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The Economic and Social Situation and Its Impact on Students' Performance in Mathematics In The PISA 2018 International Study In The Kingdom Of Saudi Arabia

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Abstract- This study explores the economic and social situation in the Kingdom of Saudi Arabia, and how it has impacted students' performance from the kingdom in mathematics in the PISA 2018 international study, in this case, the micro indices of gender and type of education are used as a basis to ascertain the relationship between socio-economic situations and students' performance in mathematics. The study utilized the OECD's Program for International Student Assessment (PISA) 2018 dataset whereby for each student, a set of plausible values is provided corresponding to distinct draws in the plausible distribution of abilities of these students. Estimates for each Plausible Value (PV) is computed and averaged to compute a final estimate. Sampling variance and imputation variance is also computed and combined to produce a final standard error. Regression models were built to examine the relationship between the economic and social status of students and their mathematics performance while moderating the effect of gender and type of education. The descriptive research design was employed for this study in which data analysis was executed using Stata 16 Statistical software package and presented in a statistically descriptive manner using mean values, standard deviations, frequency distributions and percentages while regression models were built to examine the relationship between the economic and social status of students and their mathematics performance while moderating for the effect of gender and type of education. Findings from the study reveal that there exists a relationship between socioeconomic status, gender and type of education and they bear positive or negative influence on students' educational outcomes, while in context, the economic and social situation in the kingdom of Saudi Arabia had a significant impact on student's performance in mathematics in the PISA 2018 international study. This study proves the economic and social situation in the kingdom of Saudi Arabia had a significant impact on student's performance in mathematics, however, future studies can be conducted based on other variables.

KEYWORDS: Economic and social situation, students' Performance, Mathematics, PISA 2018 International Study, gender, education.

I. INTRODUCTION

1.1. Background

Education has been judged a vital aspect of national development (Umudjere *et al*, 2016). Internationally, standards for education are measured, amongst other things, by performance of students. This is because research has established that academic performance is a major characteristic of quality education (Rono, 2013). Thus such programmes as the Program for Student Performance (PISA) ran by the Organization for Economic Cooperation and Development (OECD) and the International Mathematics and Science Survey (TIMSS) coordinated by the International Association for the Evaluation of Educational Achievement (IEA) serves as a feedback mechanism for appraising the performance of students globally.

These programs highlight students' performance in certain subjects such as mathematics and sciences. The type of educational institutions available in these countries, students age and gender, provide a comparative assessment with the aim of providing detailed hypotheses for the level of education in different countries while also furnishing these countries with insights on various policies and practices applicable in in other climes (Rfah, Nouf and Aishah, 2020). However, economic and social conditions are universal factors that to a large extent shape and determine the outcomes of educational performance in

any given society (Byun and Kim, 2010), and also influences how it impacts national development in different countries across the globe. Hence, it becomes imperative for policy makers and stakeholders to be equipped with the knowledge necessary for improving the quality of education, and by extension improve on such socio-economic factors that affect students' performance in such vital subjects as mathematics.

Mathematics is considered as one of the focal points of intelligent learning (Skemp, 2019), and the science of establishing relationships drawn from environmental variables. It entails critical reasoning, and it is problem solving oriented, which makes it the ideal subject for fostering human capacity development and growth. A strong foundation in mathematics across the globe is a prerequisite for promotion to other levels of education, and performance in the subject is reflective of intense hard work and sheer will (Adimora *et al*, 2015). Other research has shown a relationship between the subject of mathematics and increased chances for career opportunities. The subject has also proven to be crucial towards all round social advancement of any society.

Research has drawn a direct correlation between student academic performance and socio-economic development (Signh, Malik and Signh, 2016). To this end, the Human Capability Development Program (HCDP) by the Saudi Arabian government has implicitly placed a demand on educational institutions to fecundate an environment that adequately promotes the creativity of students (Elyas and Al-Sadi, 2013). The end goal is tied to the need to create a highly skilled and educated workforce, this is as academic performance serves as a bedrock for knowledge acquisition and the development of skills (Farooq *et al*, 2011). However, the gap created by the variable of the economic and social conditions present unprecedented challenges in the attainment of this goal.

The Kingdom of Saudi Arabia has in recent years invested heavily in education with its goal to create a population driven by research, knowledge, and national development (OECD, 2021). This is in consonance with the cross-sectional reforms of the Saudi Arabian government, which has seen the Kingdom participate in international surveys such as TIMSS and recently PISA (2018) and also increased budgetary allocation for the education sector which according to UNESCO has achieved some success in expanding the reach of educational access across classes throughout the Kingdom (Wallet, 2015).

