THE USA JOURNALS
THE AMERICAN JOURNAL OF SOCIAL SCIENCE AND EDUCATION INNOVATIONS (ISSN- 2689-100X)
VOLUME 06 ISSUE08

PUBLISHED DATE: - 10-08-2024
DOI: - https://doi.org/10.37547/tajssei/Volume06Issue08-14 PAGE NO.: - 207-222

RESEARCH ARTICLE Open Access

EFFECT OF SOME CURRICULUM ELEMENTS AND SCHOOL CONTEXT ON MATHEMATICS AND SCIENCE ACADEMIC PERFORMANCE AMONG 15 YEARS OLD STUDENTS

Dr. Manal D. Alkhudaydi
Department of Educational Sciences,Florida Institute of Technology, USA, Melbourne
Email: - Malkhudaydi2016@my.fit.edu
Orchid Id: - 0000-0002-6194-107X

Abstract
This research examined the effect of some curriculum elements and school context on mathematics and science academic performance among 15 years old students. It specifically aimed to demystify the effect of school type, school size, location, economic, social and cultural status, class size, student-teacher ratio, shortage of educational staff, shortage of educational material on students' achievement in science and mathematics. It analyzed the results of the 2018 PISA-Saudi Arabia. The findings revealed weak and moderate associations between the variables. Much importantly, school shortage of educational staff and school economic, social, and cultural status seems to have significant influence on mathematics and science academic performance.

Keywords Curriculum, school, mathematics, science, academic performance, education, KSA.

INTRODUCTION

The world today realizes the importance of education as the only way towards sustainable development. In this respect, the UN, through OECD, developed PISA (Zheng, et al., 2022), which is an international assessment programme, mainly to help countries monitor their students' achievement (Rappleye, 2023). The programme targets the achievement of 15-year-olds in reading comprehension, science and mathematics (Pitsia, et al., 2022).

Since its launch in 1997, PISA has received the attention of educational authorities, witnessing the participation of more than 80 countries (Ding & Tasara, 2024). This number reflects the world countries' awareness of PISA as an international assessment that provides accurate data regarding the level of education in each of the participating countries (AlAli & Wardat, 2024). Therefore, it enlightens the educational authorities in those countries to develop their educational systems.

Saudi Arabia joined PISA in 2018 ,as 6,136 students from 235 schools participated in the said programme (Furnham & Cheng, 2024). The results revealed that Saudi Arabia needs to develop its educational system, as students' scores on mathematics, science and reading were below the average set by the OECD.

The results of the 2018 PISA-Saudi Arabia reflected that the selected sample from Saudi Arabia are weak at mathematics and science subjects

(AlKaabi, et al., 2022). Table 1 illustrates this point. Since its launch in 1997, PISA has received the attention of educational authorities, witnessing the participation of more than 80 countries (Ding & Tasara, 2024). This number reflects the world countries' awareness of PISA as an international assessment that provides accurate data regarding the level of education in each of the participating countries (AlAli & Wardat, 2024). Therefore, it enlightens the educational authorities in those countries to develop their educational systems.

Saudi Arabia joined PISA in 2018 ,as 6,136 students from 235 schools participated in the said programme (Furnham & Cheng, 2024). The results revealed that Saudi Arabia needs to develop its educational system, as students' scores on mathematics, science and reading were below the average set by the OECD.

The results of the 2018 PISA-Saudi Arabia reflected that the selected sample from Saudi Arabia are weak at mathematics and science subjects (AlKaabi, et al., 2022). Table 1 illustrates this point.

Table 1. The average scores set by the OECD compared to the Saudi students' scores (PISA, 2018)

Subject	OECD average	Saudi students' scores
Mathematis	489	373
Science	489	386
Reading	487	399

Source: Designed by the researcher, based on the results of the 2018 PISA.

Thus, this study ventured to examine the effect of some curriculum elements and school context on mathematics and science academic performance among 15 years old students. It used data included in the 2018 PISA assessment. Therefore, it reanalyzed and interpreted the findings of the 2018 PISA, focusing on the data related to Saudi Arabia. Besides, the focus is made on the extent to which mathematics and science academic performance are influenced by some curriculum elements and school context.

RESEARCH SIGNIFICANCE:

Despite the fact that more than two decades since PISA's first application in 2000, Saudi Arabia did not join the programme until 2018. This indicates a lack of studies interpreting the results of this international assessment. Therefore, this is one of the early researches interpreting the findings of the 2018 PISA-Saudi Arabia. Furthermore, it is the first study that uses the data of the 2018 PISA-Saudi Arabia to examine the effect of some curriculum elements and school context on mathematics and science academic performance among 15 years old students. Its findings will enlighten the educational authorities in Saudi Arabia and provide them with the necessary data to develop the educational system. Besides, it will be the cornerstone on which future research in this field will be based.

