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Factors Affecting Saudi Students' Achievement In Reading Literacy In Light Of PISA 2018

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Abstract

Nearly 217 million students from secondary college (it includes 60% of the adolescents worldwide) do not accomplish minimal stages in their reading ability by the end of their secondary school. This is shown in goal 4.1 of the UN's SD Goals. Thus, the prompt and effective identity of this drawback as well as the execution of corrective practices is crucial for economies. In the year 2018, PISA, (the Programme related to International Student Assessment, evaluated the studying abilities of school students in a number of 80 international economies and location. Thus, this work ultimately presents a method that makes use of PISA's facts to construct a logistic regression structure to pick out the primary components that led to underperformance of college students. Findings showed that metacognition techniques, student-teacher relationships, socioeconomic status, abilities related to Information and Communication Technology abilities, are the elements that are responsible for low reading skills.

Keywords: PISA 2018 Study, Reading Literacy, metacognition techniques, Student-teacher relationships

1. Introduction

1.1 Introduce the Problem

The reading skill is ultimately an essential as well as lifelong strategic skill crucial for successful learning (Alenezi 2021). It is recognized everywhere as an important skill and categorized as the most effective tools for imparting knowledge, enhancing cognitive development, as well as promoting learning progress. Many researches have reflected that reading is an activity which is crucial for developing knowledge.

Reading competence is askill of apprehending and practicing language mandatory in society or individuals. Meaning can be derived through text through different means.

Their aim of reading is to learn and participate either at school level or in everyday reading communities, and to have fun. Furthermore, Hejase, (2019) found that reading consists of two acts, the first related to cognition and alphabetical decoding, and second is the resulting activities, such as entertainment and comprehension.

1.2 Explore Importance of the Problem

Nearly 60% of students around the world have been facing a lack of major studying capabilities. Among them adolescents are affected most. In the light of the data of UNESCO Institute for Statistics (UIS) (2017), 61% population of adolescents that are aged 12- and 15-years have now no longer received the minimum level of reading proficiency. According to World Bank Overview (2021) this reality takes place even if schooling insurance is the biggest in history.UNESCO (2021) stated

that the reading skills' loss evidently suggests that when referring to the term access to education it does not mean assuring great gain in knowledge to clear up essential troubles in reading proficiency.

According to a study conducted by Romdhani (2019) data from the Arab League Organization for Education, Culture and Science (ALECSO) indicate that the illiteracy rate in Arab countries is around 21%, which is well above the world average of around 13%. In the meantime, there is no agreed opinion regarding the notion of implementing fundamental reading literacy program at the level of secondary education. However, majority of the organizations have implication to economic planning. These data gathering projects include the Programme decided for implementing the OECD International Student Assessment (PISA) as a standard. This level aims to enable students demonstrating skills of knowledge acquaintance, and problem solving (Vazquez-Lopez &Huerta-Manzanilla, 2021). The OECD runs projects to collect data that are of significant for International Student Assessment. PISA is the world's biggest evaluation system of secondary education and is conducted every three years since 2000. The main objective of PISA is comparative assessment regarding quality assessment of learning and teaching in the subjects of Science, Mathematics, and about the reading literacy of the students that are of the age of 15-years in participating countries.

1.3 Describe Relevant Scholarship

Reading Literacy was chosen as the main subject during the 2018 session with Mathematics and Science as minor subjects. Above 600,000 students representing 79 states were enroled in this program. These participants represented over 31 million 15-year-old students (OECD, 2019). Countries that participated for first time included Belarus, Bosnia and Herzegovina, Brunei Darussalam, Ukraine, Philippines, Saudi Arabia, and Morocco. The Kingdom of Saudi Arabia (KSA) participated in PISA 2018 exercise with 6,136 students from 235. The aggregate score in Mathematics for students from the KSA was 373 compared to the overall average of 489 for all participating countries with the highest score of 591. The Saudi score for science was 386 compared to the average of 489 for all participating countries and a highest score of 590; and in Reading Literacy the score was 399 compared to the average of 487 from all participating countries and a highest score of 555. Hence for KSA, the average score for all subjects was 386.0 which is below the OECD average.

Besides, assessment under the PISA regarding Reading Literacy also entails evaluation of other cognitive capabilities i.e., fundamental skills of decoding, vocabulary, grammar, detailed dialectal and literal content, and world knowledge. More comprehensively, PISA evaluation of reading skills includes measuring the ability to comprehend the meaning of written words and short phrases, comprehension of sentences and long texts. The OECD uses results from the assessment to provide countries with data that help them have better understanding of tasks that 15-year-old pupils with poor reading proficiency can perform and to make planning decisions for their educational system and their wider national economic development. By looking at these scores and a careful examination of the PISA data, the study examines the link joining contextual factors with the achievements of students from KSA. Contextual factors include Social, Environment, family background, and availability of ICT resources. The relationship between these contextual factors is a vast topic that needs to be investigated. Therefore, the aim here is to present an empirical proof of the interconnection between contextual factors and students performance on PISA 2018. The study fills the gap by investigating the affect of these factors on the Saudi students' performance by using student and school factors as the key variables of this study. Thestudy contributes as it explores these factors with specific focus on Reading Literacy in KSA and category of

contextual factors within the domain of the school environment as well as student control.

