2018. In this respect, the research question is as below:

- Which student and school level factors significantly explain the variation in students' reading literacy achievement in PISA 2018?

Method

Design of the study

The design of the research is a correlational study analysing secondary data. Gall, Gall, and Borg (2003) defined correlational study as the study having the purpose to explore relationships among variables. In correlational studies, there are predictor and criterion variables. Predictor variable is the variable that is used to make a forecast about criterion or outcome variable while criterion variable is the variable being predicted by the predictor variable (Creswell, 2012). The predictor variables of the current study are at student level and school level. Student-level factors are disciplinary climate in test language lessons, enjoyment of reading, sense of belonging, parents' emotional support, perceived discriminating school climate, perceived cooperation, and ICT competence. The reason why these variables were selected is related to the nature of the current study and student characteristics. The first two variables were linked to reading literacy while remaining five variables were based on perceptions of the students. School-related factors are shortage of educational material, shortage of educational staff, student behaviour hindering learning, teacher behaviour hindering learning, and proportion of parents voluntarily involved in the school. The reason of choice of these variables were inclusion of many school components from parents to the material. The criterion variable of the study is reading literacy score in PISA 2018 dataset. Figure 1 represents the student-level and school-level factors of the study.

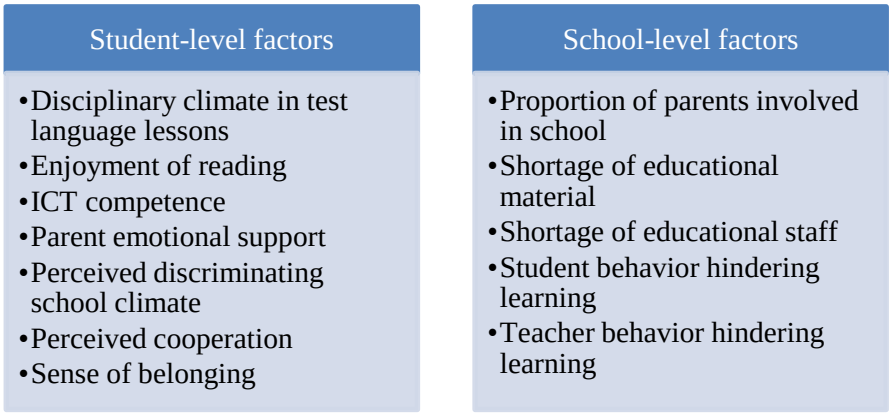

Figure 1. Variables of the study

Sample of the study

The sample of the study was 15-year old Turkish students participating in PISA 2018. This sample consisted of 6890 students from 186 schools. Stratified sampling was preferred in PISA e.g. Level 1 of Classification of Statistical Region Unit, type of school, administrative style of school, location of school, and gender were stratified in sample selection. Considering the first level Statistical Region Unit, most of the students (20.2%) were selected from Istanbul region while the least proportion of the students (1.6%) were participated from region of West Anatolian.

Data source

In the current study, secondary data coming from PISA 2018 student and school questionnaires were used. Datasets of both student and school questionnaires include data belonging to 612004 students from 21903 schools in 79 countries and economies. In both datasets, test items are formed as a mixture of multiple choice questions and questions requiring to be constructed by participants. There were also additional questionnaires prepared by countries for teachers and parents. Finally, countries had a chance to choose three optional questionnaires focusing on familiarity with computers, expectations for further education, and well-being. In order to achieve the purpose of the current study, two datasets were filtered by considering PISA results of Turkey; the data of 6890 students and 186 schools were available. For the context of the study, seven student-level and five school-level variables in addition to reading literacy scores were selected from PISA 2018 datasets to be analyzed. Table 1 depicts student-level and school-level variables.

Table 1. Variables and information about the items

Variables	Item Type	Sample Item
The first level: Student-level variables		
Disciplinary climate in test language lessons	Five items with 4-point Likert scale	The teacher waits long for students to quiet down.
Enjoyment of reading	Five items with 4-point Likert scale	Reading is one of my favorite hobbies.
ICT competence	Five items with 4-point Likert scale	If my friends and relatives have a problem with digital devices, I can help them.
Parent emotional support	Three items with 4-point Likert scale	My parents support my educational efforts and achievements.

Perceived discriminating school climate	Four items with 4-point Likert scale	They say negative things about people of some cultural groups.
Perceived cooperation	Three items with 4-point Likert scale	It seems that students are cooperating with each other.
Sense of belonging	Six items with 4-point Likert scale	I feel like I belong to the school.
The second level: School-level variables		
Proportion of parents involved in school	One ratio scale question	Discussed their child's progress with a teacher using their own initiative
Shortage of educational material	Four items with 4-point Likert scale	A lack of physical infrastructure
Shortage of educational staff	Four items with 4-point Likert scale	Inadequate or poorly qualified teaching staff
Student behavior hindering learning	Six items with 4-point Likert scale	Student use of alcohol or illegal drugs
Teacher behavior hindering learning	Five items with 4-point Likert scale	Teachers not meeting individual students' needs

Student dataset. Students answered questions related to their background information like attitudes, beliefs, and experiences. It consists of 1118 variables or items. For the purpose of the current study, seven student-level variables 31 items were included in the study. To check internal consistency, PISA 2018 reports of OECD were examined. Internal consistency of main scaled indices of Turkey data showed that Cronbach's Alpha values changed between .78 and .92 (OECD, 2019).

