



The Influence of Student-Level Factors on Reading Literacy: A Comprehensive Study*

Öğrenci Düzeyinde Yer Alan Faktörlerin Okuma Okuryazarlığına Etkisi: Kapsamlı Bir Çalışma

Tahsin FIRAT** 

İlhan KOYUNCU*** 

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ABSTRACT: The aim of the present study was to examine the factors affecting the students' reading performance in a broad sense. The sample was comprised of a total of 752076 students who participated in PISA studies from OECD member countries during the years 2000 (n = 159095), 2009 (n = 298454), and 2018 (n = 294527) in which reading literacy was the major domain of interest. The causal relationships were examined using a series of multiple linear regressions by using IDB Analyzer software, which creates syntaxes that replicate the analysis 80 times for each plausible value and calculate the average values by taking into account the student weights as suggested in the PISA manuals. The results revealed that enjoyment of reading (at 91%, 100%, and 56% of countries in 2000, 2009, and 2018, respectively) and index of economic, social, and cultural status (at 81%, 91%, and 91% of countries in 2000, 2009, and 2018, respectively) were ranked among the most significant variables that predict reading literacy in all three PISA cycles. While metacognition was not included in 2000, it was among the most important variables (at 100% of countries) in 2009 and 2018.

Keywords: Index of economic, social, and cultural status, metacognition, OECD countries, reading performance, reading enjoyment.

ÖZ: Bu çalışmanın amacı, öğrencilerin okuma performanslarını etkileyen faktörleri geniş ölçekte incelemektir. Örnekleme, PISA okuma okuryazarlığının tematik alan olduğu 2000 (n = 159095), 2009 (n = 298454) ve 2018 (n = 294527) yıllarında OECD üyesi ülkelerden PISA çalışmalarına katılan toplam 752076 öğrenciden oluşmaktadır. Nedensel ilişkiler, her olası değer için analizi 80 kez tekrarlayan betikleri oluşturan ve PISA kılavuzlarında önerildiği gibi öğrenci ağırlıklarını dikkate alarak ortalama değerleri hesaplayan IDB Analyzer yazılımı kullanılarak bir dizi çoklu doğrusal regresyon analizi ile incelenmiştir. Sonuçlar, okumadan zevk almanın (2000, 2009 ve 2018'e katılan ülkelerin sırasıyla %91, %100 ve %56'sında) ve ekonomik, sosyal ve kültürel statü endeksinin (2000, 2009 ve 2018'e katılan ülkelerin sırasıyla %81, %91 ve %91'inde) her üç PISA döngüsünde de okuma okuryazarlığını yordayan en önemli değişkenler arasında yer aldığı görülmüştür. Üstbiliş 2000 yılında sonraki yıllardaki gibi bir yapıda yer almazken, 2009 ve 2018 yıllarında (ülkelerin %100'ünde) en önemli değişkenler arasında yer almıştır.

Anahtar kelimeler: Ekonomik, sosyal ve kültürel statü indeksi, OECD ülkeleri, okuma performansı, okumadan zevk alma, üst biliş.

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** Assoc. Prof. Dr., Adıyaman University, Adıyaman, Türkiye, tahsinfirat02@gmail.com, orcid.org/0000-0002-3577-7907

*** Corresponding Author: Assoc. Prof. Dr., Adıyaman University, Adıyaman, Türkiye, ilhankync@gmail.com, orcid.org/0000-0002-0009-5279

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All of us agree that reading is one of the fundamental tools for understanding people and our world to create personal and national welfare. On the other hand, students with difficulties reading and understanding information tend to experience various problems at school and in society. So, what are the primary predictors of reading skill that is very effective in the development of both individuals as well as societies? Extensive discussions and studies are still ongoing about this issue. Identifying which of these predictors is more effective on the reading skill will shed light to societies and policymakers for improving it further. Especially in recent years, many countries have been revising their own systems by taking part in various assessment studies to test their academic success at the national and international scales (Berberoğlu & Kalender, 2005; Tavsancil et al., 2019). The Program for International Student Assessment (PISA) project conducted by the Organisation for Economic Co-operation and Development (OECD) is one of several such studies that have been attracting attention. These studies, each called the "PISA cycle," have been carried out every three years since 2000. Reading literacy has been considered the major domain of interest in PISA studies in 2000, 2009, and 2018. The present study aimed to examine the variables that predict reading achievement in light of PISA data. Therefore, it seems essential to review related literature in order to understand the rationale and the importance of the study in general.

Literature Review

Factors Influencing Reading Achievement in General

For a successful reading, readers have to first reflect on the words in the written text using the proper knowledge and skills, comprehend the analyzed words, and retrieve the target message after analyzing the sentences comprised of these words (Güldenöglü et al., 2013). Reading is a difficult and complex process, starting with discerning/realizing the sounds in the written text and comprehending the target message in the text (Fırat, 2020). The foundations of reading achievement are laid during the preschool period, which makes an impact on reading achievement in later stages of schooling. Indeed, it is emphasized that early literacy skills during the preschool period (letter knowledge, vocabulary, rapid naming, phonological awareness) have important impacts on acquiring and improving reading skills (Hulme et al., 2015; Ozernov-Palchik et al., 2017; Suggate et al., 2018; Torppa et al., 2010). Moreover, it has been determined that the skills during this pre-school period affect reading achievement in PISA. As an example, Eklund et al. (2018) illustrated in their study on students with dyslexia risk and no dyslexia risk that the verbal communication skills (e.g., vocabulary) evaluated before starting school predict about 53% of the PISA reading variance for the high-risk group and 31% for the low-risk group. Pre-reading precursors (phonological awareness, rapid naming, letter knowledge) predicted 15% of the PISA reading variance for the high-risk group and 13 % for the low-risk group. Similarly, Manu et al. (2021) found that early literacy skills, excluding phonological awareness are important predictors of reading skills (comprising 28% of the variance) in 9th grade. Whereas vocabulary knowledge was the most important predictor. Considering that these studies were longitudinal, the effect of early literacy skills on PISA reading variance is remarkable.