1.4Research Question

1) Do the student characteristics and school climate factors contribute significantly to an explanation of the variance in students' scores in the area of Reading literacy in PISA 2018 dataset?
2) Do the school resources and context contribute significantly to an explanation of the variance in students' scores in the area of Reading literacy in PISA 2018 dataset?

3. Literature Review

Vazquez-Lopez and Huerta-Manzanilla (2021) found that PISA test is the commonly adopted index for determining whether a student has achieved the required level of reading competence. This test assesses students' reading, math, and science skills at the end of basic school.It is a major source of data on the subjects of education and economic development. Researchers in Spain and Germany used PISA data to examine the association of parental participation in children's education and PISA score. Results suggest that parental involvement may be important but not all factors contribute positively to the desired educational outcome. Data analysis suggests that achievement in Reading Literacy is prone to impact from families' social background and that shortfall in performance starts in the early childhood. Dolean(2019) finding indicates that there are factors related to socio-economic status (SES) that affects outcome in Reading Literacy. A plethora of studies have concluded that there is a significant correlations between students SES and educational outcome given to Reading Literacy. Students enrolled in higher SES background were reported more inclined to have higher achievements than that of students from lower background of SES (Shera, 2014; Albania, et al., 2014); López, 2020; Bodovski, et al., 2017).

Hwang, et al., (2018) analysis of PISA data from 10 countries shows a positive correlation between educational outcome in Science and Mathematics and frequency of student-centred instruction. Results from this study also demonstrated that student-Centred instruction frequently narrows the gulf between students. Another study by Aytekin and Tertemiz (2018) conducted a comparative analysis that looked at factors that affects positive educational outcomes by comparing the PISA results of Turkey with those of South Korea within the context of economic development. South Korea had a higher overall PISA score than Turkey because they have an economic system that is driven by the export of manufactured goods (Ertem, 2020).

Hu,et al., (2018) did an analytic study on 44 countries. This was done by regarding the relationship of the accessibility and usage of ICT with reference to educational outcome in mathematics and Science concluded that a positive correlation exists between ICT competence and educational outcome in Reading Literacy, Mathematics and Science.Ertem (2020) carried out an analysis of PISA 2018 data of both school and students' attributes that influences the reading fluency of Turkish students. The findings unveil that students who perceive themselves as capable in the usage of ICT got higher scores in Reading Literacy than that of those who did not. Moreover, gender differences amongst students were also associated with score patterns such as,boys tend to have higher assessment marks in Mathematics while girls tends to score higher in the assessment of Reading Literacy (Breda &Napp 2019).This relationship is consistent across many OECD countries with girls outperforming boys in Reading Literacy (PISA 2018 Results 2019; I). This PISA gender gap is significantly large and is consistent across many assessment cycles. A study conducted by Fredriksson, (2009) on Sweden's education system made the observation that migrant students are better than native students in

reading Literacy but there is a significant difference between the two. Gender gap increases during certain period of educational development amongst student of lower SES. There are some correlations of the gender gap to SES as well as social background.

In a selective educational system, disparities between institutions become a major concern. Some people believe that private schools are used to separate children depending on their social and economic status. Therefore, students in private schools have academic achievements that are remarkably similar to those of students in public schools. An analysis of PISA 2012 data from 40 countries was carried out by Sakellariou (2017) who concluded that only a few private schools showed any significant advantage over the public schools. Competition among schools is seen as another factor that contributes to inequality. Selective schools seek to admit certain pupils in order to enhance their prestige and status. Some school districts seek to make selective schools more accessible to pupils from all SES background, even though prior academic performance is used as a selection criterion. It has been discovered from PISA data analysis of students from low and high SES background that family resources put a huge impact on educational result than school resources such as the size of class and competition. For instance, class size of 40-59 pupils in Kenya is seen as too large and is a major cause of low-quality teaching. A similar situation is reported for public schools in South Africa and is seen as a reason for adopting a teacher centred approach in spite of the attempt to move away from this approach to student centred learning (de Jager,2017). Studies of schools in Malaysia indicate that small class size is an important factor that contributes to better performance in national examinations. All these studies suggest a negative correlation between educational outcomes and large class size.