School dataset. School questionnaire including questions pertaining to school management and learning environment was administered to school principals. It consists of 196 variables or items. Among them, five variables having 20 items were selected for the purpose of the study. To check internal consistency, PISA 2018 technical report of OECD was examined. Table on scale reliabilities for all derived variables in the school questionnaire of Turkey showed that Cronbach's Alpha values changed between .79 and .89 (OECD, forthcoming).

Reading literacy. In PISA dataset, reading literacy has items or texts related to cognitive processes including locate information, understand, and evaluate and reflect. Further, texts are classified along four dimensions: source, organization and navigation, format, and type. There are three scenarios including totally 21 items. Through using responses coming from these items, 10 plausible values which are indicators of students' ability estimation were calculated in reading. For the purpose of the current study, one of these plausible values were used as the dependent variable. According to Wu (2005) usage of one of plausible values alone is enough to estimate the population parameters highly correctly.

Data analysis

Secondary data were analyzed by Hierarchical Linear Modelling (HLM) and the analysis was conducted in student and school levels. HLM is a complex form of least squares method. In this method, independent variables are separated to levels hierarchically so that variations on dependent variable are calculated more accurately. The reason why HLM was used instead of Multiple Linear Regression was that student data were nested in schools. Both school and student characteristics must be examined within HLM since education systems have a hierarchical structure. Further, HLM eliminates the violation of assumption of independent observation for nested data.

Assumptions of HLM are linearity, normality, and homoscedasticity. Linearity is an indicator the relationship between variables and was met due to straight lines observed in the analysis. Normality is related to normally distribution of the error terms of each level of the model and was provided by plots and histograms given by analysis. Lastly, homoscedasticity is an indicator for equal variances on groups and was assumed since scatter plot observed in the analysis did not depict any pattern.

In the analysis, weighted likelihood estimates (WLE) scores of independent variables were included due to consideration of contextual realities. By using Turkey data, HLM was constructed within three models: null model, random intercept model, and means as outcome model. Null model analyzed how well nested data were significant. Random intercept model analyzed how well student level factors predicted reading literacy while means as outcome model analyzed how well school level factors predicted reading literacy. Detailed procedure for the analysis of data was explained in the results section.

Results

In order to investigate how much variance in reading is caused by differentiation in student-level and school-level factors, null model was performed. Intercept value that means average of school performance in terms of reading literacy is 463.18. The model is significant (t = 93.71, p < .001) and the usage of HLM instead of regression is significant. The 95% confidence interval was from 453.50 to 472.86. Table 2 shows statistics related to null model.

Table 2. Statistics about null model

	Coefficient	*SE*	*t ratio*	*df*	*p*
Intercept	463.18	4.94	93.71	184	< .001

Variation in the reading scores of students from different schools is great as it was summarized in Table 3, X^2 (184) = 7674.84, p < .001. In-class correlation coefficient (ICC) for school differences was calculated as .57 and 57% of variance in reading literacy was accounted for by school differences. This great variance also showed that running HLM for this dataset was appropriate. On the other hand, in-class correlation coefficient for student variations was calculated as .43 such that 43% of variance in reading literacy was explained by variation in students.

Table 3. ANOVA results

	Variance	*df*	X^2	*p*
Between-group	4373.28	184	7674.84	< .001
In-group	3337.03			
Total	7710.31			
In-group correlation coefficient	.57			
Between-group correlation coefficient (ICC)	.43			

Random intercept model

Level-1 model focusing on effects of student variables on reading literacy revealed that in-group variance decreased to 3086.46 from 3337.03 when student variables added to model, which means 7.52% variance in reading literacy was explained by in-group differences. Further, there was a decline in the amount of deviance from 67344.96 to 66844.97. Test of variance-

covariance components in the level-1 model was significant, X^2 (184) = 7244.36, $p < .001$. All of these indicators showed that level-1 model was significant (Garson, 2013).

Table 4 summarized statistics related to model. Disciplinary climate in test language lessons, enjoyment of reading, parental emotional support, discriminating climate, perceived cooperation, and ICT competence significantly predicted reading literacy. Reading literacy was positively related to disciplinary climate in test language lessons, enjoyment of reading, ICT competence, and parental emotional support whereas it was negatively related to discriminating climate and perceived cooperation. One-unit increase in enjoyment of reading increases reading literacy 10.40 points. One-unit increase in ICT competence increases reading literacy 7.90 points. One-unit increase in discriminating climate decreases reading literacy 7.42 points. One-unit increase in perceived cooperation decreases reading literacy 3.26 points. One-unit increase in parent emotional support increases reading literacy 4.03 points. One-unit increase in disciplinary climate increases reading literacy 1.80 points. Sense of belonging did not a have significant impact on reading literacy.