It has also been determined that many factors have an impact on successful reading during the school period such as fluent reading (Klauda & Guthrie, 2008; Torppa et al.,

2020), knowledge of text structure (Kendeou & Van Den Broek, 2007; Pyle et al., 2017), vocabulary knowledge (Elleman et al., 2009; Quinn et al., 2020), motivation (Guthrie et al., 2007; Troyer et al., 2019), memory (Arrington et al., 2014; Johann et al., 2020), prior knowledge (Kendeou & Van Den Broek, 2007; Ozuru et al., 2009) as well as cognitive and metacognitive strategies (Firat, 2019; Soto et al., 2019).

The Effect of Metacognitive Factors

In recent years, researchers have emphasized the importance of metacognition for reading skills (Firat & Koçak, 2019; Williams & Atkins, 2009). Metacognition, or simply put, thinking about thinking, plays a key role in successful reading (Baker, 2002; Cummins et al., 2005). Metacognitive skills enable readers to plan prior to reading, monitor themselves and control the process during reading, and evaluate the process and themselves after the reading process (Firat & Ergül, 2020). Such that, studies carried out have put forth that metacognition strongly separates successful readers from weak readers (Anastasiou & Griva, 2009; Artelt et al., 2001; Firat & Koçak, 2019; Kuruyer & Özsoy, 2015). Indeed, metacognition, which plays a vital role in reading achievement, has been included among the variables that predict reading in PISA 2009 (see OECD, 2009). Firat and Koyuncu (2023) used PISA 2018 data and found that students' metacognitive strategy choices are related to their reading proficiency levels. In other words, successful readers use complex and effective strategies, while weak readers use simpler strategies.

The Effect of Motivational Factors

PISA considers reading not only in the school context but in a much more comprehensive manner (Rogiers et al., 2020). In this regard, "reading enjoyment" emerges as another important factor for reading. Reading enjoyment signifies the satisfaction that we get from reading in our daily lives (Tavsancil et al., 2019). Wigfield and Guthrie (2000) have stated that students' reading skills are improved by reading practice, indicating that it is explained through the desire and motivation for reading. It is considered that motivation mediates the time spent reading or the amount of reading (Schiefele et al., 2012). Previous studies have also reported that there is a positive correlation between reading motivation and reading achievement (Lau & Chan, 2003; Miyamoto et al., 2019; Orellana et al., 2020; Taboada et al., 2009).

The Effect of Social, Cultural, and Economic Factors

In addition, socioeconomic status (SES) is another factor impacting reading achievement (Shala & Grajevci, 2018). Education levels of the parents and home literacy environment are among the variables taken into consideration at the student level within the framework of SES. Whereas the variables of teacher quality, place of residence, number of activities at the school, student-teacher ratio, school type, educational resource, and family engagement attract attention at the school level (OECD, 2018). It was observed when previous studies were examined that the education levels of the parents are related to reading skills (Gülleroğlu et al., 2014; Kotte et al., 2005; Valenzuela et al., 2015; Vázquez-Cano et al., 2020). Families with higher socioeconomic standards can provide their children with a better learning environment and have more educational resources at home (Kır, 2016). It has also been put forth that the home literacy environment (meaning study room, worktable, study environment) is closely related to reading achievement (Gülleroğlu et al., 2014; İnce & Gözütok, 2018; Shala & Grajevci, 2018). According to İnce and

Gözütok (2018), reading success differs significantly based on home educational resources, and students with rich educational opportunities tend to perform better. In addition, the researchers stated that apart from the course materials, the educational facilities provided to the students at home (desk, computer, novel, poetry, and story books) motivated the students to benefit from rich educational materials and to read different types of books. It is indicated in studies outside of the PISA data that the presence of a library at home (number of books) and support of the literacy skills of the child make positive contributions to the reading achievement of the child in the school environment (Boerma et al., 2017; Gottfried et al., 2015; Griffin & Morrison, 1997; Park, 2008; Sénéchal & LeFevre, 2014). Çoban (2020) reported that families with high SES support their children more, which in turn has a positive impact on reading achievement. In addition, studies have shown that SES has an impact on reading achievement at the school level (Kır, 2016; Rajchert et al., 2014). Children with low SES are less likely to compensate for the myriad difficulties they face when they attend lower-quality schools in stratified school systems (Parker et al., 2021).

Importance of the Study

As can be seen, it is possible to state that there are many variables that predict reading achievement. On the other hand, we are of the opinion that it is important to determine which of these variables are more effective on reading achievement and to what extent they predict reading. For this purpose, the factors affecting the reading performance of students participating in PISA studies from OECD member countries in the years 2000, 2009, and 2018, in which reading literacy was the major domain of interest, were examined. In this context, there are some important points that highlight and make the present study important. First, it is considered an important aspect of this study that the significant predictors of reading performance were determined and ranked according to their significance levels. Secondly, the PISA data used in the present study was highly reliable. It was obtained from well-structured assessment and evaluation processes and has been used in many widely known international outlets. Moreover, it has influenced educational policies in many countries all around the world. Third, selecting all possible variables that could be predictive of reading success after examining all the variables in PISA student questionnaires allowed us to examine and compare all possible predictors of reading performance together. Fourth, the large sample group from all OECD member countries with a time span of 18 years made it possible to acquire more generalizable results with greater precision and set our study apart from others. Last but not least, the present study has important implications for researchers, policymakers, and practitioners working in the field of reading, interested in large-scale assessments such as PISA, and following current studies in the field of education. Longitudinal studies have shown that early literacy skills in early childhood are effective on PISA reading achievement (Manu et al., 2021; van Bergen et al., 2021). Therefore, the results we will obtain in the light of PISA findings will guide us to analyse the factors affecting reading achievement correctly to increase each child's reading achievement from early childhood.

Aim of the Study

The aim of the present study was to examine the variables predicting reading performance of the students from OECD member countries participating in PISA 2000, 2009, and 2018 studies in which reading literacy was the major domain of interest. For this purpose, answers were sought to the following research questions:

- What are the factors that affect the students' reading skills, and what are the total explained variance rates of these variables in predicting reading performance in PISA 2000, 2009, and 2018, separately?
- What are the similarities and differences between the results obtained for each PISA cycle?

Method

Research Design

This study is a quantitative survey research since it aims to describe the existing characteristics of students by using the data collected through PISA student questionnaires. In addition, since the relationship between independent and dependent variables is explained through a regression equation, it is also a correlational study.