PROBLEM STATEMENT:

Saudi Arabia realizes the importance of education for achieving its goals of sustainable development. In this respect, Saudi Vision 2030 gives much importance to education. It views education as the backbone of any development. Therefore, Human Capital Development Program was launched. But these efforts have not achieved the desired educational goals.

The findings provided by the 2018 PISA reflect Saudi students' low scores in reading comprehension, science and mathematics. The low scores of students indicate the need to carry out studies that will explicat ethr. Thus,

RESEARCH QUESTIONS:

1. To what extent do some curriculum elements affect mathematics academic performance among 15 years old students in KSA?
2. To what extent do some curriculum elements

affect science academic performance among 15 years old students in KSA?

3. To what extent does school context affect mathematics academic performance among 15 years old students in KSA?

4. To what extent does school context affect science academic performance among 15 years old students in KSA?

RESEARCH OBJECTIVES:

1. To know the effect of some curriculum elements on mathematics academic performance among 15 years old students in KSA.

2. To know the effect of some curriculum elements on science academic performance among 15 years old students in KSA.

3. To know the effect of school context on mathematics academic performance among 15 years old students in KSA.

4. To know the effect of school context on science academic performance among 15 years old students in KSA.

LITERATURE REVIEW:

Students' achievement in science and mathematics has been one of the most important topics occupying the minds of scholars and educationalists who consider these subjects as the center of academic achievement in science. In this respect, Adewuyi and Gbolade (2024, p 171) explored certain psychosocial predictors of students' achievement in Mathematics. It is a path-analytical study that takes the correletional design. Its results show a correletion between psychosocial variables and students' achievement in Mathematics.

Alghamdi (2017, p 6079) examined the effects of an integrated curriculum on student achievement in Saudi Arabia. The study ultimately revealed that curriculum integration positively affects students' achievement. Apart from this, Alyanak and Özkaya (2024, p 20) investigated the effect of intelligence games on 5th grade students' mathematics attitudes and academic achievement. Using the quasi-experimental design, the study highlighted positive changes in the experimental group's towards mathematics. It also highlighted the positive changes in their academic achievement.

Asanre, et al. (2024, p 275) identified the impact of interest and motivation on academic achievement of junior secondary school students in mathematics. This descriptive survey highlighted that motivation and interest play a positive role in student achievement in mathematics. Apart from this, Aslam, et al. (2024, p 113) studied the link between the model of understanding by design and the academic achievement in science. It targeted a sample of fifth grade students in Pakistan. This sequential explanatory research proved the effectiveness of applying the model of understanding by design in science education.

Bascones, et al.. (2024, p 210) examined certain contextual factors that ultimately affect student performance in mathematics. This descriptive inferential research proved the influence of different factors on students' performance in mathematics. These factors such include students' attitudes towards mathematics, parental support, self-efficacy and the learning environment.

Furthermore, Rodríguez, et al. (2020, p 96) compared between native and immigrant students in terms of achievement. The study is based on PISA 2018. Its results proved that the native students had better knowledge of mathematics and science skills than the immigrant students. Apart from this, Sabitu and Khalid (2024, p 150) studied the effects of computer animation on students' academic achievement in Geometry. The study targeted a sample from senior secondary school students in Oyo Metropolis, Nigeria. This quasi-experimental study reflected a significant difference in the performance of students taught geometry using computer animation and the students taught using the traditional method.

Shishigu, et al. (2024) studied the effect of integrating technology in learning on mathematical achievement. It also examined the effect of technology in decreasing anxiety associated with learning mathematics. The data collected from a sample of students from Wolkite University, Ethiopia revealed the effect of technology in reducing mathematics anxiety and increasing learners' achievement. Apart from this, Wanke, et al. (2024, p 636) studied the effect of certain institutional factors on academic performance in Brazil. Its results obviously reflected that certain institutional factors, like school libraries, projectors, computer facilities, etc., positively affect students' achievement.

Since its launch as an international assessment of educational systems' outcomes, PISA has been widely discussed as the most effective tool of monitoring 15-years old students' achievement. In this respect, Gamazo and Martínez-Abad (2020, p 1) explored different factors linked to academic performance in PISA 2018. The research used data mining techniques and found that academic performance of students in science, reading and mathematics.

Moreover, Karakus, et al. (2022, p 233) attempted to know the academic achievement of the 1st and 2nd generation immigrant students. The study analyzed data provided by PISA 2018. It revealed that teacher enthusiasm, perceived parental support and the adaption of instruction were associated with improved academic performance.