Table 4. Level-1 model

	Coefficient	*SE*	*t ratio*	*p*
Intercept	460.23	4.65	98.88	< .001
Disciplinary climate	1.80	.82	2.17	.03
Enjoyment of reading	10.40	.77	13.47	< .001
ICT competence	7.90	.72	10.94	< .001
Parent emotional support	3.20	.75	4.29	< .001
Perceived discriminating climate	-7.42	.75	-10.03	< .001
Perceived cooperation	-3.26	.67	-4.90	< .001
Sense of belonging	.28	.75	.38	.71

Means as outcome model

Level-2 model focusing on effects of school variables on reading literacy depicted that in-group variance decreased to 2659.84 from 4373.28 due to addition of school variables into the model, which means 39.18% variance in reading literacy was explained by between-group differences. Moreover, there was a decline in the amount of deviance from 67344.96 to 66757.17. Test of variance-covariance components in the level-2 model was significant, X^2 (184) = 5046.75, $p < .001$. All of these indicators showed that level-2 model was significant (Garson, 2013).

Table 5 summarized statistics related to level-2 model. Proportion of parents involved in the school, shortage of educational material, student behavior hindering learning, and teacher behavior hindering learning predicted reading literacy significantly. One unit decrease in student behavior hindering learning and shortage of educational material increase reading literacy are 30.41 and 15.68 points respectively. That being said, one unit increase in teacher behavior hindering learning and proportion of parents involved in the school increase reading literacy 17.21 and .36 points, respectively. Shortage of educational staff did not exert a significant impact on reading literacy.

Table 5. Level-2 model

	Coefficient	*SE*	*t ratio*	*p*
Intercept	434.20	8.98	48.38	< .001
Proportion of parents involved in school	.36	.16	2.28	.02
Shortage of educational material	-15.68	5.21	-3.10	.003
Shortage of educational staff	-1.41	4.69	-.30	.76
Student behavior hindering learning	-30.41	4.79	-6.35	< .001
Teacher behavior hindering learning	17.21	5.35	3.22	.002

Discussion and Conclusion

The study investigated the relevant relationships embodied in reading literacy with student-level and school-level variables. Research results showed that between-group variance appeared greater than in-group variance and that most differences in reading literacy scores were caused by differences in schools rather than in students. Further, student-level variables which are disciplinary climate in test language lessons, enjoyment of reading, ICT competence, parental emotional support, perceived discriminating climate, and perceived cooperation significantly predicted reading literacy. On the other hand, school-level variables predicting reading literacy significantly were proportion of parents involved in the school, shortage of educational material, student behaviour hindering learning, and teacher behaviour hindering learning.

First of all, variance in reading score was explained mostly by school differences. ICC for school differences was calculated as .57, which means more than half of total variance in Turkey data originated from school differences. This conclusion remarks two important conditions. The first one is the requirement of multi-level analysis on investigation of Turkey's PISA results due to greater ICC value. The second one is interrogation of school differences in terms of quality. In fact, quality issue in schooling has been discussed by researchers who concentrate on equality of opportunities. Mercik (2015) compared PISA scores of Turkey and Finland in terms of equality of opportunity in education, social success, and justice and concluded that progress in educational quality and quantity was not adequate to provide educational equality. Further, Çelen, Çelik, and Seferoğlu (2011) analysed PISA scores over Turkish Education System and emphasized that some equity policies like access of girls, free course books, and increase in schooling rate induced progress in international exams. Therefore, conclusion based on great ICC finding is coherent with the general idea in the literature.

The current study performed two-level hierarchical linear modelling. The first level model showed that six student variables predicted reading literacy significantly. Also, it explained about 8% variance in student-level. Increases in disciplinary climate in test language lessons, enjoyment of reading, ICT competence, and parental emotional support increase reading literacy. On the other hand, decreases in discriminating climate and perceived cooperation decrease reading literacy. Among these results, an interesting point emerging was the negative relationship between reading literacy and student cooperation. The reason why this is so may be attitudes of the students towards reading activities. In other words, the students may perceive reading an individual activity rather than a group work. According to Yıldız and Kaman (2016), reading activities were more related to personal attitudes. Hence, cooperation does not matter in individual activities.

Results related to climate is consistent with the literature where classroom disciplinary climate was found to be related to academic achievement (Cheema & Kitsantas, 2014; Chi, Liu, Wang,

& Han, 2018; Sortkaer & Reimer, 2018). On the other hand, perceived discriminating school climate was negatively linked to reading literacy in the context of the current study. In other words, discriminative issues like exclusion of other culture decreased performance on reading. Cultural respect or diversity is a trend topic all over the world since immigration mobility has increased dramatically in recent years due to either personal choice based on freewill or escape from wars and rebellions. Schachner, He, Heizman, and Van de Vijver (2017) examined acculturation and school adjustment of immigrant youth. Their study showed that school belonging, attitude towards school, and truancy all of which are related to achievement are endorsed by multicultural policies. In a similar vein, Yang and Ham (2017) analysed cross-national multi-level data and concluded that higher degree of anti-discrimination legislation was associated with lower degree of truancy among immigrant children.