Participants

The population of the study was comprised of 15-year-old students from OECD member countries. The sample included a total of 752076 students who participated in the PISA studies in the years 2000 ($n = 159095$), 2009 ($n = 298454$), and 2018 ($n = 294527$). The distribution of the participants by country is given in Table 1.

Table 1
Descriptive Statistics

	Years					
	2000		2009		2018	
Country	f	%	f	%	f	%
Australia	5176	3.25	14251	4.77	14273	4.80
Austria	4745	2.98	6590	2.21	6802	2.30
Belgium	6670	4.19	8501	2.85	8475	2.90
Canada	29687	18.66	23207	7.78	22653	7.70
Switzerland	6100	3.83	11812	3.96	5822	2.00
Chile	.	.	5669	1.90	7621	2.60
Colombia	.	.	.	.	7522	2.60
Czech Republic	5365	3.37	6064	2.03	7019	2.40
Germany	5073	3.19	4979	1.67	5451	1.90
Denmark	4235	2.66	5924	1.98	7657	2.60
Spain	6214	3.91	25887	8.67	35943	12.20
Estonia	.	.	4727	1.58	5316	1.80

Finland	4864	3.06	5810	1.95	5649	1.90
France	4673	2.94	4298	1.44	6308	2.10
United Kingdom	9340	5.87	12179	4.08	13818	4.70
Greece	4672	2.94	4969	1.66	6403	2.20
Hungary	4887	3.07	4605	1.54	5132	1.70
Ireland	3854	2.42	3937	1.32	5577	1.90
Iceland	3372	2.12	3646	1.22	3296	1.10
Israel	.	.	5761	1.93	6623	2.20
Italy	4984	3.13	30905	10.36	11785	4.00
Japan	5256	3.30	6088	2.04	6109	2.10
Korea	4982	3.13	4989	1.67	6650	2.30
Lithuania	.	.	.	.	6885	2.30
Luxembourg	3528	2.22	4622	1.55	5230	1.80
Latvia	.	.	.	.	5303	1.80
Mexico	4600	2.89	38250	12.82	7299	2.50
Netherlands	2503	1.57	4760	1.59	4765	1.60
Norway	4147	2.61	4660	1.56	5813	2.00
New Zealand	3667	2.30	4643	1.56	6173	2.10
Poland	3654	2.30	4917	1.65	5625	1.90
Portugal	4585	2.88	6298	2.11	5932	2.00
Slovak Republic	.	.	4555	1.53	5965	2.00
Slovenia	.	.	6155	2.06	6401	2.20
Sweden	4416	2.78	4567	1.53	5504	1.90
Turkey	.	.	4996	1.67	6890	2.30
United States	3846	2.42	5233	1.75	4838	1.60
Total	159095	100.00	298454	100.00	294527	100.00

Note. The value is approximately 100.00. It was rounded since previous cells also have rounding values.

Participants given in Table 1 were selected by PISA practitioners through stratified and random sampling (see OECD, 2012, n.d.; Ray & Margaret, 2003). According to Table 1, Chile, Estonia, Israel, Slovak Republic, Slovenia, and Turkey did not participate only in the PISA 2000 study, while Colombia, Lithuania, and Latvia did not participate in either PISA 2000 or PISA 2009. By 2018, it is seen that the number of students has almost doubled while the number of participating countries has increased.

Data Collection Tools

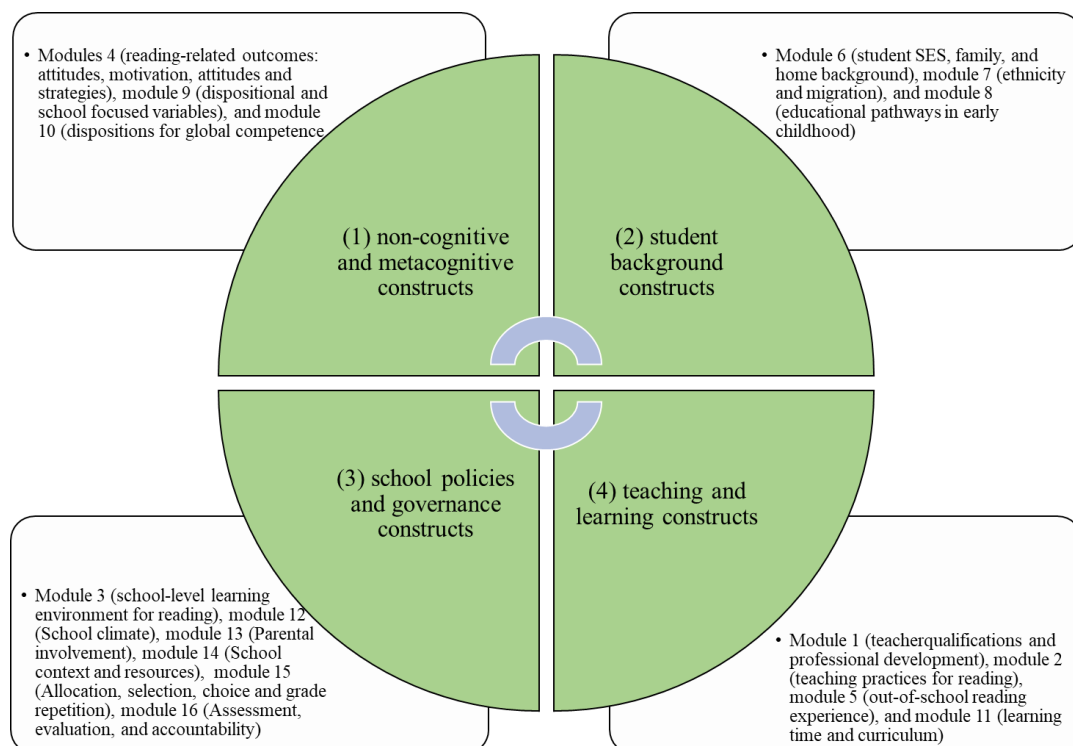
The data collection tools used in the present study were student questionnaires and cognitive tests used in PISA 2000, 2009, and 2018 studies in which reading literacy was the major domain of interest. Student questionnaires included non-cognitive items on students' background information, their sociodemographic characteristics, and general or

domain-specific tendencies. In comparison, cognitive tests were comprised of questions that measured literacy levels in mathematics, science, and reading. The students' performance levels for these fields are expressed with the scores known simply as 'plausible values' obtained from the posterior distribution of score estimations made in accordance with item response theory. While five plausible values were calculated in PISA 2000 and 2009, ten plausible values were given in PISA 2018.