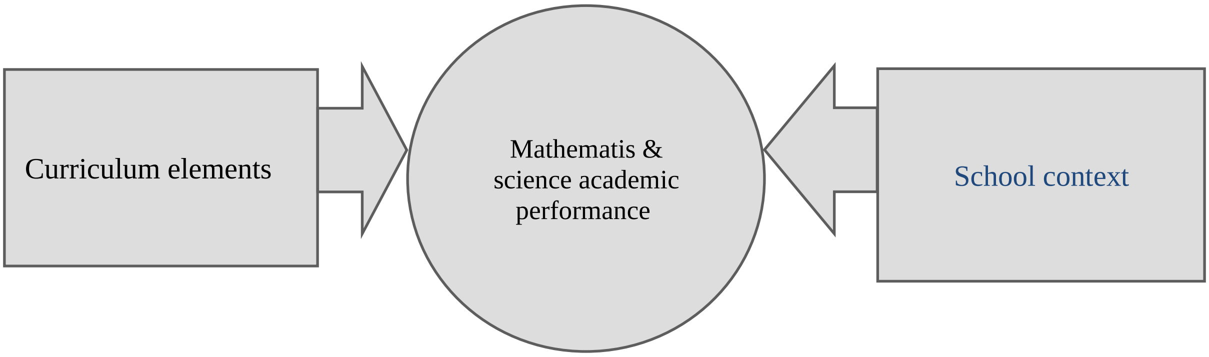
Furthermore, Martins Azinheiro, et al. (2021, p 723) carried out a research to know school effectiveness as revealed by the PISA tests. The study made it obvious that the Centers of Portugal can improve their students' achievement according to the PISA data.

Another study was carried out by Pulkkinen and Rautopuro (2022, p 114). It ventured to examine the link between PISA performance and school achievement in Finland. Based on Finnish PISA 2015 and 2018 data, the study found a moderate link between its variables. Apart from this, Qian and Lau (2022, p 137) studied the effects of achievement goals and perceived reading instruction on Chinese student reading performance. The study analyzed the related data provided by PISA 2018. It evidently reflected that achievement goals and reading instructional practices significantly contribute to Chinese students' reading performance.

RESEARCH METHODS

This quantitative study is a secondary analysis of the results provided by the 2018 PISA assessment (OECD, 2018). Moreover, the analysis is based on the descriptive and inferential methods. Therefore, it is a multi-level analysis that mainly analyzes the effect of curriculum elements and school context on mathematics and science academic achievement. Figure 1 reveals the conceptual framework on which this study is based.

Figure 1. The conceptual framework for this study



***Source: Designed by the researcher**

The study targets 15-year-old students in KSA. Moreover, the sample included 6,136 students who were selected from 235 schools. This is the sample selected by the 2018 PISA.

Furthermore, the selection of the curriculum elements and the school factors was based on the literature review.

RESULTS AND DISCUSSION

The results of the 2018 PISA revealed that Saudi students have low levels of achievement in mathematics and science. According to PISA, the content of science curriculum has to be relevant to real-life situations. Moreover, it should represent a major explanatory theory or an important scientific concept. Besides, it must be appropriate to the developmental level of 15-year-olds (OECD, 2019a, p. 105).

The science framework developed by PISA 2018 relied on Webb's Knowledge and Bloom's Taxonomy to classify knowledge. The competencies included in Bloom and Webb are believed to be the center of the scientific literacy. Therefore, they should be essential parts of any science and mathematics curriculum.

In this respect, the students' low levels of academic achievement in science and mathematics are attributed to curriculum and school factors. Therefore, Webb's idea of Knowledge Levels is a typical basis for including cognitive items in mathematics and science curriculum. It is associated with giving verbal cues like compare, analyse, arrange, etc., and asking students to identify the cognitive demand. PISA provided three levels of cognitive demand; namely, low (L), medium (M) and high (H). The low level is associated with doing a one-step procedure like recalling an idea, a term, etc. The medium level implies the application of concepts in describing a phenomenon. Furthermore, the high level is associated with analyzing and interpreting complex data. Therefore, this level implies reasoning, evaluating, synthesizing, justifying, making plans, etc. (OECD, 2019a, p.110).

Before discussing these aspects in relation to the research questions, and based on the results of the 2018 PISA-Saudi Arabia, it is urging to present the independent variables investigated in this study, along with their PISA codes, data type and number of items related to each variable. Table 2 provides the necessary details.

Table 2. Independent variables investigated in this study

Level	Variables	PISA code	Data type	No. of items
School				
	School Type	SCHLTYPE	Categorical	1
	School Size	CLSIZE	Categorical	1
	Location	SCHLOCATION	Categorical	1
	Economic, Social and Cultural Status	ESCS	Numerical	4*
	Class Size	CLSIZE	Numerical	1
	Student-teacher ratio	STRATIO	Numerical	2
	Shortage of educational staff	STAFFSHORT	Numerical	4
	Shortage of educational Material	EDUSHORT	Numerical	4

*** Number of indices,*Source: Designed by the researcher.**

The independent variables investigated in this study are school-level variables. Even the curriculum elements variable is categorised under school-level. These variables include school type, school size, location, economic, social and cultural status, class size, student-teacher ratio, shortage of educational staff and shortage of educational material.