Other school environmental attributes that affect educational outcomes include quality of educational materials, availability of computer resources, location of the school, adequacy of teachers and libraries, support infrastructures such as labs, internet access and workshops. In some instances, the location of schools proves to be a significant factor for example when schools are in rural areas and there is a need to implement reforms that rely significantly on support infrastructure that are not readily available in certain remote locations (Shera, 2014). The shortage of adequate staff is also a significant factor that contributes to low performance in PISA. Teacher behaviour does have high influence on students' motivation to read. Trained qualified teachers are important factors to consider to improve Reading Literacy outcome.An analytical study from PISA 2018 data conducted by Ertem (2020) on student and school attributes that affects the outcome of Reading Literacy amongst students in Turkey stated that there are significant aspects of both students and teachers' behaviour that hinders desired outcome on Reading Literacy. Student teacher relationship also derives a considerable impact on the outcomes related to the fields ofMathematics and Reading Literacy. Qualities of student-teacher interaction that contribute to improve educational outcome across all subjects include interactions that encourage student learning, helps students to set and achieve goals and are based on students' feeling being cared for and treated fairly and been given the opportunity to make their own choice. A study by Shehzad et al., (2020) was conducted to unveil relationship between the sources of Saudi students' self-efficacy as well as their reading strategies. In this respect, the results unveiled that self-efficacy sources had significant correlation with reading self-efficacy beliefs.

4. Methods

4.1 Design, Sample and Setting

The present study is analytical in nature which tends to measure the chosen variables. The data used in analysis consists of a stratified random sample of 6136 Saudi students (15-year-old) that study in 235 schools.

4.2Data Collection and Analysis

This research employed the PISA 2018 for data analysis. Moreover, the PISA comprises a cross-national survey that examines the level of students, who were 15 years old, in reading, mathematics, and scientific literacy and it executes it once in three years under the auspices of the so called (OECD).

A procedure of stratified sampling that followed two stages was involved in PISA to get a sample of students (aged 15 years) within all the stated country. The first stage calls for the selection of a representative sample of at least 150 schools in each country randomly, taking into consideration aspects such as location and schools that serve 15-year-old. The second stage involve the random selection of students who are 15-year-old from each school that has been selected in the first stage (OECD, 2019). In Saudi Arabia, 235 schools with eligible 15-year-old students were randomly sampled from 13 geographic regions. Najran and Jizan regions were excluded, which represent 7.59% of this population (OCED, 2019). In the second stage, 35 students were randomly sampled from each school that has been selected in the first stage. The PISA sample for Saudi Arabia included 235 schools and 6,136 students. This study engaged students and school-level variables that were centered on the suggested conceptual framework so as to establish the connection between the stated variables and students' reading performance. Seven variables (student-level) and eight variables (school-level), considered to be exogenous to reading performance, were selected from the PISA 2018 data. Table 1 embodies a short description of this.

Table 1.A summary of variables at the levels of student and school

	Variables	PISA code
Student-level		
	Reading performance	
	Gender	GENDER
	Social, Economic and Cultural Status	ESCS
	Early childhood education	DURECEC
	ICT recourses	ICTRES
	Home educational resources	HEDRES
	Teacher support	TEACHSUP
	Exposure to bullying	BEINGBULLIED
	Disciplinary climate	DISCLIMA
School-level		
	School Type	SCHLTYPE
	Class Size	CLSIZE
	Location	SCHLOCATION
	Computer availability	RATCMP1
	Access to the Internet	RATCMP2
	Teacher behaviour hinder learning	TEACHBEHA
	Educational staff shortage	STAFFSHORT
	Educational Material Shortage	EDUSHORT

4.3 Dependent variable

4.3.1 Student dataset

Seven variables were selected for student level variable. They were gender, economic, social and cultural status, parental education, early childhood education, ICT resources, disciplinary climate, exposure to bullying, and teacher support. Gender was ultimately coded using Dummy-variable as female = 0 and male = 1. Moreover, the (ESCS) was construed from three indices that were associated with family background concerning education, occupation and home possessions, as well as about books at home. Early childhood education (DURECEC) specifies the years that a student spent in studying and cares during his/her early childhood. The ICT resources (ICTRES) point to the amount of ICT resources available at home. The (HEDRES) indicates the number of educational resources available at home.

The following student level variables were scaled using 4-point Likert scale. Disciplinary climate (DISCLIMA) indicates the students' responses to questions about how often they miss opportunities for learning, using these options ("every lesson", "most lessons", "some lessons", "never or hardly ever"). Exposure to bullying (BEINGBULLIED) indicates the students' responses about being bullied during the last year. Furthermore, teacher support (TEACHSUP) indicates students' responses to questions about how often teachers provide feedback and support them.