PISA practitioners conduct comprehensive studies in each cycle regarding the validity and reliability of the data collection tools used in the research and share them in printed publications (see OECD, 1999, 2009, 2012, 2019, n.d.; Ray & Margaret, 2003). Technical reports include detailed information on sample selection, the development and implementation processes of scales, reliable transfer of data to databases, and providing comparability of scoring by using various weighting procedures (see OECD, 2012, n.d.; Ray & Margaret, 2003). Assessment and analytical framework publications included detailed explanations of how skills for each field are defined, how performance levels are determined, and what the questionnaires include (see OECD, 1999, 2009, 2019). By detailing and clarifying all the processes of the studies in this way, the measurement process with high validity and reliability is performed in PISA cycles. Therefore, the validity and reliability of the PISA data used in the present study were high enough to perform further analyses.

The scope of student questionnaires used in PISA studies has been revised over the years to keep psychometric and methodological developments in mind and to develop tools that are more sensitive to cultural differences. However, the framework that can make possible trend comparisons over the years has been tried to be maintained (OECD, 2019). The measured constructs in the questionnaires and the contents of the modules related to those constructs are given in Figure 1.

Figure 1
Constructs to Be Covered in the Questionnaires

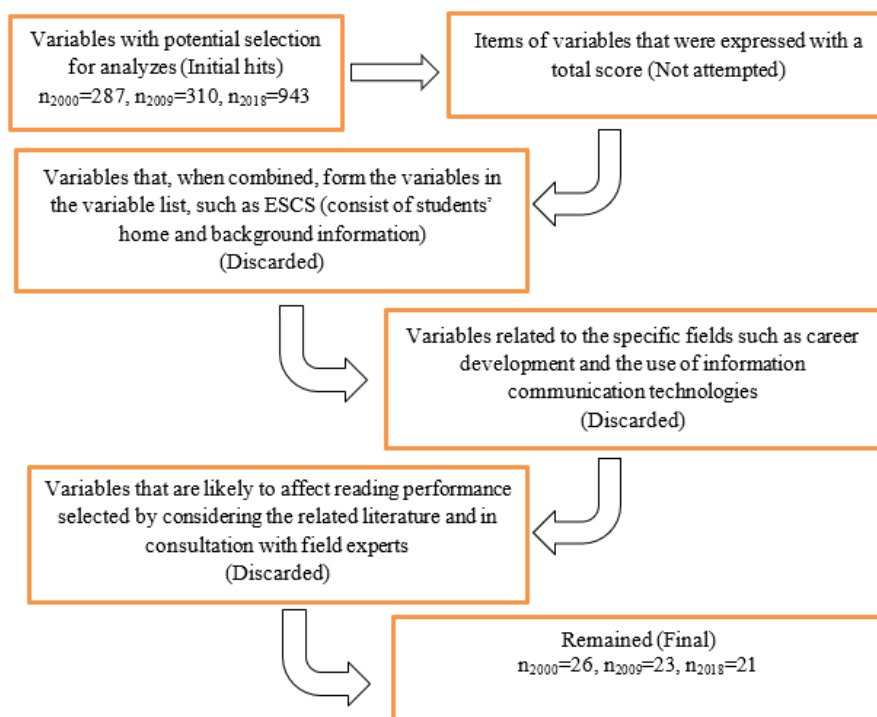


When Figure 1 is examined, the variables used in PISA studies are classified as (1) non-cognitive and metacognitive constructs, (2) student background constructs, (3) school policies and governance constructs, and (4) teaching and learning constructs. A systematic method was followed in the selection of independent variables to be used in the present study for each of the PISA cycles. Figure 2 presents this process.

According to Figure 2, first of all, all variables in the data files that were expressed as a total score with a continuous variable deleted from the data files. Afterwards, variables such as stratum, school type, second language spoken, etc., which are formed in different ways and not interpreted similarly in every country, have been removed from the files. Next, variables such as economic, social, and cultural status index (ESCS), which consists of a combination of more than one variable (parents' educational and occupation status, home and cultural possessions), were selected, and other variables that were used to obtain those variables were discarded. Later, variables related to the fields, such as career development and the use of information communication technologies, were eliminated since they were not applied in all participating countries and all PISA cycles. Finally, variables that are likely to affect reading performance were selected by considering the related literature and in consultation with field experts. The literature related to reading that was given in the introduction part was considered when selecting the factors that may affect reading literacy. The field experts were two academics studying reading comprehension. A regression analysis was not used to eliminate the variables with very small regression coefficients at this point since it was already aimed to determine significant levels of all variables related to reading literacy in the present study. At this stage, the variables that were not clearly related to reading literacy were eliminated. As a result, the variables given in Table 2 for PISA 2000, Table 3 for PISA 2009, and Table 4 for PISA 2018 were obtained.

Figure 2

Flowchart for Variable Selection Process



Although the total number of variables given in Figure 2 has increased over the years ($n_{2000}=287$, $n_{2009}=310$, $n_{2018}=943$), the number of variables selected within the scope of the present study has decreased over the years ($n_{2000}=26$, $n_{2009}=23$, $n_{2018}=21$). Except for gender, all variables included in the analyses were continuous. This situation arises from the fact that the number of variables consisting of the combination of other variables has increased over the years in PISA cycles, and only these derived variables were used instead of many other variables used in PISA student questionnaires.

Data Analysis

In the present study, multiple regression analysis was used as data analysis method. Assumptions (independence of independent variables, normality, linearity, homoscedasticity, independence of errors) of this method were checked prior to the analyses and there were not any significant deviations. The reason why multi-group or multi-level analyses were not performed is that the students in the examined PISA studies were not the same in each cycle (the data does not have a longitudinal structure), and the independent variables were obtained at the student level. SPSS syntaxes, which replicate the analysis 80 times for each plausible value and calculate the average values by taking into account the student weights as suggested in the PISA manuals, were created with IDB Analyzer software. Gender was a categorical variable, and it was dummy coded as given in the SPSS syntax created by IDB Analyzer software. All analyses were performed via IBM SPSS Statistics software.

Results

Significance Levels and Total Explained Variance Rates

Under this subheading, the results are reported separately for each PISA cycle.