The above-mentioned variables are investigated through the 2018 PISA's application of School Questionnaire. (OECD, 2019b). Moreover, they are given the short forms SCHSIZE, SCHLTYPE, SCHLOCATION, ESCS, CLSIZE, STRATIO, STAFFSHORT, and EDUSHORT, respectively.

INTER-CORRELATION RESULTS

The SPSS (V.28) was used to determine the preliminary bivariate relationships among the variables being investigated in this study. The results of inter-correlation are presented in Table 3. In this respect, PISA recommends 10 bivariate correlations for plausible values. Besides, predictors of students' achievement, along with their average, were obtained. Their average values were used to explicate the most unbiased estimates. The inter-correlations, which were determined according to Pearson and Kendall, revealed weak and moderate associations between the variables. Significantly, the only correlation with strong degree was the one between the STAFFSHORT and EDUSHORT ($r = .702$). Thus, the two variables were relied upon in predicting students' literacy in mathematics and science. The associations range from weak to moderate.

Table 3. Correlation Among School Variables

Variables	1	2	3	4	5	6	7	8
1- SCHSIZE	-							
2- SCHLTYPE	.012	-						
3- SCHLOCATION	.538**	-.134	-					
4- ESCS	.263*	-.402**	.381**	-				
5- CLSIZE	.284**	.267*	.225*	-.015	-			
6- STRATIO	.588**	.017	.286**	.128	.106	-		
7- STAFFSHORT	-.023	.076	-.160	-.098	-.083	.033	-	
8- EDUSHORT	.010	.052	-.108	-.103	-.089	.132	.702**	-

*** Correlation is significant at 0.05 (2-tailed), ** Correlation is significant at 0.01 (2-tailed), Source: designed by the researcher.**

Results regarding Scientific Literacy questions:

The following equations will be used to answer the research questions regarding scientific literacy scores.

Level-1: $Y_{ij} = \beta_{0j} + r_{ij}$

Level-2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(SC\_ESCS_j) + \gamma_{02}(STRATIO_j) + \gamma_{03}(SCHSIZE_j) +$$

$$\gamma_{04}(CLSIZE_j) + \gamma_{05}(EDUSHORT_j) + \gamma_{06}(STAFFSHO_j) + \gamma_{7}(STYPE\_PR_j) + \gamma_{08}(SLOCA\_VI_j)$$

$$+ \gamma_{09}(SLOCA\_SM_j) + \gamma_{10}(SLOCA\_TO_j) + \gamma_{11}(SLOCA\_LA_j) + u_{ij}$$

where,

B_{0j} is the mean scientific literacy scores for school j.

γ_{00} is the mean outcome in the population.

γ_{01} is the differentiating effect (slope) of the mean of school economic, social, and cultural status on the school mean scientific literacy score.

γ_{02} is the differentiating effect (slope) of the student-teacher ratio on the school's mean scientific literacy score.

γ_{03} is the differentiating effect (slope) of school size on the school mean scientific literacy score.

γ_{04} is the differentiating effect (slope) of class size activities on the school mean scientific literacy score.

γ_{05} is the differentiating effect (slope) of teacher shortage on the school mean scientific literacy score.

γ_{06} is the differentiating effect (slope) of the mean of school shortage of educational staff on the school mean scientific literacy score.

γ_{07} is the differentiating effect (slope) of the mean of school type on science learning.

γ_{08} is the differentiating effect (slope) of village schools' mean on the school mean scientific literacy score in comparison to city schools.

γ_{09} is the differentiating effect (slope) of small-town schools mean on the school mean scientific literacy achievement in comparison to city schools.

γ_{10} is the differentiating effect (slope) of town schools mean on the school mean scientific literacy score in comparison to city schools.

γ_{11} is the differentiating effect (slope) of large city schools mean on the school mean scientific literacy score in comparison to city schools.

Table 4 presents the fixed effect results which imply that only 2 variables, out of the 8 variables categorized as school-level, were significant. They were school ESCS and STAFFSHO. In this respect, an increase of 1 unit in schools' ESCS entailed an increase of more than 15 points in students' scores in science, keeping other variables constant ($t = 2.89$). Furthermore, an increase of 1 unit in STAFFSHO caused 7.56 points decrease in students' scores in science within school, while other variables remain constant ($t = -2.37$).