Results from the PISA survey of 2018 showed that Saudi Arabian students consistently scored lower in subjects as science and mathematics (Schleicher, 2019). The poor performance of Saudi Arabia in the PISA 2018 study shows the fledgling impacts of these variables on the performance of students in the Kingdom and therefore gives rise to a need for the holistic study of these variables which is in line with the aspirations of Saudi education ministry which seeks to empower students with necessary skills and knowledge needed for national progress (Ministry of Education: Saudi Arabia, 2004, in Alreshidi, 2016). This research therefore seeks to examine the economic and social situation in Saudi Arabia vis-a-vis the micro variables of gender and type of education, and how it impacted on students' performance in mathematics in the PISA 2018 international study.

1.2. Statement of the Problem

The PISA survey results of 2018 showed that Saudi Arabian students underperformed consistently in science and mathematics (Schleicher, 2019). These results indicate that the efforts of the government towards increased educational participation have not yet translated into improved students performance and learning outcomes compared to other OECD countries. This makes it necessary to investigate the subject matter in order to point out prevalent issues and draw up solutions that can increase Saudi Arabian students' performance.

In addition, previous studies have focused on examining correlates between poor academic performance and social status in relation to several such factors as teaching method, school environment, students' personality and environmental factors amongst others (Narad & Abdullah, 2016; Farooq *et al*., 2011). These studies alongside other numerous studies are conducted to assess academic performance. However, in the context of Saudi Arabia there is a lack of sufficient research that examines other microeconomic and social variables of gender and type of education. This gap in the literature needs to be addressed. Therefore, the current study seeks to examine the economic and social situation in Saudi Arabia vis-a-vis the micro variables of gender and type of education, and how it impacted on students' performance in mathematics in the PISA 2018 international study.

1.3. Rationale

The purpose of this study is to understand how socio-economic realities affect students' performance in education in general, and more so in an important subject such as mathematics. The Saudi students' poor performance at the PISA 2018 international study is a pure example, a pointer to a problem endemic either in our educational system or our economic structure. The problem is one whose ripple effect has thus far spilled into education. This study aims to understand this problem and proffer recommendations accordingly.

1.4. Research Questions

The following research question are developed to guide this study:

1. What is the effect of the variable of the economic and social situation on the performance of students in the Kingdom of Saudi Arabia in mathematics in the study of PISA 2018?
2. Are there statistically significant differences in the performance of students in the Kingdom of Saudi Arabia in mathematics in the PISA test according to the economic and social status variable due to the gender variable?
3. Are there statistically significant differences in the performance of students in the Kingdom of Saudi Arabia in mathematics in the Pisa test according to the variable of economic and social status due to the variable of the type of education (civil government)?

1.5. Research Objectives

This study is primarily conducted to assess the economic and social situation and its impact on students' performance in mathematics in the PISA 2018 international study in the Kingdom of Saudi Arabia. Specifically, the study seeks to:

1. Understand the effects of economic and social variables on the performance of students in the Kingdom of Saudi Arabia in mathematics in the study of PISA 2018.
2. Investigates statistically significant differences in the performance of students in the Kingdom of Saudi Arabia in mathematics in the PISA test according to the economic and social status variable due to the gender variables.
3. Ascertain statistically significant differences in the performance of students in the Kingdom of Saudi Arabia in mathematics in the PISA test according to the variable of economic and social status due to the variable of the type of education (civil government).

1.6. Significance of the Study

Students' performance in mathematics in the PISA 2018 international study in the Kingdom of Saudi Arabia bears direct importance for policy makers and stakeholders alike as regards the trajectory of the kingdom towards achieving the goal of vision 2030. Conclusions drawn from this research will serve as a reference point for future studies as regards students' performance in mathematics and academics in general, support professionals and decision makers in the formulation, funding and implementation of future research and programs.

1.7. Scope of the Study

To maintain this study within a realistic and manageable scope, this research will only focus on the economic and social situation and its impact on students' performance in mathematics. The PISA 2018 international study in the Kingdom of Saudi Arabia will be examined to get required information about this research. The case study is the PISA 2018 international study, the reference point groups are students' performance in mathematics.

1.8. Organization of Study

The entire study will be organized into five chapters. Chapter one introduces the study, statement of the problem as well as provides objectives of the study, research questions, significance of the study, scope, organization of the study and the definition of terms. The second chapter will focus on the theoretical and conceptual framework of the study and the review of relevant literature. The third chapter will be the research methodology. It examines the research design, population and sample size, sapling technique, instrument to be used, data analysis and the ethical consideration of the study. Chapter four contains the

presentation collected data presented, analysis and discussion of findings. While chapter five summarizes findings of the study and gives a conclusion and will also offer recommendations of the study.

1.9. Definition of Terms

This section discusses the definition of terms, setting the tune for terms as they will be used in the research.

1.9.1. Economic and Social Variables

The economic and social variables refer to the relationship between economic and social factors such as education, income, education, family, peer group, job description, societal trends, norms, culture and traditions etc. They ensure the survival and well-being of individuals in the society. These elements also play significant roles in determining individual and collective choices with direct or indirect impacts on the outcome of our choices. These factors are ordinarily considered across several research, further research on these factors represent or can translate into even greater impact for whatever research area it is being used for, which is further used to predict economic and social trends and postulate on the perceived impacts.