Results for PISA 2000

In Table 2, the results obtained by multiple linear regression analysis are given with standardized and unstandardized regression coefficients, and significance test values.

Table 2

Average Regression Coefficient Values for Reading Literacy in PISA 2000

	Variable	<i>B</i>	<i>B</i> (se)	<i>t</i> (<i>B</i>)	β	β (se)	<i>t</i> (β)
	(CONSTANT)	447.57	2.98	150.21	.	.	.
1	Enjoyment of reading	17.24	0.6	28.6	0.20	0.01	29.60*
2	Highest in. socio-econ. index	0.92	0.03	33.69	0.16	0.00	34.37*
3	Self-concept (Academic)	12.74	0.49	25.95	0.14	0.01	26.30*
4	Family educational support	-12.08	0.38	-31.6	-0.13	0.00	-31.74*
5	Reading diversity	10.39	0.44	23.39	0.11	0.00	24.47*
6	Gender	-18.02	0.87	-20.81	-0.10	0.00	-21.11*
7	Control strategies	9.21	0.58	15.79	0.10	0.01	16.06*
8	Memorisation	-8.35	0.49	-17.11	-0.09	0.00	-17.66*

9	Mother ISCED qualification	4.71	0.36	13.23	0.07	0.00	13.37*
10	Father ISCED qualification	4.22	0.34	12.36	0.06	0.00	12.00*
11	Effort and perseverance	-5.62	0.54	-10.36	-0.06	0.01	-10.56*
12	School disciplinary climate	-4.55	0.42	-10.93	-0.05	0.00	-11.31*
13	Self-efficacy	4.36	0.57	7.70	0.05	0.01	7.69*
14	Teacher support	-4.27	0.44	-9.79	-0.04	0.00	-9.82*
15	Self-concept (Verbal)	3.37	0.41	8.18	0.04	0.00	8.42*
16	Elaboration strategies	-3.16	0.44	-7.13	-0.03	0.00	-6.80*
17	Achievement press	-2.73	0.4	-6.76	-0.03	0.00	-6.30*
18	Control expectation	2.86	0.52	5.46	0.03	0.01	5.79*
19	Family structure	-4.02	0.72	-5.59	-0.02	0.00	-5.81*
20	Number of minutes per week in language courses	-0.03	0.01	-3.87	-0.02	0.01	-3.34*
21	Sense of belonging	1.36	0.37	3.73	0.01	0.00	3.43*
22	Instrumental motivation	-1.26	0.40	-3.12	-0.01	0.00	-3.21*
23	Competitive learning	1.11	0.39	2.84	0.01	0.00	3.03*
24	Cooperative learning	-0.81	0.40	-2.03	-0.01	0.00	-2.09*
25	Teacher-student relationship	-0.76	0.46	-1.65	-0.01	0.00	-1.73
26	Interest in reading	0.69	0.56	1.23	0.01	0.01	1.46

Note. B: Unstandardized regression coefficient; B (se): Standard error of B; t (B): t value of B; β : Standardized regression coefficient; β (se): Standard error of β ; t (β): t value of β .

*Significant at 0.05 level (two-tailed).

According to Table 2, all variables except interest in reading and teacher-student relationship significantly predict reading performance ($p < .05$). Total explained variance rate of all variables in reading performance is 37%. When looking at the standardized regression coefficients, the most significant predictor of reading performance is enjoyment of reading. The least predictive significant variables are a sense of belonging, competitive learning, cooperative learning, and instrumental motivation.

Results for PISA 2009

In Table 3, the results obtained by multiple linear regression analysis are given with standardized and unstandardized regression coefficients and significance test values.

Table 3

Average Regression Coefficient Values for Reading Literacy in PISA 2009

	<i>Variable</i>	<i>B</i>	<i>B (se)</i>	<i>t (B)</i>	β	β (se)	<i>t</i> (β)
	(CONSTANT)	519.25	1.86	278.88	.	.	.
1	Joy/Like reading	22.86	0.26	87.34	0.26	0.00	91.45*
2	Meta-cognition: Summarising	18.16	0.24	76.16	0.20	0.00	77.58*
3	Index of economic, social and cultural status	17.70	0.28	63.94	0.18	0.00	66.99*
4	Use of libraries	-11.82	0.24	-48.57	-0.13	0.00	-49.59*
5	Reading for school: Functional reading materials	-11.24	0.24	-47.03	-0.12	0.00	-47.08*
6	Meta-cognition: Understanding and remembering	10.37	0.24	43.28	0.12	0.00	44.26*
7	Use of control strategies	10.59	0.29	36.61	0.12	0.00	37.35*
8	Use of memorisation strategies	-8.71	0.25	-34.38	-0.09	0.00	-34.89*
9	Reading for school: Interpretation of literary texts	7.07	0.27	26.18	0.08	0.00	26.44*
10	Reading for school: Traditional literature courses	-6.93	0.29	-24.06	-0.07	0.00	-24.34*
11	Reading for school: Non-continuous materials	5.32	0.24	22.25	0.06	0.00	22.57*
12	Gender	-9.52	0.46	-20.60	-0.06	0.00	-21.09*
13	Immigration status	-14.40	1.38	-10.41	-0.05	0.00	-18.70*
14	Online reading	4.51	0.25	17.98	0.05	0.00	18.36*
15	Diversity reading	4.19	0.25	16.42	0.04	0.00	16.48*
16	Disciplinary climate	3.67	0.24	15.51	0.04	0.00	15.86*
17	Use of elaboration strategies	-3.72	0.25	-14.78	-0.04	0.00	-14.81*
18	Family structure	4.65	0.54	8.55	0.02	0.00	8.67*
19	Teacher student relations	2.01	0.24	8.22	0.02	0.00	8.29*
20	Use of structuring and scaffolding strategies	-1.95	0.29	-6.68	-0.02	0.00	-6.63*
21	Attitude towards school	-1.38	0.24	-5.76	-0.01	0.00	-5.38*
22	Learning time (minutes per week)	-0.02	0.01	-3.36	-0.01	0.00	-3.00*
23	Teachers' stimulation of reading engagement	0.50	0.30	1.68	0.01	0.00	1.78

Note. B: Unstandardized regression coefficient; B (se): Standard error of B; t (B): t value of B; β : Standardized regression coefficient; β (se): Standard error of β ; t (β): t value of β .

