A Study of the Relationships Between some variables and Student Achievement on the TIMSS-2019 International Study in the Kingdom of Saudi Arabia

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Abstract

The results of the TIMSS study showed that the average achievement of students in the Kingdom of Saudi Arabia in mathematics is lower than the international average. Student achievement in learning is affected by different variables such as characteristics of the student, teacher training and qualifications, as well as the school. As such, this study aims to determine the reason for student low achievement in mathematics using the data of the TIMSS study of 2019. Detailed data is provided about these variables through the student's questionnaire, the teacher's questionnaire, and the school's questionnaire. The study found that a positive relationship exists between the gender variable and student outcomes/achievement in the study of mathematics. The study also found that computational skills could aid students' learning such that they would have the mental capacity to perform and achieve in mathematics and other science subjects.

Keywords: Instructional clarity and educational qualification, students' Achievement, Mathematics, TIMSS2019 International Study, gender

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1. Introduction

Quality education has been a very important objective in the Saudi for years. As part of Saudi Vision 2030, the Saudi government launched an extensive and ambitious strategic program in 2016 to wean the country off its energy sector dependency (Rashad, 2016). The initiative involves public investments, policy initiatives and diversification initiatives as well as advancement of its educational sector. One of the pillars of the strategy is the Human Capability Development Program, which aims to prepare the Saudi citizens for job market in view of needed skills in the 21st century global economy (Vision 2030, 2022). In addition, O'Sullivan (2016) highlighted that the educational sector of the KSA has been the subject of attention of the government for the last ten years with a goal of improving access to education at all levels, with special attention to higher/tertiary education. As the KSA has continued to experience tremendous economic, industrial and technological prosperity owing to their leveraging on gas reserves, it will depend on Saudi citizens' qualifications and skills to harness this opportunity to achieve long-term stability.

At the moment, the country is moving towards building a knowledge-based economy, one in which they are aware that education – good, quality education – plays a very crucial foundational role (O'Sullivan, 2016). The KSA has since prioritized its educational sector in a way that would help the nation move close to being a knowledge-based economy by starting at the grassroots: reforming educational initiatives and prepare children in early elementary, primary, and secondary levels. One of the ways in which the country does this is through international assessments of results for participating schools in the KSA.

These assessments are established and curated by various international organizations with a view to assess students' abilities and performance in various disciplines, most notably mathematics and other sciences. The assessments are meant to play key roles in developing or helping the government with critical effective reform strategies of its educational sector. Some of these international institutions include Trends in International Mathematics and Science Study (TIMSS), established in 1995 and curated by the International Association for the Evaluation of Educational Achievement (IEA) (TIMSS, 2019). TIMSS is held every four years. Many countries seek to raise the level of scientific achievement for their request, including Saudi Arabia. The Ministry of Education in KSA is committed to providing high- quality education, but most students score below the international average. Preliminary research on performance in KSA indicates that most students record low scores in the subject of mathematics. In this vein, the recent Trends in International Mathematics and Science

Study (TIMSS) scores published in 2019 categorize KSA among the five countries with the lowest average achievement in mathematics around the world.

Galdas & Bankston (1997) and Sirin (2005, Sirin) mention that economic and social factors are among the strongest predictors of achievement, while Rivikin, Rivikin, Hanushek & Kain, (2005) indicate that economic and social factors are among the strongest predictors of achievement, as well as Swinton, Thomas, Benjamin and Howard (2010) that the characteristics of the teacher, which include the level of his academic and educational qualifications, the training courses he received, and his years of experience, are related to students' achievement, and Akyuz (2010) mentioned how studies in general have shown that the variables associated with the teacher, such as: gender, experience, and academic level all have different effects on achievement in mathematics.

In the light of the foregoing, the researcher saw the importance of studies targeting the investigation of the relationship of some contextual variables with the achievement of students in the Kingdom of Saudi Arabia, especially their achievement in mathematics, due to their poor achievement in it compared to their achievement in other subjects.

2.Significance Of The Study

Students' performance in mathematics in the TIMSS2019 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.