1.9.2. Students' Performance

Student performance is often used in referring to grades of students, however grades is not the full measure of a student's intelligence, thus in this study student performance is not restricted to the classroom alone, but extends to cover student achievement outside of the classroom this is factors that impact students' performance are not restricted to the classroom but rather sterns from societal socio-economic factors. In this study also, students' performance is used interchangeably with academic performance.

1.9.3. PISA 2018 International Study

The Program for Student Performance (PISA) is conducted by the Organization for Economic Cooperation and Development (OECD). The Kingdom of Saudi Arabia is an active participant. Used in this context is the result of the study and how it applies and affects Saudi Arabia.

1.9.4. Gender

Gender is a social construct which refers to the popular classification into the male and female, setting roles, duties, and responsibilities on each category. This is in consonance with the classification of gender in the Kingdom of Saudi Arabia.

1.9.5. Environment and Curriculum

The environment refers to settings both in and outside of school. It encompasses physical structures, school buildings and equipment and gadgets that facilitate teaching and are used for learning, as well as climates, nature of home, facilities, and so on. Curriculum, on the other hand, refers to a pre-planned series of prospective experiences for educational institutions covering several subject areas and learning domains for students, geared to spur creativity, thinking within or outside of the educational institution.

1.9.6. Teaching Method

The teaching method refers to the methods, techniques and skillful application of impacting knowledge. They are widely applied in class scenarios to ensure student participation and engagement. They include presentation, recital, memorization.

II. LITERATURE REVIEW

This section reviews various literature on how students' economic, social and cultural status affect their academic performance in the subject of mathematics in the 2018 PISA competition. Each subheading attempts to conceptualize tested variables such as socioeconomic status (SES), economic, social and cultural status (ESCS), gender, and type of education, government or private. The conceptualization of these variables enables their operationalization in the context of this study, and helps to understand how they interact with academic performance on a whole.

2.1. Socioeconomic Status (SES) and the Evolution of Economic, Social and Cultural Status (ESCS)

Studies have shown that a relationship exists between a household's social, economic, and cultural status, and a child's academic performance from such households (Broer *et al*, 2019). The problem overtime, however, has been the conceptualization of SES and developing a consensus in the academia on adoptable measures and the variables (Brese and Mirazchiyski, 2013; Duncan and Murnane, 2011; Ermisch *et al*., 2012), all of which help determine how best to operationalize the concept to generally measure the quality of family backgrounds, after which the conversation can then be expanded to cover how the SES of such family households affect their children in terms of academic performance. This problem then makes it difficult to accurately define what social, economic and cultural status of students actually means, given that, first, the limited access to information about student's household where invasion of privacy is a main concern, and second, the metrics to use in determining whether or not an average household is SES balanced enough to positively or negatively affect children's educational performance.

However, modern studies like the American Psychological Association (APA) referred to socioeconomic status as the social class of a person or group (APA, 2018). Research has found that household income and social class can positively or negatively affect overall quality of life (Kim and Park, 2015). In other words, people from households with high income and high social standings have been found to have better quality of life in terms of quality education, sound health, and general well-being (Dickinson and Adelson, 2014) . SES is brought up in this discussion in reference to Avvisati (2020) who was of the opinion that the Economic, Social, Cultural Status (ESCS) index used in PISA questionnaires was closely connected with other measures used in educational performance such as SES: a measure which only excludes the cultural variable in measurement (O'Connell, 2019).

There are ideas which constitute frames in the structure of ESCS in education research. These ideas gather to provide a conceptual foundation for its application in PISA reports. Socioeconomic status in education outcome has been defined in terms of a combination of both the materialist perspective—which focuses on wealth and poverty and their implications on academic performance—and the gradient perspective which focuses on socioeconomic status of an individual or group (Willms and Tramonte, 2015). Socioeconomic status has therefore been defined as quantifiable values and resources an individual or group has access to and can control (Avvisati, 2020). This conceptual agreement sets the tone for a possible conceptual definition of ESCS measure adopted in PISA analysis. Avvisati (2020) therefore declares:

ESCS is a measure of students' access to family resources (financial capital, social capital, cultural capital and human capital) which determine the social position of the student's family/household.

Although some scholars (Pokropek *et al,* 2017; Willms and Tramonte, 2015) have continually criticized ESCS as the adoptable indices in PISA on the grounds of its validity and reliability, others believe the ESCS variable of measurement can be improved to reduce errors in measurement as well as its comparability across different contexts. Some of the components that constitute the frame that determines a student's socioeconomic standings relative to educational performance include parental education, parental occupation, and household income (which is reflective in household possessions (Avvisati, 2020).