The current study also showed enjoyment of reading, ICT competence, and parental emotional support increased reading literacy. These findings are compatible with the literature. Tavşancıl, Yıldırım, and Bilican-Demir (2019) investigated the relationship between reading enjoyment and reading performance in PISA 2009 and found out enjoyment of reading improved reading performance as the current study did. On the other hand, a study by Cheema (2018) showed differentiation in reading scores according to performance level of the country. Enjoyment of reading was positively related to reading performance in high academic performance countries whereas it was negatively associated with reading performance in low academic performance countries.

ICT competence has a special place in PISA 2018 since a serious amount of test was implemented via computers (PISA, 2019). The current study showed that students perceiving themselves competent in ICT got higher scores in reading than other students. This finding was similar to other findings in the literature. In the literature of Turkey, studies mostly concentrated on the positive effect of ICT usage or opportunities on performance (Acar, 2015; Delen & Bulut, 2011; Demir & Kılıç, 2009; Gümüş & Atalmış, 2011; Güzeller & Akın, 2014). However, Demir, Kılıç, and Ünal (2010) conducted a study to examine the relationship between math performance and ICT competence and found a positive relationship like the current study did. Within an international perspective, Hu, Gong, Lai, and Leung (2018) investigated the role of ICT on achievement and concluded that ICT competence was positively related to reading, science, and math literacy scores.

Parent involvement in schooling makes a difference in favour of positive educational outcomes. Parent involvement sometimes is visible in the form of physical participation in the school while at times it is apparent as emotional support to the children. The current study showed that when emotional support of parents increased, reading literacy of the children increase. This conclusion is not different from the general idea in the literature. Gamazo, Martinez-Abad, Olmos-Miguelanez, and Rodriguez-Conde (2018) assessed the factors related to school effectiveness in PISA 2015 and found out that student level variables including classroom discipline, self-efficacy, teacher unfairness and parental emotional support predicted school effectiveness. Bilicioğlu and Yılmaz (2017) compared Turkey and Singapore PISA 2015 scores in terms of parental support, exam anxiety, and science field interest. The authors concluded that students in two countries did not differentiate in terms of parental support. Apart from PISA results, the literature has studies showing positive relationships between parental support and academic performance (Dinç, 2017; Doğan, 2018; Gonida & Cortina, 2014; Walker, Shenker, & Hoover-Dempsey, 2010). As a result, parental support has crucial importance to get positive school outcomes.

Considering school-level variables, the second level model depicted four school-level variables predicted reading literacy; 39.18% variance in reading literacy was explained by differences in school-level. This finding constituted a reflection of the literature. The studies focusing on PISA results showed that school-level variables were more dominant than student-level variables in terms of variance in outcome variable (Alacacı & Erbaş, 2010; Astrom & Karlsson, 2007; Özberk, Atalay-Kabasakal, & Boztunç-Öztürk, 2017; Üstün, Özdemir, Cansız, & Cansız, 2019).

Proportion of parents involved in the school, shortage of educational material, student behaviour hindering learning, and teacher behaviour hindering learning predicted reading literacy. To begin with, proportion of parents involved in the school increased reading literacy. This finding is consistent with the findings of the other studies. For instance, Sebestian, Moon, and Cunningham (2017) investigated relation of parent involvement with achievement in PISA 2012 and found that parent-initiated involvement increased student achievement. Also, a study by Ho (2010) showed that science literacy was positively and significantly associated with parental involvement and parental investment. In conjunction with the content of the current study, Topping (2007) synthesized the PISA and PIRLS literature on reading achievement and concluded that parent involvement, support, and communication had a positive relationship with reading achievement.

Importance of educational material for positive school outcomes was exhibited in the current study. Shortage of educational material increased, then reading literacy could decrease. This finding is compatible with the literature. Yıldırım, Şahin, and Sezer (2017) investigated the effect of school characteristics on PISA mathematics literacy and proved the positive relationship between mathematics literacy and quality of educational resources. Demir, Ünal, and Kılıç (2010) examined the effect of quality of educational material on mathematics achievement and revealed that educational resources like shortage of computers and of library materials had an influence on mathematics achievement. Yıldırım (2012) analysed PISA 2006 results descriptively and concluded that quality of education depended on school-related factors like adequacy of teacher, resources, and infrastructure. Study by Özer-Özkan (2016) concentrated on school factors related to success in PISA 2012 and figured out the quality of educational resources predicted school success in PISA.