3.Review Of Related Studies

This literature review aims to understand some of the various factors that may affect achievement of Saudi Arabian 8th Graders at the 2019 TIMSS. The section examines literatures from other scholars in the study area of TIMSS and other science related disciplines with a view to identifying some of these variables involved in child's educational outcome in TIMSS. This review will examine the impact of teachers, socioeconomic status of students, technology and computers, and other factors.

3.1. Foundational Basis: The TIMSS as an International Assessment Framework

Academic disciplines exist to enable to children effectively participate in the society by equipping them with the tools needed to excel in daily life (Mullis & Martin, 2020). To this end, in defense of the science disciplines, it is important to have a background understanding of mathematics and other science subjects as this knowledge will play significant roles in how children would evolve to interact with the natural environment, the economy, politics, sports, health, and other industries. As a result, international organizations were formed to assess the abilities of students in mathematics and the sciences. These international educational assessment organizations and agencies provide frameworks through which assessments of students from participating countries are ordered.

Trends in International Mathematics and Science Study (TIMSS) was set up in 1995 and has been conducted every four years (TIMSS, 2019). The cooperative provides important insights and relevant policy data that shows student's achievements in mathematics and other science subjects. The data can then be used as a measuring tool by participating countries: a way to assess outcomes of educational policies in relation to set policy objectives a country's educational system set out to achieve. To understand the contexts of children's learning of mathematics and other sciences and how these contexts affect academic achievement, performance or outcome, TIMSS collects raw date through questionnaires administered to students, their parents or guardian or caregivers, teachers, as well as school principals (TIMSS, 2019). A comparative data is then provided in sum about the achievements of participating countries in relation to variables in the home, school or classroom.

Also, these assessments can play key roles in developing or rethinking effective educational strategies for educational reforms. This is done through exemplification: by exemplifying what leading countries have either done or are doing to maintain a solid educational system as seen in the outcomes of students. For example, Finland is notable country whose performance have been very consistent for years (TIMSS, 2019). Their education system has been one in which other countries want to model by. Finland is noted for its holistic educational approach whereby not much emphasis is placed on the demand of the curriculum. Instead, teachers are meant to focus on what students are familiar with. In other words, students are taught in a very personalized way such that their pre-existing knowledge serve as a springboard for whatever new is meant to be taught (Birsa, 2018). This was discovered by Maroun, Samman, Moujaes, and Abouchakra (2008) whose study aimed at how education reforms in Saudi Arabia can be can be effective for the improvement of the educational system/structure of the larger GCC region as well. Indeed, the TIMSS assessments can help Saudi Arabia

exemplify strategies from other countries who are making more progress with their education. This is with a view to improve the Saudi educational system by examining factors consistent with the success of other educational systems.

Other international frameworks exit which assess student's achievement or performance in mathematics and subjects in the science discipline. For instance, asides the TIMSS: conducted by the International Association for the Evaluation of Educational Achievement (IEA), there is also Programme for International Student Assessments (PISA) conducted by the Organization for Economic Cooperation and Development (OECD) (OECD, n.d.). While the TIMSS cooperation measures achievements in mathematics and other sciences for 4th and 8th grade students (Mullis & Martins, 2014), PISA on the other hand is more concerned with assessing the knowledge and skills which students from participating countries possess during the stipulated learning period.

3.2. Computational Thinking Skills

A study by Alyahya and Alotaibi (2019) aimed to understand how computing skills were developed as instructional design materials to enhance understanding, achievement and performance in mathematics and other science disciplines. According to ISTE (2015), computational thinking combines a range of other thinking nodes such as problem solving, algorithmic thinking, cooperative thing, critical thinking and creativity. In other words, computational thinking (CT) skills are a combination of five (5) independent skills. First of all, algorithms are particular to computer science and coding, which is important for solving problems related to programming. However, the application of algorithmic thinking to problem-solving in general may yield improved efficiency (Shute, Sun, and Asbell-Clarke, 2017). Creative thinking, on the other hand, is more related to the flexibility of ideas, of the mind, of being unorthodox (Alyahya and Alotaibi, 2019). Lastly, critical thinking pertains critiquing information and data, looking for validations of a position of study supported or refuted by evidence (Holmes, Wieman, & Bonn, 2015). The study of Alyahya and Alotaibi (2019) in relation to the impact of computational thinking (CT) skills as instructional approaches that influence TIMSS achievements, concluded that CT skills had a significant influence on student learning of mathematics. This was from a student sample of about 46 female students. The results singled out problem solving skills to have the highest impact on student's ability to be successful in TIMSS assessments, while creativity was shown to have little relevance in the same stead.