2.2 Gender in Women's Education and Future Implications

Girl-child education in the KSA has over the years improved exponentially from periods when women were forbidden from going to school. This is because much of the educational structure in the MENA region took roots from religious cultures where education for women/girls is largely forbidden (Alyami, 2016), and even when Saudi religious culture began to evolve and accommodate change, education for women remained segregated. In other words, the Saudi educational system, as with its social, political, economic and justice systems, was still highly Islamic (Alsuwaida, 2016) and women had separate learning institutions they attended. Studies have shown how advantageous single sex schools are in the MENA region (Jelas *et al*., 2014; Al-Sindi, 2013; Pahlke and Hyde, 2016). Much of the change in Saudi's educational system happened politically following the appointment of Mrs. Noura Al-Fayez as the Vice-Minister of Education, the first woman to ever be appointed in such a capacity. This triggered a reverberating effect in girl-child education in Saudi Arabia (Alyami, 2016).

However, Hamdan (2005) cited in Alsuwaida (2016) differed on the popular view on women's long standing socioeconomic exclusion from society, claiming that in the past, women in the Arab world enjoyed social participation in all aspects of life as opposed to what the scholar claims to be the recent phenomenon of social seclusion. Alsaleh (n.d.) also supported the critiqued and rejected popular postulations blaming

Islamic doctrines on the pervasiveness of gender inequality in education. The scholar stressed Islam's support of women education and career building, claiming that while Islam makes raising children an important function for women; they are encouraged to be educated and forge career paths of their own (Yonous, 2011).

The implications of gender inequality in education run deep (Yasuda, 2015). Erdogan *et al* (2012) in their research on how gender inequality in education affects health, concluded that while primary, secondary and vocational education have no relationship with life expectancy, women's education remains crucial to the sustainable development aims of any country. Women's education in this context can be seen through improved indices of women/girl-child education of a given country. Gender disparity in education also has labor and employment implications going forward. Continued gender disparity relative to the future of the girl-child implicates on their access to employment and entrepreneurial opportunities (Tzannotos, 2016). This difference in education can quickly transcend to the labor market where again gender disparity often exists. Men populate certain sectors and occupations in the labor market. The market itself can, over time, given the high supply of men in the market, respond to the nature of jobs and occupations available where men would again dominate. This is what Tzannatos (2016) calls *crowding*. It can be deduced that crowding refers to a supply labor situation where an increase in the labor supply of one gender in particular industries or jobs carves a niche (in access and wages) for said gender in a way that despises access to the opposite gender. A typical example is nursing. According to Alluhidan *et al* (2020), of the 70,319 nurses who are Saudi, 62% of them are female. This means there are about 43,597 female Saudi nurses in the KSA.

2.3 The Role of ESCS in Students' Academic Performance

Various studies exist debating the influence of ESCS in academic performance (Blair, 2013; Buckley, 2016; Castagnetti and Rosti, 2010). Analysis by the PISA (2015) found that socioeconomically advantaged students perform (depending on the levels of socioeconomic advantage) better than peers who are at a disadvantage. While reporting the 2015 PISA outcomes for Australia using ESCS index as a basis, Thompson *et al* (2017) found results that supported that students from socioeconomically advantaged homes outperformed their peers from homes with low socioeconomic gradient. This means that economic, social and cultural factors play significant roles in influencing students' academic performance (Crosnoe and Cooper, 2010). In mathematical outcomes, the findings from the report supported this current study, showing that while mathematical performance of students across all socioeconomic strata declines significantly, students from backgrounds with high socioeconomic advantage recorded better performance in mathematics as compared to students from households with low socioeconomic standings. In other words, for Australia, the ESCS index holds sway in its impact on student performance in mathematics. What this means is that the advantage of a favorable environment that a socioeconomically stable household provides improves children's learning abilities which in turn reflects on their academic performance. It is important to note that the composition of the ESCS index can be broken down into economic: includes financial stability, income, which translates into availability of material possessions; social: which includes relationships a family builds with other families and the rest of society, it consists of social networks and other connections with communities (Mikiewicz *et al*., 2011; Broer *et al*, 2019); culture, which entails interactions with signs and symbols and ability to interpret meanings derivable from these modes of messaging; these may be in form of material possessions such as books, journals, internet facilities, and so on (Tittenbrun, 2016). These gather to form a household's socioeconomic environment.

Thomson (2018) argued that students from socioeconomically disadvantaged homes perform below their counterparts largely because of the shortage of the aforementioned socioeconomic indicators which gather to form a household environment within which students live and learn. Broer et al (2019) also supports the finding of this study in their book *Socioeconomic Inequality and Educational Outcomes*. The scholars stated that while the relationship between socioeconomic status and student performance may vary from country to country as a result of varying political and economic structures, systems and realities, student's access to these socioeconomic indicators greatly tip the balance in favour of or against good academic performance.

2.4 Civil Government Education Versus Private Sector Education

Civil education provided by the government is one in which ownership, control, management and administration rests on the government who appoints personnel to fill relevant positions. A study by Rong'uno (2017) pointed out that government schools typically find it difficult to meet up the surging demand for education amidst growing population figures. This then leads to a situation where public schools become grossly understaffed and concurrently overpopulated with students and pupils. Learning

facilities as well become inadequate to meet growing populations. This creates a highly uncomfortable environment for learning which has a ripple effect in students' assimilation and information processing, which ultimately affects their proficiency in subjects across their education.