Behaviours observed in the schools determine achievement as well. Both teacher and student behaviours hindering learning were found significant for the reading literacy in the current study. Nevertheless, student behaviours hindering learning decreased reading literacy; teacher behaviours hindering learning increased reading literacy. Findings related to negative relationship between student behaviours hindering learning were parallel to the literature (Özer-Özkan, 2016; Üstün, Özdemir, Cansız, & Cansız, 2019). On the other hand, findings related to positive relationship between teacher behaviour hindering learning served blur in the literature since the literature has studies showing positive relation, negative relation, and no relation. Some of the studies (İş-Güzel, 2014; Huang & Sebestian, 2015; Polidano, Hanel, & Buddelmeyer, 2013) demonstrated a positive relationship between these as the current study did. However, Yıldırım, Şahin, and Sezer (2017) conducted a study to analyse the effect of school characteristics on mathematics literacy. The authors found that school climate factors including teacher behaviours hindering learning has a negative relationships with mathematics literacy. Most of the studies found non-significant relationship between literacy scores and teacher behaviour hindering learning (Aksu, Güzeller, & Eser, 2017; Berberoğlu, Çalışkan, & Karslı, 2019; Liu, Van Damme, Gielen, & Van Den Noortgate, 2015; Özer-Özkan, 2016).

The reason why relation between reading literacy and teacher behaviour hindering learning has diversity may be contextual and developmental. Considering contextual factors, student-teacher relations may differ according to context or culture. To illustrate, Akyüz and Pala (2010) investigated PISA 2003 in terms of student and class characteristics and discovered that the variable related to student-teacher relations influenced mathematics literacy negatively in Turkey and Greece while these relations did not affect mathematics literacy significantly in Finland. Considering developmental factors, adolescence may determine the teacher behaviours as there is an increase in adolescent's self-esteem and independence (Roeser & Eccles, 1998). The students in adolescence may disregard teacher behaviour so teacher behaviour either hindering or enhancing learning is not a concern.

The current study has some implications in terms of research, theory, and practice. Considering research, the researcher of the current study did not come up with a study analysing PISA 2018 results inferentially during the formation of the study. There were descriptive reports presenting results in terms of reading, science, and mathematics. To that end, the current study had an attempt to fill gap in the literature. In terms of theory, inter-school differences and between-school differences underpinned the importance of equality of opportunity in education. Decrease in these differences may increase equality in learning environments. In addition, antecedents of reading literacy like disciplinary climate, ICT competence, and student behaviour hindering learning can form an evidence for the theoretical base of academic achievement or student performance. Lastly, in practice, the current study may give an opportunity for policy-makers or educational leaders to re-organize settings in the schools. Supporting students and enriching school environments would increase not only achievement of the students but also quality of schools.

Limitations and Future Direction

The researcher of the current study has a desire to emphasize limitations of the study. In order both to make contributions on resolution of these limitations in further studies and to spread the effect of the study, the researcher has recommendations in terms of research, theory, and practice. First of all, in spite of the strongest sides of the current study including large body of dataset, random sampling, and multi-level analysis; it is eventually based on secondary and quantitative data analysis. Whence, studies in the future could conduct empirical studies including both quantitative and qualitative primary data from large samples. Random sampling made the study generalizable to population so that researchers could conduct similar studies with other variables to shed light to the big picture related to PISA. To illustrate, relation of mathematics literacy to equity policies may be investigated. On the other hand, as a limitation, the results of the current study cannot be generalized to other contexts due to the fact that school dynamics determining reading literacy in primary schools may change. To eliminate this limitation, first-hand studies may be conducted in different levels of schooling.

In terms of theory, the current study concentrated only some antecedents of literacy. In this respect, further studies may be supported by more compact theories focusing on core or grouped variables. For instance, social justice may be studied as a theoretical framework within the integration of relevant variables like ESCS (Economic, Social, and Cultural Status), cultural diversity, and family opportunities.

Practical recommendations to practitioners, stakeholders, policy-makers, and educational administrators were a kind of summary of implications and findings. They could consider activities and strategies improving climate in the lessons, making enjoyable reading, enriching

learning and home environments with ICT devices, informing and supporting parents and families, making school more egalitarian, and with more individualized educational programs. Besides, schools could be re-organized to become more sophisticated. To name a few changes to be considered here, encouraging parents to be involved in the schools, providing more educational material, and student-centred approaches to remedy student misbehaviours may all be all ways to do so and thereby enhancing learning environments.

References

Acar, T., & Öğretmen, T. (2012). Analysis of 2006 PISA science performance via multilevel statistical methods. *Education and Science, 37*(163), 178-189.

Acar, T. (2015). Examination of the PISA 2009 reading skills and information and communication technology (ICT) use skills of Turkish students. *Educational Research and Reviews, 10*(13), 1825. doi: 10.5897/ERR2015.231

Aksu, G., Güzeller, C. O., & Eser, M. T. (2017). Analysis of maths literacy performances of students with hierarchical linear modeling (hlm): The case of PISA 2012 Turkey. *Education and Science, 42*(191). doi: 10.15390/EB.2017.6956.

Akyüz, G., & Pala, N. M. (2010). The effect of student and class characteristics on mathematics literacy and problem solving in PISA 2003. *Elementary Education Online, 9*(2), 668-678.