4.3.2 School dataset

The principal of each participated school completed the School Questionnaire (SCQ). The SCQ comprised of questions pertaining to school management, learning environment, social factors, and resources. The research examined the way social factors and resources of a school ultimately have an influence on the students' reading performance. The eight school-level variables were taken into consideration in this study are school type, class size, school location, computer availability, access to the Internet, teacher behaviour hinder learning, shortage of educational staff, and educational material shortage. School type (SCHLTYPE) variable classifies school as either public or private (one item), school type was coded as private = 1 and public = 0. Class size (CLSIZE) is the average of class sizes in each school. School location (SCHLOCATION) classifies schools into five categories, from a village (fewer than 3000 inhabitants) to a large city (with over 1.000.000 inhabitants). Dummy-variable coding was used to transform school location into numerical data. Four coded variables were created, and results were in comparison with CITY as the reference group. Computer availability (RATCMP1) indicates the percentage of available computers to size of school. Access to the Internet (RATCMP2) indicates the ratio of Internet-connected computers.

The following school level variables were scaled using 4-point Likert scale. Teacher behaviour hinder learning (TEACHBEHA) was taken that was based on school principals' observations regarding their assumption about elements that involved in hindering student learning due to teachers` behaviour. The values that carry positive signs indicate "principals' opinions that such behaviours which are related to teachers challenge and obstacle learning; values which carry negative points reflect that principals thought that these behaviours related to teachers obstacle learning to a lesser extent, when it is compared to the average of OECD" (OECD 2019)shortage of educational staff (STAFFSHORT) constructed based on four items namely poorly qualified assisting staff, unqualified teachers, teaching staff and assisting staff lack. Also, Shortage of educational material (EDUSHORT) was used that was based on four items such as educational material with low quality; educational material lack; physical infrastructure with low quality as well as physical infrastructure lack. Positive values, with reference to these two indexes, show that principals observed the amount or/and quality of human resources as well as educational

material at their schools as bigger hindrance than the average of OECD.

Given the nested form of the PISA data, multiple regressions cannot be taken into consideration. Dual-level (HLM) approaches were adopted aiming to answer the research questions. HLM recognises the fact that students are allowed to have residual components in all levels of hierarchy and eradicates the breach of supposition regarding independent observation for nested data. At the primary level, variables of the student level were introduced in the said model so as to observe dissimilarities between schools. Second, variances between schools were inspected through a forecaster at the school level. HLM considers the fact that students are registered in schools by allowing residual components at each level in the hierarchy. Using the HLM software version 8, three models were generated. The first model is the null model which had no predictors in order to analyze the manner that the data were actually significant. The second model analysed the manner that variables of student level influenced reading literacy. On the other hand, the third model analysed the manner variables of school level influenced reading literacy.

The researcher computed a correlation matrix among the followed predictors to ensure that dataset does not have multicollinearity. Multicollinearity occurs when two or more predictors in the dataset are highly correlated, in case correlation coefficients go beyond 0.80 (Field, 2009). Moreover, the Factor of Variance Inflation, which is abbreviated as (VIF) is another indicator commonly used to test Multicollinearity. The analysis of correlation and VIF for variables included in level 1 and level 2 models were not highly correlated to each other and their VIF values were less than 2.50. Thus, the dataset in this study was free of multicollinearity. Comprehensive procedure for the HLM analysis is explicated in the results section.

5. Result

As suggested by OCED, ten bivariate correlations for the reading plausible values and predictors were obtained and the average of them was used to reflect the most unbiased estimates. Table 2 presents the correlation of different variables and indices mentioned in level 1.The magnitude of associations was moderate. First, gender had a significant correlation (r = -.341) with Reading Literacy scores. Economic, cultural and social status (ESCS), resources of ICT, home educational resources HEDRES, Disciplinary climate (DISCLIMA), and Teacher support (TEACHSUP) were positively correlated to Reading Literacy scores, at 0.34, 0.28, 0.27, 0.07, and 0.11 respectively. Early childhood education (DURECEC) and Exposure to bullying (BEINGBULLIED) were negatively associated with Reading literacy score, at -0.06. and -.16 respectively. All the predictors in level 1 had significant relationship with Reading Literacy scores. Therefore, the predictors belonging to level 1 were added to the multilevel modelling process and no modification was needed on the study conceptual framework at this point.