The socioeconomic status of parents has been revealed as an influential factor in parents' choice of education to offer their children. Bonsu (2016) supports this position following their comparative analysis on academic performance of public and private school students in junior secondary schools. The study found that socioeconomic background of family positively influenced their choice to offer their children private education to escape the shortfalls of public school education. Parents of students who are socioeconomically advantaged are testaments to quality education they too received in their formative years, which they tend to pass on to their children. Education is crucial to the KSA's vision 2030 project (Barry, 2019). In line with this target, the government has invested heavily in education (Kalahan and Celep, 2011). The private education sector is currently the largest in the UAE, valued at about 5 billion dollars (Strategic Gears Management Consultancy, 2018). In terms of enrollment, the UAE's geographical and demographic advantage ranks them above the KSA. The proliferation of private schools in Saudi Arabia is a reflection of the government's resilience towards improving access to quality education on all fronts (Mullis *et al*., 2016), seeing that government schools dominate the educational landscape.

III. METHODOLOGY

The research aims to examine the effect of economic and social status on the mathematics performance of students in the Kingdom of Saudi Arabia. The research also aims to examine the effect of gender on the economic and social status and mathematics performance relationship of students in the Kingdom of Saudi Arabia.

Similarly, the research aims to examine the effect of type of education (civil government) on the economic and social status and mathematics performance relationship of students in the Kingdom of Saudi Arabia.

3.1. Respondents Selection and Inclusion

The research utilized the PISA 2018 dataset. PISA is the OECD's Program for International Student Assessment. PISA measures 15-year-olds' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges. Consent was sourced from respondents and the data was kept fully anonymized.

PISA reports student performance through plausible values (PVs), obtained from Item Response Theory models. The general principle of these models is to infer the ability of a student from his/her performance at the tests.

For each student, a set of plausible values is provided, that corresponds to distinct draws in the plausible distribution of abilities of these students. Estimates for each Plausible Value (PV) were computed and averaged to compute a final estimate. Sampling variance and imputation variance was also computed and combined to produce final standard error.

For this research, only 6,136 students that participated in the survey in the Kingdom of Saudi Arabia were selected. The PISA source consent from respondents and the data was kept fully anonymous.

3.2 Data Analysis

The analysis was executed using Stata 16 Statistical software package. Descriptive statistics was presented using mean values, standard deviations, frequency distributions and percentages. Regression models were built to examine the relationship between economic and social status of students and their mathematics performance while moderating for the effect of gender and type of education.

3.3 Limitations of the Study

The major limitation to the study is the porous nature of data and sparse distribution of respondents, which are totally conditions that are outside the control of the researcher.

3.4 Results

The research aims to examine the effect of economic and social status of students in the Kingdom of Saudi Arabia on their mathematics performance. The research tests the following hypothesis:

- H_0: Economic and social status of students in the Kingdom of Saudi Arabia has no effect on their mathematics performance.
- H_0: Gender does not moderate the relationship between economic and social status of students in the Kingdom of Saudi Arabia and their mathematics performance.
- H_0: Type of education (civil government) does not moderate the relationship between economic and social status of students in the Kingdom of Saudi Arabia and their mathematics performance.

3.5 Socio-Economic Characteristics of Respondents

Table 1: Characteristics of Respondents.

Characteristics	**No of patients (%)**
Age, mean (S.D, Range)	15.79 (0.28, 15.33 – 16.25)
Gender	
Female	2,992 (48.76)
Male	3,144 (51.24)
Economic and Social Status, mean (S.D, Range)	-0.66 (1.18, -4.83 – 2.78)

Table 1 presents the characteristics of respondents. The table shows that the mean age of students was 15.79, S.D = 0.28. The result also showed that there were more males (51.24%) compared to females in the research. Furthermore, economic and social status of students in the Kingdom of Saudi Arabia was low (M = -0.66. S.D = 1.18) compared to other countries covered by PISA.

Figure 1: Economic, Social and Cultural Status Index of students in the Kingdom of Saudi Arabia.