*Significant at 0.05 level (two-tailed).

R² and Adjusted R²=.48

When Table 3 is examined, all variables except teachers' stimulation of reading engagement significantly predict reading performance ($p < .05$). Total explained variance rate of all variables in reading performance is 48%. According to the standardized regression coefficients, the most significant predictor of reading performance is joy/like reading. The least predictive significant variables are attitude towards school, family structure, and learning time (minutes per week).

Results for PISA 2018

In Table 4, the results obtained by multiple linear regression analysis are given with standardized and unstandardized regression coefficients and significance test values.

Table 4

Average Regression Coefficient Values for Reading Literacy in PISA 2018

	<i>Variable</i>	<i>B</i>	<i>B (se)</i>	<i>t (B)</i>	β	β (se)	<i>t</i> (β)
	(CONSTANT)	513.08	1.75	293.31	.	.	.
1	Meta-cognition: Assess credibility	22.04	0.31	71.02	0.23	0.00	72.78*
2	Index of economic, social and cultural status	17.20	0.36	47.42	0.17	0.00	48.44*
3	Meta-cognition: Summarising	16.30	0.34	48.02	0.17	0.00	48.52*
4	Self-concept of reading: Perception of competence	13.69	0.38	36.01	0.14	0.00	36.41*
5	Joy/Like reading	9.15	0.31	29.81	0.11	0.00	30.30*
6	Meta-cognition: Understanding and remembering	9.17	0.33	28.15	0.10	0.00	28.47*
7	Self-concept of reading: Perception of difficulty	-9.34	0.35	-26.73	-0.10	0.00	-26.64*
8	Teacher-directed instruction	-9.35	0.39	-23.84	-0.10	0.00	-24.01*
9	Disciplinary climate in test language lessons	4.50	0.30	15.06	0.05	0.00	15.40*
10	Perceived feedback	-4.45	0.35	-12.84	-0.05	0.00	-13.09*
11	General fear of failure	4.06	0.29	13.84	0.04	0.00	13.64*
12	Teacher's stimulation of reading engagement perceived by student	4.00	0.37	10.82	0.04	0.00	10.97*
13	Teacher support in test language lessons	2.73	0.40	6.82	0.03	0.00	6.62*
14	Index immigration status	-13.24	3.22	-4.11	-0.02	0.00	-7.02*
15	Perceived teacher's interest	2.42	0.38	6.43	0.02	0.00	6.25*
16	Learning time (minutes per week) in total	-0.01	0.00	-6.71	-0.02	0.00	-5.83*
17	Parents' emotional support perceived by student	1.48	0.31	4.73	0.02	0.00	4.91*
18	Gender	1.41	0.62	2.25	0.01	0.00	2.17*
19	Subjective well-being: Sense of belonging to school	-0.68	0.31	-2.18	-0.01	0.00	-1.91
20	Duration in early childhood education and care	-0.80	0.31	-2.57	0.00	0.00	-1.02
21	Attitude towards school: Learning activities	-0.14	0.30	-0.47	0.00	0.00	-0.39

Note. B: Unstandardized regression coefficient; B (se): Standard error of B; t (B): t value of B; β : Standardized regression coefficient; β (se): Standard error of β ; t (β): t value of β .

*Significant at 0.05 level (two-tailed).

R² and Adjusted R²=.45

According to Table 4, all variables except subjective well-being (sense of belonging to school), duration in early childhood education and care, and attitude towards school (learning activities) significantly predict reading performance ($p < .05$). Total explained variance rate of all variables in reading performance is 45%. When standardized regression coefficients were examined, the most significant predictor of reading performance was meta-cognition (assess credibility). The least predictive significant variable is the gender of the students.

Comparison of Prediction Results Obtained for each of the PISA Cycles

The results revealed that enjoyment of reading and index of economic, social, and cultural status (highest in socio-econ. index in PISA 2000) were ranked among the most significant predictive variables according to standardized regression coefficients in all three PISA cycles. However, when all three cycles are compared, the order of factors predicting reading literacy shows significant differences. Self-concept variable was among the most significant predictors in PISA 2000 and 2018. Meta-cognition was not included in the PISA 2000 study. However, this variable, which was included in PISA in 2009 and 2018, was among the most important variables. While the variables explained the variability in PISA reading scores in 2000 by 37%, this rate increased to 48% in 2009 and remained at 45% in 2018, with a slight decrease.

The most predictive variables that were used in at least two PISA cycles were examined according to their significance levels in each of the OECD countries. Since the aim of the present was to show the general trend of factors affecting reading literacy, and there was too much data to show and explain by country, we gave only some statistics for the most significant variables as percents. The enjoyment of reading was one of the most significant variables at 91%, 100%, and 56% of OECD countries in PISA 2000, 2009, and 2018, respectively. The highest socioeconomic index was one of the most significant variables at 81% of OECD countries in PISA 2000. The index of economic, social, and cultural status, an equivalence of this index, was one of the most significant variables at 91% of OECD countries in PISA 2009 and PISA 2018. Meta-cognition (Summarising) was one of the most significant variables at 100% of OECD countries in PISA 2009 and 2018. Similarly, meta-cognition (assess credibility) was one of the most significant variables at 100% of OECD countries in PISA 2018. When examining total explained variance ratios (R^2), 62%, 65%, and 56% of OECD countries have a variance rate of equal to or greater than .37, .48, and .45 for PISA 2000, 2009, and 2018, respectively.

Considering the PISA Assessment and Analytical Framework (OECD, 2019), the least and/or negative predictors of PISA performance were related to strategy use, test language lessons and school, student-self, family, and reading-related attitudes. The variables that had negative effects on PISA performance were related to strategy use (in 2000: elaboration strategies, memorisation; in 2009: use of memorisation strategies, use of structuring and scaffolding strategies), test language lessons, and school-related factors (in 2000: school disciplinary climate, teacher support, achievement press, cooperative learning; in 2018: teacher-directed instruction perceived feedback), student-self factors (in 2000: gender, number of minutes per week in language courses; in 2009: use of libraries, gender, Immigration status, learning time (minutes per week); in 2018: index immigration status, learning time (minutes per week) in total), family related ones (in 2000: family educational support, family structure), and reading related attitudes (in 2000: instrumental

motivation, effort and perseverance; in 2009: reading for school: functional reading materials, reading for school: traditional literature courses, attitude towards school; In 2018: self-concept of reading: perception of difficulty). Similarly, factors that least affect reading performance were related to strategy use (in 2009: use of structuring and scaffolding strategies), test language lessons, and factors related to school (in 2000: school climate, competitive learning cooperative learning; in 2009: teacher-student relations; 2018 In years: perceived teacher's interest), student-self factors (in 2000: number of minutes per week in language courses; in 2009: learning time (minutes per week); in 2018: index immigration status gender - learning time (minutes per week) in total), family related ones (in 2009: family structure; and in 2018: parents' emotional support perceived by student), and reading related attitudes (in 2000: instrumental motivation; in 2009 and 2018: attitude towards school).