Alacacı, C. & Erbaş, A. K. (2010). Unpacking the inequality among Turkish schools: Findings from PISA 2006. *International Journal of Educational Development, 30*(2010), 182-192. doi:10.1016/j.ijedudev.2009.03.006.

Åström, M., & Karlsson, K. G. (2007). Using hierarchical linear models to test differences in Swedish results from OECD's PISA 2003: Integrated and subject-specific science education. *Nordic Studies in Science Education, 3*(2), 121-131.

Aytekin, G. K., & Tertemiz, N. I. (2018). PISA sonuçlarının (2003-2015) eğitim sistemi ve ekonomik göstergeler kapsamında incelenmesi: Türkiye ve Güney Kore örneği [Investigation of PISA 2003-2015 results in terms of education system and economic indicators. Sample of Turkey and South Korean]. *Journal of Kırşehir Education Faculty, 19*(1), 103-128. doi: 10.29299/kefad.2018.19.004.

Barro, R. J. (2013). Education and economic growth. *Annals of Economics and Finance, 14* (2), 277-304.

Berberoğlu, G., Çalışkan, M., & Karslı, N. (2019). Variables predicting PISA scientific literacy scores in Turkey. *International Journal of Science and Education, 2*(2), 38-49.

Bilicioğlu, A., & Yılmaz, K. (2017). An international comparative study about some variables in Turkey and Singapore: Exam anxiety, science field interest, and parent support scores of students. *Abant İzzet Baysal University Journal of Faculty of Education, 17*(3), 1201-1220.

Bozkurt, B. Ü. (2016). A report on reading instruction in Turkey: İmplications from PISA scale. *Abant İzzet Baysal University Journal of Faculty of Education, 16*(4), 1673-1686.

Cheema, J. R., & Kitsantas, A. (2014). Influences of disciplinary classroom climate on high school student self-efficacy and mathematics achievement: A look at gender and racial–ethnic differences. *International Journal of Science and Mathematics Education, 12*(5), 1261-1279.

Cheema, J. R. (2018). Adolescents' enjoyment of reading as a predictor of reading achievement: new evidence from a cross-country survey. *Journal of Research in Reading, 41*(S1), S149-S162. doi: 10.1111/1467-9817.12257.

Chi, S., Liu, X., Wang, Z., & Won Han, S. (2018). Moderation of the effects of scientific inquiry activities on low SES students' PISA 2015 science achievement by school teacher

support and disciplinary climate in science classroom across gender. *International Journal of Science Education*, *40*(11), 1284-1304. doi: 10.1080/09500693.2018.1476742.

Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research.* New York, NY: Pearson

Çelen, F. K., Çelik, A., & Seferoğlu, S. S. (2011). *Turkish education system and PISA results.* Paper presented at XIII. Conference on Academic Informatics, İnönü University, Malatya.

Delen, E., & Bulut, O. (2011). The relationship between students' exposure to technology and their achievement in science and math. *The Turkish Online Journal of Educational Technology, 10*(3), 311-317.

Demir, İ., & Kılıç, S. (2009). Effects of computer use on students' mathematics achievement in Turkey. *Procedia Social and Behavioral Sciences, 1*, 1802–1804. doi: 10.1016/j.sbspro.2009.01.319.

Demir, İ., Kılıç, S., & Ünal, H. (2010). Effects of students' and schools' characteristics on mathematics achievement: findings from PISA 2006. *Procedia-Social and Behavioral Sciences, 2*(2), 3099-3103. doi: 10.1016/j.sbspro.2010.03.472.

Demir, İ., Ünal, H., & Kılıç, S. (2010). The effect of quality of educational resources on mathematics achievement: Turkish case from PISA-2006. Procedia-Social and Behavioral Sciences, 2(2), 1855-1859. doi:10.1016/j.sbspro.2010.03.998.

Dinç, F. (2017). *The relationship between level of parent involvement in schooling and academic achievement of students*. (Unpublished master's thesis). Pamukkale University, Denizli.

Doğan, U. C. (2018). *The relationship between parent involvement and support and academic achievement at English of elementary school students*. (Unpublished master's thesis). Maltepe University, İstanbul.

Erdem-Kara, B., & Tat, O. (2019). An international comparison on efficiency in the use of educational resources. *Journal of Theory and Practice in Education, 15*(2), 153-170. doi: 10.17244/eku.478617

Gall, G., & Gall, J. P. Borg. (2003). *Educational research: An introduction*. New York, NY: Pearson.

Garson, G. D. (2013). *Hierarchical linear modeling: Guide and applications*. Los Angeles, LA: Sage.

Gamazo, A., Martinez-Abad, F., Olmos-Miguelanez, S., & Jose Rodriguez-Conde, M. (2018). Assessment of factors related to school effectiveness in PISA 2015. A multilevel analysis. *Revista de Educacion*, *379*(2018), 56-84. doi: 10.4438/1988-592X-RE-2017-379-369.

Gonida, E. N., & Cortina, K. S. (2014). Parental involvement in homework: Relations with parent and student achievement-related motivational beliefs and achievement. *British Journal of Educational Psychology*, *84*(3), 376-396.