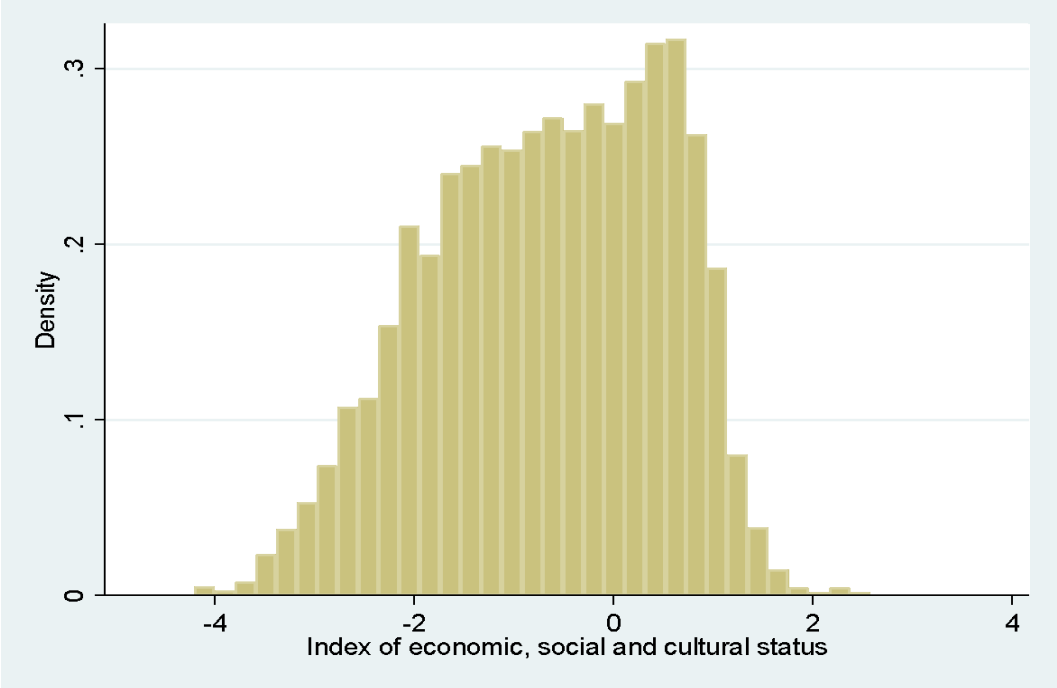

Table 2: Linear Regression showing the effect of Economic, Social and Cultural Status on Mathematics performance

pvmaths	Coef.	St.Err.	t-value	t param	p-value	Sig
ESCS	21.63	1.66	13.05	82.26	0.000	***
Constant	388.90	2.92	133.31	72.03	0.000	***
Average R-squared	0.106		Number of obs	6086		
			Prob > F	0.000		

**** p<0.01, ** p<0.05, * p<0.1*

The regression model shows that there was a statistically significant relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics ($\beta = 21.63$, $p < 0.001$). The result showed that as the economic, cultural and social status of a student increases, performance in mathematics increases. The result also showed that economic, cultural and social status of a student accounts for a 10.6% variation in their performance in mathematics ($r^2 = 0.106$).

Table 3: Linear Regression showing the moderating effect of Gender on the relationship between Economic, Social and Cultural Status, and Mathematics performance

pvmaths	Coef.	St.Err.	t-value	t param	p-value	Sig
ESCS	22.97	2.08	11.01	86.08	0.000	***
Gender						
Male	RC					
Female	-12.61	5.07	-2.48	81.75	0.014	**
Female#ESCS	0	0	.	80	.	
Constant	407.90	7.92	51.50	64.03	0.000	***
Average R-squared	0.111		Number of obs		6086	
			Prob > F		0.000	

**** p<0.01, ** p<0.05, * p<0.1*

Table 3 presents the relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics regression model while moderating for the effect of gender. The result shows that there was a statistically significant relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics ($\beta = 22.97$, $p < 0.001$). The result showed that an increase in the economic, cultural and social status of a student leads to a significant increase in their mathematics performance. The result also showed that the gender of a student also has a significant effect on their mathematics performance. The result 888888888887777 showed that females have a significantly lower performance in mathematics ($\beta = -12.61$, $p < 0.005$) compared to their male counterparts. The interaction effect between gender and economic, social and cultural status was not computed. The effect of economic, cultural and social status of a student and gender accounts for a 11.1% variation in their performance in mathematics ($r^2 = 0.111$).

Table 4: Linear Regression showing the moderating effect of Gender and type of education (civil government) on the relationship between Economic, Social and Cultural Status, and Mathematics performance

pvmaths	Coef.	St.Err.	t-value	t param	p-value	Sig
ESCS	19.89	1.64	12.11	86.97	0.000	***
Gender						
Male	RC					
Female	-12.90	4.83	-2.67	79.41	0.009	**
Type of Education						
Private	RC					
Government	17.24	6.60	2.61	88.66	0.011	**
Female#ESCS	0	0	.	80	.	
Education#ESCS	0	0	.	80	.	
Constant	387.68	8.89	43.62	77.52	0.000	***
Average R-squared	0.116		Number of obs		6086	
			Prob > F		0.000	

**** p<0.01, ** p<0.05, * p<0.1*

Table 4 presents the relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics regression model while moderating for the effect of gender and type of education. The result shows that there was still a statistically significant relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics ($\beta = 19.89$, $p < 0.001$). The result showed that an increase in the economic, cultural and social status of a student leads to a significant increase in their mathematics performance.