Table 2. Bivariate Correlation Coefficient (r)

Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1- Reading Score	-								
2-Gender (Male)	-.341**	-							
3-Escs	.344**	-.018	-						
4-Durecec	-.063**	.057**	.036**	-					

5- Ictres	.284**	-.086**	.854**	-.005	-				
6- Hedres	.279**	-.135**	.536**	.009	.536**	-			
7- Disclima	.071**	-.012	-.017	-.021	.006	.028*	-		
8- Beingbullied	-.165**	.227**	-.006	.042**	-.048**	-.081**	-.159**	-	
9-Teachsup	.114**	-.003	.026*	.000	.044**	.076**	.158**	-.101**	-

* Correlation is viewed as significant at the dual-tailed 0.05.

** Correlation is viewed as significant at the 2-tailed 0.01.

The first question was: Are there differences in the mean achievement scores of reading literacy among Saudi schools. To know the percentage of variance elucidated in Level 1 (σ2) as well as Level 2 (τ00), the first model (null model) had no detail about predictors. The intraclass correlations (ICC) of the two-level HLM models enable us to calculate the proportion's variance explicated among each of the levels. A model of ANOVA along with the null model was ultimately constructed to examine whether the differences were found as significant at all levels:

1st level Model: $Yij = \beta 0j + rij$

2nd level Model: $\beta 0j = \gamma 00 + u0j$

Where:

Yij refers to the dependent variable (Reading Literacy Scores) for each student at school.

β0j is the intercept or mean achievement of the school.

rij refers to the effect associated with student I in school j.

γ00 is the average of the school means reading literacy achievement.

u 0j reflects the random effect related to school j.

As presented in Table 3, the maximum likelihood estimate of the component variance at level 1(student-level (σ2)) is 2690.33, at level 2 (the school-level (τoo)) is 3901.06. A significant τoo ($\chi 2 = 4229.51$, df = 233) implies that there is a considerable amount of variation among schools ($p < .001$), and multilevel analysis is an appropriate method for the current dataset. The intraclass correlations ICC is calculated as following:

$ICC = \tau oo / (\tau oo + \sigma 2)$

$ICC = 2690.33/(3901.06+2690.33) = 0.40.$

The findings of the ICC showed that nearly 60% of the Reading Literacy total variance can ultimately be linked to students, whereas 40% of the total variance can obviously be linked to the schools that they are enrolled in.

Table 3. Null model final computation of components of variance (1st model).

Random Effect	**Standard Deviation**	**Variance Component**	**x^2**	**p.**
School average, u_{0j}	51.86	2690.33	4229.52	0.001**
Level-1 Effect, r_{ij}	62.46	3901.06		
Note. *p< .05. **p < .01. ***p < .001				

5.1 Student-level factors

Second model focused on the influence of student variables on reading literacy. Student-level factors include Gender, ESCS, DURECEC, ICTRES, HEDRES, DISCLIMA, BEINGBULLIED, and TEACHSUP. The following equations were estimated to answer the 2nd question:

Level-1:

$Yi = \beta 0j + \beta 1j\ (Gender\_M) + \beta 2j\ (ESCS) + \beta 3j\ (DURECEC) + \beta 4j\ (ICTRES) + \beta 5j\ (HEDERS) + \beta 6j\ (DISCLIM) + \beta 7j\ (BEINGBULLIED) + \beta 8j\ (TEACHSUP) + r\ ij$

Level-2:

$\beta 0j = \gamma 00 + u0j$

$\beta 1j = \gamma 10$

$\beta 2j = \gamma 20$
$\beta 3j = \gamma 30$
$\beta 4j = \gamma 40$
$\beta 5j = \gamma 50$
$\beta 6j = \gamma 60$
$\beta 7j = \gamma 70$
$\beta 8j = \gamma 80$

Where;

β0j is the mean Reading literacy achievement in school j

β1j is the mean difference between the scientific literacy achievement of male and female students

β2j is the differentiating effect of social, economic as well as cultural status in school j

β3j is the differentiating effect of the years a student spent during their early childhood care and education in school j.

β4j is the differentiating effect of amount of ICT resources available at home in school j

β5j is the differentiating effect of number of educational resources available at home in school j

β6j refers to the differentiating effect of disciplinary climate in school j

β7j refers to the differentiating effect of being bullying in school j

β8j is the differentiating effect of the teacher to support in school j

Table 4 presents results for the second model in the list of hierarchical linear models concerning variables of student level. The overall mean of reading literacy scores was 436.06 (SD= 4.23). Seven out of eight student-level variables tested in a series of random coefficients model had significant effects on reading literacy. According to the results of model 2, the slope of student's gender (γ 10) was -50.38 (t = -9.80), meaning that male students score about 50 points lower, on average, when compared to female students. The slope of the economic, cultural as well as social status (ESCS) of a student was a significant variable in predicting reading literacy score, its slope (γ 20) was 11.26 (t = 11.97); indicating that about one standard deviation change in ESCS was associated with 11.26 change in the reading score. One-unit increase in early childhood education (DURECEC) and being bullying (BEINGBULLIED) decreases reading literacy score by 3.78 and 5.28 points respectively. An increase by one unit in ICT resources and disciplinary climate ultimately levels up reading literacy by 2.87 and 3.23 points respectively. The slope of students' responses about teacher support (γ 80) was 6.99 (t = 7.59), meaning that, one unit increase in teacher support of students will result in 6.99 units surge in their score of reading literacy. The coefficient of the home educational recourses (HEDRES) variable was ultimately not found significant at the student's level.