Discussion and Conclusion

The aim of the present study was to examine the variables predicting reading performance of students from OECD member countries who participated in PISA 2000, 2009 and 2018 studies in which reading literacy was the major domain of interest. The results acquired within the scope of the study were interpreted and discussed under the following headings.

The Role of Reading Enjoyment

As a result of the study, it was determined that reading enjoyment is one of the most significant variables predicting PISA reading achievement. This motivational factor helps students in starting the reading process more willingly while also helping them in putting forth greater effort to be successful in this process. Moreover, enjoyment of reading and motivation for reading have a positive impact on the time that students allocate for reading. It was also indicated that reading motivation predicts reading amount and that reading amount predicts reading comprehension at a statistically significant level (Guthrie & Wigfield, 1999). In addition, higher motivation for reading enables students to make more reading practice which in turn improves their vocabulary and reading comprehension skills (Stanovich, 1986). Indeed, previous studies have reported that willingness to read has a positive impact on reading achievement (Lau & Chan, 2003; Miyamoto et al., 2019; Orellana et al., 2020). Brozo et al. (2007) observed a positive correlation between the enjoyment of reading of students and reading achievement within the framework of PISA results in three OECD countries (Ireland, United Kingdom and the United States). Eklund et al. (2018) determined that reading books in their free time is effective on the PISA reading achievements of students.

On the other hand, lack of motivation for reading may lead to students participating less in the school process and may also result in failures at school. Cheema (2018) reported upon examining demographic differences such as gender and socioeconomic status that enjoyment of reading is positively correlated with school achievement in countries with high academic performance and that it is negatively correlated with school achievement in countries with low academic success. Besides, failure in reading may also have an adverse impact on school achievement for students. As an example, Torppa et al. (2020) identified that weak readers have low reading motivation and that they have higher burnout levels and lower school enjoyment compared with typical readers. Similarly, Wolters et al.

(2014) found that weak readers feel more reading anxiety compared with successful readers.

The Role of Metacognition

When PISA reading results since 2009 were examined, metacognition (see Metacognition: Assess credibility and Meta-cognition: Summarising) has been an important predictor of reading achievement. Similar results have also been obtained in studies other than PISA (Kim et al., 2012; Lau & Chan, 2003). Artelt et al. (2001) found that metacognitive knowledge, reading speed, and the number of books at home (an indicator of family history) are effective variables in reading comprehension. Researchers found that metacognition has the highest impact (explains 42% of the variance) on reading achievement from among the variables. In this regard, students with higher reading achievement are those who use metacognitive strategies more. Koyuncu et al. (2022) highlighted the importance of teaching students metacognitive strategies in schools to reduce the effect of ESCS on reading achievement.

Reading achievement of students with metacognitive skills can be attributed to several reasons. Firstly, metacognitive skills enable students to establish an internal language for interacting and establishing contact with the text (Bender, 2002). Secondly, students with metacognitive skills use various strategies before (e.g., predicting, skimming), during (e.g., activating prior knowledge, considering reading speed), and after (e.g., summarizing, evaluation) reading for understanding the text (Fırat & Koçak, 2019; Swanson, 1999). These enable the students to read more carefully and think systematically (Allen, 2006). All of these allow the students to take part in the reading process more actively and to regulate themselves during this process. Therefore, teachers need to consider how they might include metacognitive strategies in their regular instruction in order to raise each student's reading proficiency (Memisevic & Cehic, 2022).

The Role of Reading Enjoyment + Role of Metacognition

As a result of the PISA study, students with higher reading achievement are those who enjoy reading and who have metacognitive skills. Actually, it is possible to indicate that these two skills are not independent. When the PISA Assessment and Analytical Framework (OECD, 2019) is examined, motivation (enjoyment of reading, joy / like of reading, interest in reading) and metacognition (assessing credibility, summarising, understanding, and remembering) variables are under the title of non-cognitive and metacognitive constructs (see Figure 1). There are some other studies that emphasize the relationship between motivational factors and metacognition (e.g., Lau & Chan, 2003; Roeschl-Heils et al., 2003; Tavsancil et al., 2019). For example, Roeschl-Heils et al. (2003) found that there is a correlation between metacognitive strategies, reading motivation, and reading comprehension. In addition, Lau and Chan (2003) found that weak readers received lower scores in using all reading strategies especially sophisticated cognitive and metacognitive strategies, compared to good readers. Moreover, successful readers in the study had higher internal motivation for reading than weak readers. This indicates that students who use high-level learning strategies more frequently have higher reading enjoyment (Tavsancil et al., 2019). Miyamoto et al. (2019) determined that internal motivation has statistically significant impacts on internal motivation through metacognitive knowledge. Lau and Ho (2016) have indicated that self-regulation strategies,

as the combination of reading enjoyment and control strategies, were among the important predictors of reading achievement in China in PISA 2009. In conclusion, these studies show that students who use learning strategies with high-level skills enjoy reading more, and these students are more successful in reading comprehension. In this regard, carrying out studies for increasing students' motivations during strategy teaching may facilitate reading advancement.

The Role of SES

Another result obtained from the study was that the impact of SES on PISA reading achievement was at the highest level in all three cycles. In accordance with this result, it has been determined in many studies that SES is effective in reading achievement (Artelt et al., 2001; Erdoğan & Güvendir, 2019; İnce & Gözütok, 2018; Kotte et al., 2005; Valenzuela et al., 2015; Vázquez-Cano et al., 2020). The higher the parents' educational level, professional prestige, and income, the higher their children's reading ability and vice versa (Chen et al., 2018). Hemmerichs et al. (2017) stated that students with lower SES have lower reading literacy and negative reading attitudes than students with higher SES.