The result also showed that the gender of a student also has a significant effect on their mathematics performance. The result showed that females have a significantly lower performance in mathematics ($\beta = -12.90$, $p < 0.005$) compared to their male counterparts.

The result further showed that there was a positive statistically significant relationship between type of education (civil government) and mathematics performance. The result showed that students in government schools have a statistically significant higher performance in mathematics ($\beta = 17.24$, $p < 0.005$) compared to students in private schools. The result further showed that economic, cultural and social status of a student, gender and type of education accounts for a 11.6% variation in the mathematics performance of students ($r^2 = 0.111$).

IV. DISCUSSION

The first problem the findings of this study highlight is the gender disparity evident in the statistics that place male students 51.24% more in number than 48.76% of female students. This shows that male students were more than female students in the PISA assessment of 2018. It does not, however, represent the entire gender indices of the KSA. Nonetheless the gender disparity in education is presented in this fact even though other studies show a significant progress in women education to rival the statistical balance between male counterparts (Akabayashi *et al*, 2020). Evans *et al* (2020) supports this assertion saying that in the world today women are more educated than as the indices of old presented. After sampling about 126 OECD countries with data drawn from 1960 up until 2010, Evans *et al*, (2020) concluded that while the education of women has grown exponentially over the years, women are still more than likely to be uneducated across the four levels (nursery, primary, secondary and tertiary education) as opposed to men.

Using the regression model, the second result in this study shows that there was a statistically significant relationship between the economic, social and cultural status of a student in the Kingdom of Saudi Arabia and their performance in mathematics ($\beta = 21.63$, $p < 0.001$). The result showed that as the ESCS of a student increases, performance in mathematics also increases in a corresponding manner. This means that the socioeconomic and sociocultural realities of students both have a significant impact on their performance in the subject of mathematics. Inferring from foregoing literature, this means student's access to family resources which suggests their social position, which in turn is implicated on their academic performance.

A study by Kareshki and Hajinezhand (2014) on the role quality of schooling and family background play in student's academic accomplishments in Mathematics in the Middle East, found results that contrasted this study. After collecting data from a sample size of students in 8th grade across the 8 middle eastern countries, results from the study proved that parent's involvement in the academic affairs of their children yielded more effect on their performance in mathematics. In other words, parental involvement in the educational affairs of children proved to be a source of encouragement to those children to perform better and achieve more (Del Boca *et al*., 2014; Brilli *et al*., 2016). This makes a case for parental control as a way of improving children's performance in their academics. The study disputed the relationship between metrics of ESCS (parental education levels for instance) and child's performance in mathematics. It also proved that socioeconomic status of households has no effect on mathematical performance of children. Instead, parents need to be more involved in their children's academics as this would encourage better performance in whatever subject they offer.

In the investigation into gender and the relationship between socioeconomic status and students' performance in mathematics, this study found that the gender of a student has a significant effect on their mathematics performance. The result showed that females have a significantly lower performance in mathematics ($\beta = -12.61$, $p < 0.005$) compared to their male counterparts. A comparative study by Akabayashi *et al* (2020) on gender differences in educational outcomes, and the role of family background, made a number of findings supporting this study. First, they found that in language subjects across the 3 focus countries (USA, China, and Japan), girls outperformed their male counterparts (Lai, 2010). However for mathematics, the reverse was the case as boys performed better (Asante, 2010). When the household income variable was introduced into the fray, it was discovered that male students from households in the United States with low income performed more poorly in their test scores when compared to their female counterparts. However in China and Japan, socioeconomic realities affect the academic performance of female students more adversely than it did males (Hojo, 2015). In the United States, a rise in household income triggers a positively corresponding effect in academic performance (Lu, 2018). More so, family background tends to have a profound effect on the boy-child, while in Japan, greater responsibility is placed

on the shoulders of the boy-child as seen in the prominence of educational investment towards boys and the notion of them being family breadwinners in the future.

While education of the girl-child has improved exponentially over the years, comparative inquiry into which gender performs better in a given subject opens up a different conversation entirely. This investigation into the early academic life of the academic performance of boys versus girls has future implications on the career path each gender will most likely take. For instance, Akabayashi *et al* (2020) are of the opinion that the high performance of boys in mathematics relative to the low performance of girls in the same subject is an important contributory factor towards the domination—in population and performance—of boys in STEM (Science, Technology, Engineering, and Mathematics) disciplines in future studies and career. Similarly, the OECD (2017) stated that because of this, the STEM disciplines and career paths remain unpopular amongst women. In other words, in an engineering class of ten, for instance, two would be girls. Female students remain less likely to venture into STEM disciplines (Akabayashi *et al*, 2020). To understand this phenomenon is to go back to the beginning of this section where results from this study shows that gender plays a role in students' performance in mathematics.