Table 4

Estimation of the Fixed Effects on the Random Coefficient Model on Scientific Literacy

Fixed Effect	Coefficient	Standard Error	*t*-ratio	*p*.
School mean, γ_{00}	412.24	12.02	34.27	0.001
SC_ESCS, γ_{01}	15.22	5.25	2.89	0.005^{**}
STRATIO, γ_{02}	0.09	0.25	0.36	0.71
SCHSIZE, γ_{03}	-0.00	0.01	-0.54	0.58
CLSIZE, γ_{04}	-0.06	0.20	-0.33	0.74

EDUSHORT, γ_{05}	-0.23	2.63	-0.08	0.93
STAFFSHO, γ_{06}	-7.56	3.19	-2.37	0.02**
STYPE-PR, γ_{07}	-0.355	13.43	-0.02	0.97
SLOCA-VI, γ_{08}	-16.27	11.59	-1.40	0.16
SLOCA-SM, γ_{09}	-0.44	9.16	-0.04	0.961
SLOCA-TO, γ_{010}	-9.48	8.49	-1.116	0.26
SLOCA-LA, γ_{011}	-6.32	7.02	-0.89	0.37

Note. In this model, dummy coded variables Gender (reference group: Female =0), Immigrant Background (reference group: Native =0), School Type (reference group: Public. = 0), and School Location (reference group: City =0). *p< .05. **p < .01. ***p < .001

The final model reflected a significant level 2 variance ($\tau_{oo} = 351.25$, $\chi 2 = 309.73$, $p < .001$) (as it is evident in Table 5). These results denote the existence of a significant but unexplained variation among the participating schools.

Table 5

Estimation of the Variance Components on Scientific Literacy Coefficient Model

Random Effect	Standard Deviation	Variance Component	x^2	$p.$
School average, u_{0j}	18.74	351.25	309.73	.000***
Level-1 Effect, r_{ij}	55.94	3130.15		
Note. *p< .05. **p < .01. ***p < .001				

Results regarding Mathematics questions:

The following equations will be used to answer the research questions regarding Mathematics scores.

Level-1: $Y_{ij} = \beta_{0j} + r_{ij}$

Level-2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(SC\_ESCS_j) + \gamma_{02}(STRATIO_j) + \gamma_{03}(SCHSIZE_j) +$$

$$\gamma_{04}(CLSIZE_j) + \gamma_{05}(EDUSHORT_j) + \gamma_{06}(STAFFSHO_j) + \gamma_7(STYPE\_PR_j) + \gamma_{08}(SLOCA\_VI_j) + \gamma_{09}$$

$(SLOCA\_SM_j) + \gamma_{10} (SLOCA\_TO_j) + \gamma_{11} (SLOCA\_LA_j) + u_{ij}$

where,

B_{0j} is the mean Mathematics scores for school j.

γ_{00} is the mean outcome in the population.

γ_{01} is the differentiating effect (slope) of the mean of school economic, social, and cultural status on the school mean Mathematics score.

γ_{02} is the differentiating effect (slope) of the student-teacher ratio on the school's mean Mathematics score.

γ_{03} is the differentiating effect (slope) of school size on the school mean Mathematics score.

γ_{04} is the differentiating effect (slope) of class size activities on the school mean Mathematics score.

γ_{05} is the differentiating effect (slope) of teacher shortage on the school mean Mathematics score.

γ_{06} is the differentiating effect (slope) of the mean of school shortage of educational staff on the school mean Mathematics score.

γ_{07} is the differentiating effect (slope) of the mean of school type on science learning.

γ_{08} is the differentiating effect (slope) of village schools' mean on the school mean Mathematics score in comparison to city schools.

γ_{09} is the differentiating effect (slope) of small-town schools mean on the school mean Mathematics achievement in comparison to city schools.

γ_{10} is the differentiating effect (slope) of town schools mean on the school mean Mathematics score in comparison to city schools.

γ_{11} is the differentiating effect (slope) of large city schools mean on the school mean Mathematics score in comparison to city schools.

Table 6

Estimation of the Fixed Effects on the Random Coefficient Model Mathematics

Fixed Effect	Coefficient	Standard Error	*t*-ratio	*p*.
School mean, γ_{00}	420.2113	13.2267	31.77	0.001**
SC_ESCS, γ_{01}	23.44146	5.72275	4.09	0.001**
STRATIO, γ_{02}	-0.2622	0.285841	-0.91	0.362

SCHSIZE, γ_{03}	0.012719	0.015974	-0.54	0.428
CLSIZE, γ_{04}	-0.301663	0.228789	-0.33	0.191
EDUSHORT, γ_{05}	0.312564	2.894063	-0.08	0.914
STAFFSHO, γ_{06}	-7.360351	3.524466	-2.088	0.040*
STYPE_PR, γ_{07}	-6.562504	14.686981	-0.447	0.656
SLOCA_VI, γ_{08}	-12.408622	12.666089	-0.980	0.330
SLOCA_SM, γ_{09}	-0.514187	10.083034	-0.051	0.959
SLOCA_TO, γ_{010}	-15.840257	9.435440	-1.679	0.097
SLOCA_LA, γ_{011}	-5.638610	7.786924	-0.724	0.471