Table 4. Fixed Effects on the RCM (Random Coefficient Model) in the 1st level[2nd model].

Fixed Effect	Coefficient	SE	t-ratio	Approx. d.f.	p-value
Reading Literacy, Γ_{00}	436.064686	4.234831	102.971	233	0.000***
Gender_M, Γ_{10}	-50.385879	5.138994	-9.805	5894	0.000***
Escs, Γ_{20}	11.260823	0.940186	11.977	5894	0.000***

Durecec, Γ_{30}	-3.785075	0.928464	-4.077	5894	0.000***
Ictres, Γ_{40}	2.871029	0.928911	3.091	5894	0.002**
Hedres, Γ_{50}	1.599738	0.857545	1.865	5894	0.062
Disclim, Γ_{60}	3.230473	0.784039	4.120	5894	0.000***
Beingbullied, Γ_{70}	-5.285093	0.882294	-5.990	5894	0.000***
Teahsup, Γ_{80}	6.995001	0.921246	7.593	5894	0.000***

Note. *p< .05. **p < .01. ***p < .001

In addition, as depicted in Table 5, student-level residual variance at model 2 was obtained as 3651.60. By comparing the variance estimates obtained from model 1, known as the (null model), as well as the random coefficient obtained in model 2, the researcher calculated the percentage of the variance explicated by the variables at the student-level:

((σ2 (ANOVA) - (σ2 (random coefficient)) / (σ2 (ANOVA)

(3901.06-3651.60.) / 3901.06 = .064

Table 5. Final computation of components of variance (1st model)

Random Effect	**Standard Deviation**	**Variance Component**	**x^2**	**p.**
School average, u_{0j}	36.52	1334.20	2334.03	.000***
Level-1 Effect, r_{ij}	62.46	3651.60		

Note. *p< .05. **p < .01. ***p < .001

This result indicates that out of the 60% of the within-school variance that was attributed to students in the null model 6.4 % is explicated by 1st level variables in the second model, and 93.6% of the variation within-school remained unexplained. In addition, school-level residual variance, after including the student-level variables, was obtained as 1334.20. Therefore, reduction in the residual variance at the 2nd level after the inclusion of the 1st level variables can be calculated using the following formula:

((τoo) (ANOVA) - (τoo) (random coefficient)) / (τoo) (ANOVA) =

(2690.33-1334.20)/ 2690.33= .50.

For instance, considering the null model, about 40% of the total variance credited to the school. While adding the variables of 1st level to the second model, the variance of reading literacy was abridged by 50% (40% - 20%= 20%). Based on it, it is justifiably construed that there is obviously an addition of almost 33% in the variance number when it comes to the variables of student level that are attached to the second model (3651.60/1334.20+3651.60 = .73).

5.2 School-level factors

Table 6 presents model 3 which include variables at the level of school. The eight variables of school-level encompassed in the analysis were School type (SCHLTYPE), Class size (CLSIZE), School location (SCHLOCATION, results were in comparison with (CITY), Computer availability (RATCMP1), Access to the Internet (RATCMP2), Teacher behaviour hinder learning (TEACHBEHA), educational staff shortage (STAFFSHORT), and educational material shortage (EDUSHORT). The model 3, with school-level variables, can be expressed in the following equation:

Level-1:
Yij = β 0j + rij
2nd level:

$\beta 0j = \gamma 00 + \gamma 01$ (SCTYPEj) + $\gamma 02$ (CLSIZEj) + $\gamma 03$ (RACMP1j) + $\gamma 04$ (RACMP2j) + $\gamma 05$ (TEACBEHAj) + $\gamma 06$ (STAFFSHOj) + γ 7 (EDUSHORTj) + $\gamma 08$ (SLOCA_VIj) + $\gamma 09$ (SLOCA_SMj) + $\gamma 10$ (SLOCA_TOj) + $\gamma 11$ (SLOCA_LAj) + uij

where;

B 0j is the mean Reading literacy scores for school j.

γ 00 reflects the mean outcome in the population.

γ 01 reflects the differentiating effect (slope) of the mean of school type on the school mean reading literacy scores.

γ 02 is the differentiating effect (slope) of the class size on the school's mean reading literacy scores.