Why do boys perform better than girls in mathematics? It must be noted that these results and findings vary from country to country and from environment to environment. In the United States for instance, socioeconomic background of family affects children across genders differently (Akabayashi *et al*, 2020). Di Prete and Buchmann (2013) stated that the family socioeconomic standings were more likely to have an effect on boys than girls in relation to academic performance. In an inquiry into the performance of male and female genders in science subjects (Mathematics, Physics and Chemistry) in selected secondary schools in Guinea, Toure (2016) found that from a cross section of 1,400 students, significant differences were recorded in the performance of boys and girls in the three selected science subjects where boys performed better. Biology has been pushed forward as a reason responsible for gender performance difference between boys and girls (Derks and Krabbendam, 2013). Again this explanation does not hold sway across countries and environments. Other explanations need to be probed into in order to understand why boys do better at Mathematics than girls. In the nature-nurture debate, it is important to understand other factors that may have nurtured this phenomenon. In other words, culture, tradition, family perception of abilities of male and female children which in turn reflects overtly on access to social capital needed for academic prosperity, all play different roles in the boy-girl educational dynamic.

Scholars like Bhanot and Jovanovic (2009) cited in Di Tommaso (2016), Mata, Monteiro, and Peixoto (2012) have cited parental gender stereotypes in children's abilities as a factor that negatively affects girl's esteem and confidence in their abilities in relation to mathematics. This gives rise to expectations parents develop towards the capabilities of their male and female children with respect to their performance in mathematics (Wang, 2013; Mulji, 2016). In a case where students are not motivated to perform better, performance in that subject becomes low (Othman et al., 2013; Gil-Flores *et al*, 2011). Study by Fryer and Levitt (2010) found that parents placed high expectations on their sons to perform well in mathematics, while that same expectation dropped low in their daughters' capabilities to do well in the same subject (Heckman and Kautz, 2012). In other words, daughters are not expected to outperform sons or perform exceptionally generally in mathematics at all. This exposes the cultural parental mindset towards girls as significantly different when it comes to boys (Yeung, 2013). A study by Robinson *et al* (2014) also supported the aforementioned finding in a revelation of teacher's perception of the mathematical ability of girls versus boys. However, in a twist of events, the scholars found that teachers perceived the maths abilities of girls better than of boys (Samuelsson and Samuelsson, 2016). In the same vein, girls displayed more lack of self confidence, and developed more anxiety in mathematics than boys (OECD 2015, Heckman and Kautz, 2012 and 2014; Lubienski *et al,* 2013). Lack of self-confidence may result in low esteem, and low esteem gives rise to lack of motivation towards mathematics which could ultimately translate to poor performance in the subject (Di Tommaso *et al*, 2016). From the trails of evidence seen, does this then mean that the good performance of male students in mathematics is positively related to the priority parents place on male children in KSA given the statistical fact that this current research uncovered? The interaction effect between gender and economic, social and cultural status presents a research gap for other researchers to explore and investigate in the future.

In terms of education type (civil government or private sector education) and its effect on students' performance in mathematics relative to ESCS, results from this study showed a positive statistically significant relationship between type of education (civil government) and mathematics performance. The result found that students in government schools have a statistically significant higher performance in mathematics ($\beta = 17.24$, $p < 0.005$) compared to students in private schools. This begs the question: how

different are the standards of education between private schools and government schools in KSA? What are the factors responsible for these gaps of difference between government education and private sector education? How does that affect parent's decision making in the choice of education to give their children? Is the KSA students' performance at the PISA competition reflective of the overall educational standards in KSA (DeLa Rica Goiricelaya, 2012)? What was the composition of KSA students in the PISA competition? Were there more private school students in the study population than students from government schools? These are all very important questions that can give insights into the educational structure of the KSA and the reach at which said structure over-determines educational outcomes relative across genders.

However, Bonsu (2016) also noted that while government schools struggle in terms of providing learning infrastructures for students and pupils, they are better equipped with qualified teachers than private schools. This current study found that students from government schools performed better than students from private schools in mathematics, a testament to the findings of Bonsu (2016). This suggests that parents in socioeconomically equipped backgrounds have the resources and capital which they invest in a child, which is then seen as evidence in academic outcomes (Rogošić and Baranović, 2016). In summary, the ESCS index has proved invaluable in the discussion of the socioeconomic realities of an individual or group and how they go ahead to influence, largely, academic performance.

V. CONCLUSION

The ESCS index is invaluable in determining answers to all three research questions presented in the earliest chapter of this study. First, socioeconomic status bears a positive or negative influence on students' educational outcomes in general. In the conversation of mathematics, while results vary across different geographical contexts, a relationship exists between the two variables.

Gender also plays a role in mathematics performance of students both in socioeconomically advantaged and disadvantaged homes. The nature-nurture debate provides interesting insights into other explanations that may be responsible for such phenomenon. Students who attend private schools outperformed students from public schools on a number of grounds. First, infrastructural inadequacy notorious with public schools which ultimately affects student academic performance is a strong point of contact. Also, parental educational background in the form of socioeconomic advantage also plays a role in parent's choice of giving their children the best education.

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