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

The results related to the fixed effect are shown in Table 6 which implies that only 2 variables, out of the 8 variables categorized as school-level, were significant. They were school ESCS and STAFFSHO. In this respect, an increase of 1 unit in schools' ESCS entailed an increase of more than 23 points increase in students' Mathematics scores within a school, while other variables remain constant (t = 4.09). Furthermore, an increase of 1 unit in STAFFSHO caused 7.36 points decrease in students' scores in science within school, while other variables remain constant (t = -2.09).

The final model implied a significant variance of level 2 (τoo = 476.133, $\chi 2$ = 329.4495, p < .001). This result is presented in Table 7 that unveils an unexplained variation among schools. This result significantly agrees with the results of some studies like (Yardim, et al., 2024;Bidegain, G., & Lukas, 2020; Pamuk, et al., 2023; Perera & Asadullah, 2019; Arroyo, et al., 2024).

Table 7

Estimation of the Variance Components on Coefficient Model Mathematics

Random Effect	Standard Deviation	Variance Component	x^2	*p.*
School average, u_{0j}	21.820	476.133	329.4495	.000***
Level-1 Effect, r_{ij}	54.01176	2917.269		

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

This result attributes the students' weak academic performance in mathematics and science cane be related to school shortage of educational staff and school economic, social, and cultural status. Moreover, this result aligns with (Alghamdi, 2017; Alkhudaydi, 2023; Alyanak & Özkaya, 2024; Karakus, et al., 2022) thay attribute the weak levels of achievement in mathematics and science to weaknesses in the educational material. However, it contradicts with (Martins, et al., 2021; Wanke, et al., 2024) that attribute the students' poor mathematics and science knowledge to problems in school effectiveness and school infrastructure, respectively. It also disagrees with other studies like (Shishigu, 2024; Adewuyi, & Gbolade, 2024; Asanre, et al., 2024; Bascones, 2024; Karakus, et al, 2022; Qian & Lau, 2022; Rodríguez, et al, 2020) that investigated factors other than curriculum and school.

Furthermore, the analysis of the 2018 PISA-Saudi Arabia revealed that correlations between the variables. In this respect, the variables of SCHSIZE, SCHLTYPE, SCHLOCATION, ESCS, CLSIZE, and STRATIO recorded weak and moderate correlation with science and mathematics achievement. They recorded the correlation values of 0.00, .012, .538**, .263*, .284**, .284** and .702**, respectively. These values are consistent with other studies like (Alghamdi, 2017; Alkhudaydi, 2023; Alyanak & Özkaya, 2024; Karakus, et al., 2022). But they differ with studies like (Shishigu, 2024; Adewuyi, & Gbolade, 2024; Asanre, et al., 2024; Bascones, 2024; Karakus, et al, 2022; Qian & Lau, 2022; Rodríguez, et al, 2020).

CONCLUSION

This research has ventured to reanalyse and interpret the results of the 2018 PISA-Saudi Arabia. The focus has been on using the data provided by the 2018 PISA-Saudi Arabia in analyzing the effect of some curriculum elements and school context on mathematics and science academic performance among 15 years old students. The variables investigated in this study included school type, school size, location, economic, social and cultural status, class size, student-teacher ratio, shortage of educational staff, shortage of educational material. The results reflected weak and moderate links between school type, school size, location, economic, social and cultural status, class size, and student-teacher ratio. Furthermore, the variables of teaching staff and educational material recorded stronger correlation with science and mathematics achievement (r = .702).

In this respect, the weak performance of Saudi students in science and mathematics seems to be related to school shortage of educational staff and school economic, social, and cultural status.

RECOMMENDATIONS

1. The educational authorities in Saudi Arabia should pay attention to the school shortage of educational staff related to Mathematics and science subjects.
2. Training courses should be provided to the teachers of mathematics and science subjects.
3. Conferences and workshops on the methods of teaching mathematics and science subjects should be held.
4. The departments of science and mathematics in the Saudi universities should carry out larger-scale studies that will provide the syllabus designers in particular and the educational authorities in general with a broader understanding of the said problem.
5. The curriculum designers in Saudi Arabia should reconsider the current syllabus of mathematics and science subjects, thus investigating the weaknesses and complexities that stand as serious challenges to students.
6. Schools and teachers of mathematics and science subjects in Saudi Arabia should regularly provide the educational authorities with reports on the students' performance in these subjects.
7. The educational authorities in Saudi Arabia should conduct annual tests of mathematics and science subjects. The tests should target random samples of students from different

schools in the Kingdom.