γ 03 is the differentiating effect (slope) of the ratio of available computers on the school mean reading literacy scores.

γ 04 is the differentiating effect (slope) of the ratio of computers linked to internet on the school mean reading literacy scores.

γ 05 is the differentiating effect (slope) of the teacher behaviour hinder learning on the school mean reading literacy scores.

γ 06 is the differentiating effect (slope) of the mean of school shortage of educational staff on the school mean reading literacy scores.

γ 07 is the differentiating effect (slope) of lack of educational content on the school mean reading literacy scores.

γ 08 is the differentiating effect (slope) of village schools mean on the school mean reading literacy scores in comparison to city schools.

γ 09 is the differentiating effect (slope) of small-town schools mean on the school mean reading literacy scores in comparison to city schools.

γ 10 is the differentiating effect (slope) of town schools mean on the school mean reading literacy scores in comparison to city schools.

γ 11 is the differentiating effect (slope) of large city schools mean on the school reading literacy scores in comparison to city schools.

According to the results of model 3, out of eight school-level variables, only one variable was significant. This variable was about School location (SCHLOCATION). Generally, students who were studying in a school that was situated in village, rural area, or hamlet (nearly less than 3,000 people) scored about 28.78 points that was lower than that of students who were studying in cities. Also, students who were enrolled in schools located in large cities (over 1,000,000 people) tend to score about 5.57 points above, on average, than students who were enrolled in schools located in cities. In regard to level 1 variables, all variables retained their significance at level 2, with a samelier effect on the reading literacy scorers on both levels.

As presented in table 6, test of components related to variance-covariance included in the 3rd model was found significant as (τoo =955.92, X2 (222) = 1708.97, p < .001). Student-level residual variance at model 3 was very similar to the one obtained in the previous model 3651.37, with a very small decrease in comparison to the previous model. School-level variables examined in the intercepts as outcomes model can be calculated using the following formula:

(τoo (ANOVA)- τoo (Means as Outcomes)) / τoo (ANOVA)

= (2690.34-955.92)/2690.34 = .644

Table 6. Fixed Effects on the Random Coefficient Model in 2nd level (3rd model)

Fixed Effect	Coefficient	Standard Error	T-Ratio	Approx. D.F.	P-Value
For Intrcpt1, B_0					
Intrcpt2, Γ_{00}	426.604586	10.909269	39.105	222	0.001***
Sctype_P, Γ_{01}	11.969579	8.936418	1.339	222	0.182
Clsize_1, Γ_{02}	0.161549	0.189891	0.851	222	0.396

Racmp1, Γ_{03}	2.289191	8.241310	0.278	222	0.781
Racmp2, Γ_{04}	4.957061	6.182264	0.802	222	0.424
Teacbeha, Γ_{05}	-3.541212	2.126166	-1.666	222	0.097
Stafshor, Γ_{06}	-0.840387	2.527030	-0.333	222	0.740
Edshort, Γ_{07}	-3.126583	2.328967	-1.342	222	0.181
Sloca_Vi, Γ_{08}	-28.776823	8.706489	-3.305	222	0.001**
Sloca_Sm, Γ_{09}	-14.621519	7.723909	-1.893	222	0.060
Sloca_To, Γ_{010}	-11.922019	7.747055	-1.539	222	0.125
Sloca_La, Γ_{011}	16.382882	5.566219	2.943	222	0.001**
Gender_M, Γ_{10}	-51.020379	4.822885	-10.579	5894	0.000***
Escs, Γ_{20}	10.967095	0.940893	11.656	5894	0.000***
Durecec, Γ_{30}	-3.764253	0.927823	-4.057	5894	0.000***
Ictres, Γ_{40}	2.778941	0.928158	2.994	5894	0.003
Hedres, Γ_{50}	1.553544	0.856741	1.813	5894	0.070
Disclim, Γ_{60}	3.261860	0.783012	4.166	5894	0.000***
Beingbullied, Γ_{70}	-5.365755	0.881449	-6.087	5894	0.000***
Teahsup, Γ_{80}	6.926362	0.919838	7.530	5894	0.000***

Note. *p< .05. **p < .01. ***p < .001

Table 7 unveils that school-level variables examined in level-2 explained 60.4 % of the variation attributed the school level, which was 20% in the previous model. In addition, there is an approximately 6% addition with reference to the variance amount revealed while adding the student-level variables in the second model (3651.37/955.92+3651.37 =.79). In total, the incorporated variables of this study elucidated 64.4% of the variance among schools while it shows 6.4 % of the variance among students for reading literacy scores.