Gümüş, S., & Atalmış, E. H. (2011). Exploring the relationshıp between purpose of computer usage and reading skills of Turkish students: Evidence from PISA 2006. *The Turkish Online Journal of Educational Technology, 10*(3), 129-140.

Güzeller, C. O., & Akın, A. (2014). Relationship between ICT variables and mathematics achievement based on PISA 2006 database: International evıdence. *The Turkish Online Journal of Educational Technology*, *13*(1), 184-192.

Ho, E. S. C. (2010). Family influences on science learning among Hong Kong adolescents: What we learned from PISA. *International Journal of Science and Mathematics Education*, *8*(3), 409-428.

Hu, X., Gong, Y., Lai, C., & Leung, F. K. (2018). The relationship between ICT and student literacy in mathematics, reading, and science across 44 countries: A multilevel analysis. *Computers & Education*, *125*(2018), 1-13. doi: 10.1016/j.compedu.2018.05.021.

Huang, H., & Sebastian, J. (2015). The role of schools in bridging within-school achievement gaps based on socioeconomic status: a cross-national comparative study. *Compare: A Journal of Comparative and International Education*, *45*(4), 501-525. doi: 10.1080/03057925.2014.905103.

Hwang, J., Choi, K. M., Bae, Y., & Shin, D. H. (2018). Do teachers' instructional practices moderate equity in mathematical and scientific literacy?: An investigation of the PISA 2012 and 2015. *International Journal of Science and Mathematics Education*, *16*(1), 25-45. doi: 10.1007/s10763-018-9909-8.

İş Güzel, Ç. (2014). Uluslararası öğrenci değerlendirme programı'nda (PISA 2003) Türk öğencilerin öğrenci ve okula ilişkin etkenlerin ve etkileşimlerinin matematik okuryazarlığına etkisi [Impact of factors and interactions of Turkish student related to student and school on math literacy in PISA 2003]. *Journal of Mediterranean Educational Research*, *15*, 11-30.

Lee, Y. H., & Wu, J. Y. (2012). The effect of individual differences in the inner and outer states of ICT on engagement in online reading activities and PISA 2009 reading literacy: Exploring the relationship between the old and new reading literacy. *Learning and Individual Differences*, *22*(3), 336-342. doi: 10.1016/j.lindif.2012.01.007.

Liu, H., Van Damme, J., Gielen, S., & Van Den Noortgate, W. (2015). School processes mediate school compositional effects: model specification and estimation. British Educational Research Journal, 41(3), 423-447. doi: 10.1002/berj.3147.

Mercik, V. (2015). *The relationship between the equality of opportunity in education, general social success, and justice: The comparison of Finland and Turkey experiences within the scope of PISA project*. (Unpublished master's thesis). Balıkesir University, Balıkesir.

Oliver, M., McConney, A., & Woods-McConney, A. (2019). The efficacy of Inquiry-Based instruction in science: A comparative analysis of six countries using PISA 2015. *Research in Science Education*, 1-22. doi: 10.1007/s11165-019-09901-0.

Organization for Economic Cooperation and Development. (2017). *Education Policy Outlook: Turkey*.

Organization for Economic Cooperation and Development. (2019). *PISA 2018 results (volume III): What school life means for students' lives.* Retrieved from https://www.oecd-ilibrary.org/sites/0a428b07-en/index.html?itemId=/content/component/0a428b07-en.

Organization for Economic Cooperation and Development. (forthcoming). *PISA 2018 technical report.* Retrieved from https://www.oecd.org/pisa/data/pisa2018technicalreport/ in 12 September, 2020.

Özberk, E. H., Atalay-Kabasakal, K., & Boztunç-Öztürk, N. (2017). Investigating the factors affecting Turkish students' PISA 2012 mathematics achievement using hierarchical linear modelling. *Hacettepe University Journal of Education*, *32*(3), 544-559. doi: 10.16986/HUJE.2017026950.

Özer Özkan, Y. (2016). Examining the effective variables on classification of school's success through PISA 2012 Turkey data. *International Online Journal of Educational Sciences*, *8*(2), 117-130. Doi: 10.15345/iojes.2016.02.011.

Özer-Özkan, Y. & Acar-Güvendir, M. (2014). Socioeconomic factors of students' relation to mathematic achievement: comparison of PISA and ÖBBS. *International Online Journal of Educational Sciences*, *6*(3), 776-789. doi: 10.15345/iojes.2014.03.020.

Özkan, M., Özkan, Y. Ö., & Güvendir, M. A. (2019). Investigation of turkey and singapore schools in terms of teacher professional development and teacher behaviors hindering

learning variables *Education and Science*, *44*(198), 309-325. doi: 10.15390/EB.2019.7806.

Özmusul, M., & Kaya, A. (2014). A comparative analysis of results of Turkey's PISA 2009 and 2012. *Journal of European Education*, *4*(1), 23-40.