8. The results of the tests recommend in the previous point should be used as the basis for continuous development of teaching mathematics and science subjects.

REFERENCES

1. Adewuyi, H. O., & Gbolade, O. O. (2024). Psychosocial predictors of students' achievement in Mathematics: A path-analytical study. International Journal of Learning, Teaching and Educational Research, 23(6), 171–188. https://doi.org/10.26803/ijlter.23.6.8

2. AlAli, R., & Wardat, Y. (2024). Low Pisa performance students: Factors, perceptions, and improvement strategies. International Journal of Religion, 5(9), 334–348. https://doi.org/10.61707/nve8gj33

3. Alghamdi, A. K. (2017). The effects of an integrated curriculum on student achievement in Saudi Arabia. EURASIA Journal of Mathematics, Science and Technology Education, 13(9), 6079–6100. https://doi.org/10.12973/eurasia.2017.01051a

4. AlKaabi, N. A., Al-Maadeed, N., Romanowski, M. H., & Sellami, A. (2022). Drawing lessons from Pisa: Qatar's use of Pisa results. PROSPECTS, 54(1), 221–240. https://doi.org/10.1007/s11125-022-09619-4

5. Alkhudaydi, M. D. (2023). Factors influencing students' achievement in Scientific Literacy: A secondary analysis of Pisa 2018 data from Saudi Arabia. Scholarship Repository @ Florida Tech. https://repository.fit.edu/etd/1330

6. Alyanak, M., & Özkaya, A. (2024). The Effect of Intelligence Games on 5th Grade Students' Mathematics Attitudes and Academic Achievement. Scientific Educational Studies, 8(1), 20-40. https://doi.org/10.31798/ses.1462049

7. Arroyo, D., Constante-Amores, A., Gil, P., & Carrillo, P. J. (2024). Student well-being and mathematical literacy performance in PISA 2018: a machine-learning approach. Educational Psychology, 44(3), 340–357. https://doi.org/10.1080/01443410.2024.2359104

8. Asanre, A., Sondlo, A., & Abiodun, T. (2024). Impact of Interest and Motivation on Academic Achievement of Junior Secondary School Students in Mathematics. Journal of Mathematics Instruction, Social Research and Opinion, 3(3), 275–284. https://doi.org/10.58421/misro.v3i3.269

9. Aslam, A., Ahamd, S., Siller, H., & Nasreen, A. (2024). Impact of the Understanding by Design Model on the Science Academic Achievement of Fifth Grade Students in Pakistan. Asia-Pacific Science Education, 10(1), 113-153. https://doi.org/10.1163/23641177-bja10078

10. Bascones, G. Y., Yunzal, Jr., A. N., & Casinillo, L. F. (2024). Exploring contextual factors affecting student performance in mathematics: A sequential explanatory research. Canadian Journal of Family and Youth / Le Journal Canadien de Famille et de La Jeunesse, 16(3), 210–234. https://doi.org/10.29173/cjfy30045

11. Bidegain, G., & Lukas, J. F. (2020). Exploring the relationship between attitudes toward science and Pisa Scientific Performance. Revista de Psicodidáctica (English Ed.), 25(1), 1–12. https://doi.org/10.1016/j.psicoe.2019.08.0

02

12. Ding, H., & Tasara, I. (2024). The perceived impact of Pisa on student learning in schools in a local Chinese context. Educational Assessment, Evaluation and Accountability. https://doi.org/10.1007/s11092-024-09440-x

13. Furnham, A., & Cheng, H. (2024). The role of parents, teachers, and pupils in IQ test scores: Correlates of the programme for International Student Assessment (PISA) from 74 countries. Personality and Individual Differences, 219, 1-8. https://doi.org/10.1016/j.paid.2023.112513

14. Gamazo, A., & Martínez-Abad, F. (2020). An exploration of factors linked to academic performance in Pisa 2018 through data mining techniques. Frontiers in Psychology, 11, 1–17. https://doi.org/10.3389/fpsyg.2020.575167

15. Karakus, M., Courtney, M., & Aydin, H. (2022). Understanding the academic achievement of the first- and second-generation immigrant students: A multi-level analysis of Pisa 2018 Data. Educational Assessment, Evaluation and Accountability, 35(2), 233–278. https://doi.org/10.1007/s11092-022-09395-x

16. Martins Azinheiro, C. A., Olmos Migueláñez, S., & Torrecilla Sánchez, E. M. (2021). School effectiveness and the PISA tests. Improvement of the development of student's competences in the Centers of Portugal. Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21), 723–727. https://doi.org/10.1145/3486011.348654

1

17. OECD. (2016). PISA 2015 results, excellence and equity in education. Retrieved from https://doi.org/10.1787/9789264266490-en