The emergence of this result in the current study can be attributed to several reasons. First, families with a high education level are expected to support their children's literacy skills from the preschool period (see Ergül et al., 2020). Studies have determined that children supported in early literacy skills in the home environment are more successful in reading in later years (Sénéchal & LeFevre, 2002; Silinskas et al., 2020). Moreover, studies have determined that the children of families with lower socioeconomic status start the school process more disadvantaged (Aikens & Barbarin, 2008; Hindman et al., 2010). It is stated that the gap in reading success between students who start school with successful and unsuccessful reading skills has increased over time (Ferrer et al., 2015; Stanovich, 1986). Van Bergen et al. (2021) examined 200 students from the age of 5 to 15 and determined that students' exposure to early literacy skills predicted PISA success.

Secondly, families with a high level of education are expected to be more sensitive about the education process of their children (helping with homework, supplying private teachers, etc.). Conversely, parents who are not well-educated may not have sufficient skills for their children's academic success or may not provide the necessary support for their children (Chen et al., 2018). Third, families with higher SES are expected to enroll their children in schools with better opportunities. On the other hand, children with low SES backgrounds have a small advantage in terms of academic interest compared to children with a high SES history, as they generally enroll in poorer-performing schools (Parker et al., 2021). Fourth, families with higher SES are expected to provide the necessary facilities for their children to be successful at home. Parents with higher SES tend to provide a more stimulating home environment to support their children's cognitive development (Güleroğlu et al., 2014). However, low-income families may be unable to provide essential living materials such as a home, workplace, computer, and other supplements for children, such as extracurricular books, newspapers, and magazines (Chen et al., 2018).

The Role of the Other Variables

The results revealed that some variables were negatively related to and/or had very low beta values in predicting PISA reading performance. For example, the learning time

(minutes per week) variable was among those variables. There are two possible reasons why this variable was negatively related to reading performance in all three PISA cycles. First, there might indeed be a negative relationship between this variable and reading performance. The second reason might be that this variable was not powerful enough to predict reading success. In parallel with this assumption, this variable was among the least predictive variables in all three PISA studies. The fact that the time allocated to learning has an effect on reading success (Bloom, 1974; Lavy, 2015; Woessmann, 2003) suggests that this variable is not predictive enough. However, the fact that the regression coefficients tend to be significant due to the large sample sizes may be another reason for this result. A similar interpretation can be made for variables with negative and low regression coefficients, such as school climate, immigration status, structuring and scaffolding strategies, and some motivational factors (instrumental motivation, attitude towards school, and family support). In addition, the low predictability levels of all these variables may have resulted from the specific structure of the PISA data. The reasons for this situation can be examined with empirical studies that can reveal the causal relationship.

In addition, the negative impact of family structure and immigration status on reading performance that was found in this study is consistent with the relevant literature (Arikan et al., 2017; Azzolini et al., 2012). The other variables related to strategy use (elaboration, memorisation, and structuring and scaffolding strategies) had low statistical significance in 2000 and 2009, were later removed from PISA studies, and students' strategy use was handled under the title of metacognition. An interesting result of this study was that the use of library variables was one of the most significant factors that negatively affected reading success. However, some studies have found a positive relationship between library use, reading skills, and attitude (Adkins & Brendler, 2015; Park & Sakong, 2014). This situation might have resulted from the combined effect of other factors due to the multidimensional nature of reading comprehension.

Based on the study findings, gender (girls are more successful in reading than boys), disciplinary climate, and learning time (per week) were significant variables in all three studies. However, while the significance rank of the gender variable decreased over time, learning time (per week) remained among the least significant variables in all three PISA cycles. While immigration status was not present in 2000, it was a significant variable in 2009 and 2018. Self-concept of reading was among the most significant variables in 2000 and 2018. As a result of some other studies, gender (Chiu & McBride-Chang, 2006), disciplinary climate (Guo et al., 2018; Ning et al., 2015), learning time (Fisher et al., 1981; Kidron & Lindsay, 2014). Immigration status (Ma, 2003) and self-concept (McArthur et al., 2020; Zagoto, 2020) had significant effects on reading achievement. Carrying out further studies on why female students are more successful than male students (see Logan & Johnston, 2009), the impact of the immigration factor on reading, and why disciplinary climate increases reading will provide important feedback for education planners and policymakers.

Conclusions and Suggestions

Considering the results of this study, it was seen that reading comprehension is multidimensional, and there are many factors affecting reading performance. Reading enjoyment and economic social status index have remained among the most significant

variables over the years in PISA cycles. Moreover, it was also observed that metacognition has a high impact on reading. In this regard, the impacts of these three factors should be taken into consideration for policies to be implemented to enhance reading performance.

The fact that the ratio of explained variance dropped below 50% indicates that the variables in the PISA studies were limited in explaining reading performance. Variables related to career development and ICT use have not been considered predictors in the present study. Thus, future studies may examine the prediction power of these variables and other school-related variables that may have an impact on reading achievement.

The results of the present study are limited to 15-year-old students from OECD countries who took part in the study as well as PISA student questionnaires, cognitive tests, and other data acquisition tools. Reading performance of students from different age groups can be examined by using different kinds of performance tests in future studies, and their results can be compared with the present study's findings. The results are also limited to the analysis method used in the present study. A series of multiple linear regression analyses were performed for each PISA cycle and country. Average statistics were used to examine factors affecting reading literacy in a broad sense. Therefore, the readers are suggested to take into account this situation while looking at the results and discussions. In future studies, factors affecting reading literacy may also be examined by country with other statistical methods.

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Statement of Responsibility

First author is responsible for conceptualization, investigation, writing-original draft, writing-review & editing, supervision, and project administration. Second author is responsible for methodology, software, validation, formal analysis, investigation, resources, data curation, writing-original draft, writing-review & editing, visualization.

Conflicts of Interest

The authors declare that they have no conflict of interest.

Author Bios:

Tahsin FIRAT was an associate professor at the Adiyaman University. His major research interests include reading comprehension, youth's peer relationships and social acceptance of special education needs.

İlhan Koyuncu is an associate professor at the Adiyaman University in the department of measurement and evaluation in education. His research interests include large-scale assessments, scale development, educational data mining, and multivariate statistics.

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