Polidano, C., Hanel, B., & Buddelmeyer, H. (2013). Explaining the socio-economic status school completion gap. *Education Economics*, *21*(3), 230-247. doi: 10.1080/09645292.2013.789482.

Program for International Student Assessment. (2019). *PISA 2018: Highlight indicators.* Retrieved from https://gpseducation.oecd.org/IndicatorExplorer?plotter=h5&query=2&indicators....

Reparaz, C., & Sotés-Elizalde, M. A. (2019). Parental involvement in schools in Spain and Germany: Evidence from PISA 2015. *International Journal of Educational Research*, *93*(2019), 33-52. doi: 10.1016/j.ijer.2018.10.001.

Roeser, R. W., & Eccles, J. S. (1998). Adolescents' perceptions of middle school: Relation to longitudinal changes in academic and psychological adjustment. *Journal of Research on Adolescence*, *8*(1), 123-158. doi: 10.1207/s15327795jra0801_6.

Schachner, M. K., He, J., Heizmann, B., & Van de Vijver, F. J. (2017). Acculturation and school adjustment of immigrant youth in six European countries: Findings from the Programme for International Student Assessment (PISA). *Frontiers in Psychology*, *8*(649), 1-11. doi: 10.3389/fpsyg.2017.00649.

Sebastian, J., Moon, J. M., & Cunningham, M. (2017). The relationship of school-based parental involvement with student achievement: A comparison of principal and parent survey reports from PISA 2012. *Educational Studies*, *43*(2), 123-146. doi: 10.1080/03055698.2016.1248900.

Sortkær, B., & Reimer, D. (2018). Classroom disciplinary climate of schools and gender–evidence from the Nordic countries. *School Effectiveness and School Improvement*, *29*(4), 511-528. doi: 10.1080/09243453.2018.1460382.

Tat, O., Koyuncu, İ., & Gelbal, S. (2019). The influence of using plausible values and survey weights on multiple regression and hierarchical linear model parameters. *Journal of Measurement and Evaluation in Education and Psychology*, *10*(3), 235-248. doi: 10.21031/epod.486999.

Tavşancıl, E., Yildirim, O., & Bilican-Demir, S. (2019). Direct and ındirect effects of learning strategies and reading enjoyment on PISA 2009 reading performance. *Eurasian Journal of Educational Research*, *19*(82), 169-190.

Topping, K. (2006). PISA/PIRLS data on reading achievement: Transfer into international policy and practice. *The Reading Teacher*, *59*(6), 588-590. doi: 10.1598/RT.59.6.9.

Üstün, U., Özdemir, E., Cansız, M., & Cansız, N. (2019). What are the factors affecting Turkish students' science literacy? A hierarchical linear modelling study using PISA 2015 data. *Hacettepe University Journal of Education.* Advance online publication. doi: 10.16986/HUJE.2019050786.

Walker, J. M., Shenker, S. S., & Hoover-Dempsey, K. V. (2010). Why do parents become involved in their children's education? Implications for school counselors. *Professional School Counseling*, *14*(1), 27-41. doi: 2156759X1001400104.

Wu, M. (2005). The role of plausible values in large-scale surveys. *Studies in Educational Evaluation, 31*(2), 114-128.

Yang, K. E., & Ham, S. H. (2017). Truancy as systemic discrimination: Anti-discrimination legislation and its effect on school attendance among immigrant children. *The Social Science Journal*, *54*(2), 216-226. doi: 10.1016/j.soscij.2017.02.001.

Yavuz, E., & Çetin, B. (2017). PISA 2012 analysis of school variables affecting problem solving competency: Turkey-Serbia comparison. *Journal of Measurement and Evaluation in Education and Psychology*, *8*(4), 435-452. doi: 10.21031/epod.334610.

Yıldırım, K. (2012). PISA 2006 verilerine göre Türkiye'de eğitimin kalitesini belirleyen temel faktörler [Basic factors determining success of educational quality in Turkey by PISA 2006]. *Journal of Turkish Educational Sciences*, *10*(2), 229-255.

Yıldırım, Y., Şahin, M. G., & Sezer, E. (2017). The impact of school properties to mathematics literacy in the PISA 2012 Turkey sample. *Elementary Education Online*, *16*(3), 1092-1100. doi: 10.17051/ilkonline.2017.330244.

Yıldız, M., & Kaman, Ş. (2016). İlköğretim (2-6. sınıf) öğrencilerinin okuma ve yazma tutumlarının incelenmesi [Investigation of reading and writing attitudes of elementary school students (2-6. Grades)]. *Turkish Journal of Social Research*, *20*(2), 507-522.

Yorulmaz, Y. İ., Çolak, İ., & Ekinci, C. E. (2017). An evaluation of PISA 2015 achievements of OECD countries within income distribution and education expenditures. *Turkish Journal of Education*, *6*(4), 169-185. doi: 10.19128/turje.329755.

Yurttaş Kumlu, G. D. (2018). *The prediction level of Turkish students' PISA achievement by their accessing to information and communication technologies.* (Unpublished master's thesis). Hacettepe University, Ankara.