18. OECD. (2018a). PISA 2018 Technical Report. Retrieved from https://www.oecd.org/pisa/data/pisa2018technicalreport/

19. OECD. (2018b). PISA for development assessment and analytical framework: Reading, mathematics and science. Retrieved from PLEASE ADD LINK

20. OECD. (2018c). Sampling in PISA. Retrieved from https://www.oecd.org/pisa/pisaproducts/SAMPLING-IN-PISA.pdf

21. OECD. (2019a). PISA 2018 assessment and analytical framework. Retrieved from https://doi.org/10.1787/b25efab8-en

22. OECD. (2019b). PISA 2018 Results What school life means for students' lives Volume III. Retrieved from https://www.oecd-ilibrary.org/docserver/acd78851-en.pdf?expires=1590729857&id=id&

23. accname=guest&checksum=4B69496632D079FC0E08CA57CF03E84E

24. OECD. (2019c). Programme for International Student Assessment (PISA) results from PISA 2018. Retrieved from http://www.oecd.org/pisa/publications/PISA2018_CN_SAU.pdf

25. OECD. (2019d). Results from TALIS 2018. Retrieved from https://www.oecd.org/countries/saudiarabia/TALIS2018_CN_

26. Pamuk, S., Alıcı, D., Aktaş, M., Selvi, H., & Uzun, N. B. (2023). An Investigation of Variables Predicting the Reading Literacy in

Pisa 2018. Psycho-Educational Research Reviews, 12(1), 338–349. https://doi.org/10.52963/PERR_Biruni_V12.N1.21

27. Perera, L. D., & Asadullah, M. N. (2019). Mind the gap: What explains Malaysia's underperformance in Pisa? International Journal of Educational Development, 65, 254–263. https://doi.org/10.1016/j.ijedudev.2018.08.010

28. Pitsia, V., Lysaght, Z., O'Leary, M., & Shiel, G. (2022). High Achievement in Mathematics and Science among Students in Ireland: An In-Depth Analysis of International Large-Scale Assessment Data Since 2000. Irish Educational Studies, 43(2), 207–236. https://doi.org/10.1080/03323315.2022.2061563

29. Pulkkinen, J., & Rautopuro, J. (2022). The correspondence between Pisa performance and school achievement in Finland. International Journal of Educational Research, 114, 102000. https://doi.org/10.1016/j.ijer.2022.102000

30. Qian, Q., & Lau, K. (2022). The effects of achievement goals and perceived reading instruction on Chinese student reading performance: Evidence from Pisa 2018. Journal of Research in Reading, 45(1), 137–156. https://doi.org/10.1111/1467-9817.12388

31. Rappleye, J., Komatsu, H., Uchida, Y., Tsai, J., & Markus, H. (2023). The OECD's 'Well-being 2030' agenda: how PISA's affective turn gets lost in translation. Comparative Education, 60(2), 239–258. https://doi.org/10.1080/03050068.2023.2273640

32. Rodríguez, S., Valle, A., Gironelli, L. M., Guerrero, E., Regueiro, B., & Estévez, I. (2020). Performance and well-being of native and immigrant students. Comparative analysis based on Pisa 2018. Journal of Adolescence, 85(1), 96–105. https://doi.org/10.1016/j.adolescence.2020.10.001

33. Sabitu, K. A., & Khalid, S. (2024). Effects of Computer Animation Instructional Package (CAIP) on Senior Secondary School Students' Academic Achievement in Geometry in Oyo Metropolis, Oyo State, Nigeria. European Journal of Contemporary Education and E-Learning, 2(1), 150-161. https://doi.org/10.59324/ejceel.2024.2(1).12

34. Shishigu, A., Michael, K., & Atnafu, M. (2024). Effect of blended learning on mathematical achievement and anxiety: A context-based technology integration for meaningful learning. E-Learning and Digital Media, 0(0). https://doi.org/10.1177/20427530241241767

35. Wanke, P., Lauro, A., dos Santos Figueiredo, O. H., Faria, J. R., & Mixon, F. G. (2024). The Impact of School Infrastructure and Teachers' Human Capital on Academic Performance in Brazil. Evaluation Review, 48(4), 636-662. https://doi.org/10.1177/0193841X231197741

36. Yardim, Y., Cüvitoğlu, G., & Aydin, B. (2024). The Intraclass Correlation Coefficient as a Measure of Educational Inequality: An Empirical Study with Data from PISA 2018.PREPRINT (Version 1) available at Research Square. https://doi.org/10.21203/rs.3.rs-4066275/v1

37. Zheng, J., Cheung, K. & Sit, P. (2022). Insights from Two Decades of PISA-related Studies in the New Century: A Systematic Review. Scandinavian Journal of Educational Research, 68(3), 371–388. https://doi.org/10.1080/0031383