Table 7. Final computation of components of variance (3rd model)

Random Effect	**Standard Deviation**	**Variance Component**	**x^2**	**p.**
School average, u_{0j}	30.91	955.92	1708.97	.000***
1st level Effect, r_{ij}	60.42	3651.36		
Note. *p< .05. **p < .01. ***p < .001				

6. Discussion

Results from the analysis provide empirical evidence of the relationships between those factors considered in the study and students performance in the PISA assessment in Reading Literacy. Those key variables in this study are easily classified asstudent and school factors. In analysis a ten bivariate correlation for Reading Literacy with plausible predictor values were obtained keeping with the suggestion from the OECD. The average of these values was used to compute the most unbiased estimates. Seven of the student attributes have significant effect on student Reading Literacy scores. Thestudy results showedmoderate association of variables with Reading Literacy. The attribute variables ESC –Economic, Cultural & Social Status; Home Educational Resources; DISCLIMA-Disciplinary Climate; and TEACHUP-Teacher Support had positive correlation coefficients. With student attribute data set having the most significant correlation values, these are valid targets for policy makers

or economic planners wanting to see improvement in the scoresreading literacy of the Saudi students aged 15 years.

Results from the analysis based on model 3 suggest that only the variable SCHLOCATION in the school attribute data set is significant. Students enrolled in large cities tend to score above the average score for students located in cities. Similarly, Shera (2014) identified that the school`s location was an important element in this regard. Moreover, the results indicated that male students obtained lower than average score in comparison with their female counterparts.These results are parallel to the results of Reilly (2019) and Breda and Napp (2019) that asserted that gender differences played an important role in deriving student Reading Literacy scores. Males tend to have high assessment scores in Mathematics and girls tend to score high in Reading Literacy assessment.

ESC-Reading Literacy score correlation is significant in predicting Reading Literacy score. Moreover,the development and implementation of (ICT) putsubstantial impact on Reading Literacy scores of the students aged 15-years in Saudi Arabia. This findingis in agreement with findings from an analysis on PISA 2015 data across 44 countries where the authors also used a Hierarchical Linear Model (HLM) in their assessment on casual relationships between academic performance, National ICT access and individual student access to ICT and student attitude towards ICT.

The results also agree with the main findings of analysis of PISA 2018 data of both school and students' attributes that influences students Reading Literacy in Turkey conducted by Ertem (2020). Findings of this research exhibited that all selected students view themselves as skillfull in ICT had higher marks in Reading Literacy as compared to others who did not perceive themselves as competent (Ertem, 2020). The original question behind the motivation for this analytic research: As determined by the school attributed variables: school location, availability of educational resources in general, and ICT resources in particular. Research also demonstrates that there is considerable amount of variation among schools.First and foremost, despite the fact that the current study has strong points such as a huge dataset, multi-level analysis, random sampling. Moreover, it hinges on quantitative and secondary data analysis. Results from this study provide information that can be useful to economic planners and educational policy makers as the study is not just a scholarly report but is intended for practical use. In terms of theoretical significance, this study comprises tendencies presented in the literature on PISA. Most of these trends draw attention to comparisons between participating countries, historical trends and the relationship connecting student and school related factors and educational outcomes. In the fields of theory research, and implementation, this research study comprises some implications. Although, policymakers and economic planners are working to design policies and development strategies that target the characteristics which will help Saudi students improve their reading literacy scores.

The study recommends that the necessity of equitable opportunity in education was bolstered by inter-school and between-school inequalities. Reduced disparities in learning environments may lead to more equality. Additionally, precursors of reading literacy that includeICT competency, disciplinary climate as well as learning-disrupting student conduct, can be taken to build the academic basis or to ameliorate the performance of a student. Conspicuously, the study will facilitate policymakers or educational leaders with an opportunity to reorganise school settings in practise. Supporting students and improving educational environments will improve not only student accomplishment but also school quality. This might involve a strategy to make resources and facilities available to schools in rural areas in the same way they are to schools in big cities

9. Conclusion and Recommendations

The study found that that schools in rural areas tend to score below average. Whereas students in large cities tend to score high. At the school attribute variable level, all student attributes variables retain their relevance, with smaller effect on the Reading Literacy score at both levels. Policy makers and economic planners seeking to develop policies and development strategies that target those attributes would make significant contribution to increase Reading Literacy scores among Saudi students. This can include strategy to make resources and facilities available to schools in large cities also available to schools in rural areas.

As a result, future research could include primary data (both the quantitative and qualitative) taken from larger set of populations in their empirical studies. Researchers could do similar analyses with different factors to provide light on the big picture of PISA because this study used the random sampling, which made the study generalizable to the public. The relationship between mathematical literacy and equity policies, for example, may be researched. However, because the dynamics of school that have impact on reading literacy may modify, the findings of the study cannot be extended to other situations as a limitation. Primary research could be undertaken at various levels of education to overcome this constraint.

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