3.3. Teacher Quality

Ambusaidi and Yang (2019) studied the impact of the quality of mathematics teachers on student achievement in Oman and Taiwan. The study aimed to understand, first of all, how teacher quality was measured and determined. Therefore, the authors used variables such as teacher qualification, teaching practice, and professional development as all that constitute the quality of a teacher. Teaching experience was also proven to be positively influential to student's learning as a consequence to a teacher's years of teaching experience (Murnane and Phillips, 1981 cited in Ambusaidi and Yang, 2019). After setting that basis, the authors were now challenged to provide answers to the question of the extent to which quality of teachers in 8th grade mathematics affect student achievement in Oman and Taiwan. Results show that not all variables lead to student achievement in mathematics. For instance, the study found that the teacher qualification variable, such as level of educational qualification, diplomas, and other certifications, do not impact on student achievement, while teaching experience has positive outcomes in relation to student achievement in Taiwan. Lastly, teacher participation in professional development activities was found to have a positive effect on student's learning mathematics in Oman.

3.4. Teacher Characteristics

Scholars have stated that the characteristics of teachers of mathematics and other science disciplines are very important in relation to one of the things that TIMSS addresses (Alomiear and Alreshidi, 2022). Al-Shamrani et al., (2016) stated that teacher's characteristics should constitute the quality of professional development programs that they are exposed to and in which they participate. In another study, Blomeke et al., (2016) aimed to understand how the input and characteristics of schooling processes affect student outcomes. Therefore, through a sample of 205,515 students extracted from 47 participating countries, the results found that teacher's participation in professional development programs as well as their sense of preparedness, had strong impacts on teacher's instructional quality, which in turn robs off on student's educational outcomes. Other variables of teacher characteristics which have been studied include teacher background, gender, age, educational qualification, practices and beliefs, as well as teacher's experience. A study by Mullola et al., (2011) aimed to understand the relationship, if any, between the age and gender of teachers and student's mathematical achievements in Finland. The results found no effects of teacher's age nor gender on the mathematical achievement of students.

In a comparative analysis between Singapore, Hong Kong, Japan and Saudi Arabia, Al-Al-Harbi et al., (2020) aimed to study some of the characteristics of mathematics teachers that influence or impact on the mathematical achievement of 4th grade students following the TIMSS results of 2015. Findings from the study showed a positive impact of teaching experience, teacher's educational level, and professional development on student's achievement among the countries under comparison. The study also considered gender variable and found that gender had a favorable impact for female teachers in both Japan and Saudi Arabia. In the area of teaching experience, results were in favor of female teachers in Singapore who had less than five (5) years' experience as opposed to teachers with more than and twenty (20) years' experience. Lastly in terms of educational level, teachers with master's degrees had better impact on student's mathematical achievement when as opposed to those with first degrees in Japan.

A study by Alomiear and Alreshidi (2022) investigated whether the characteristics of teachers affect student's mathematical achievements in a comparative study between Saudi Arabia and the United States following the TIMSS results of 2019. Although the study focused on fourth grade students of both countries, data was gathered from a sample of 4,174 students and 170 teachers from Saudi Arabia; and 8,353 students and 451 teachers from the United States.

The results found one commonality between the two countries. Results were in favor of students taught by female teachers in both the Kingdom of Saudi Arabia and in the United States. In other variables, results found that teacher's age, educational level, gender, as well as qualification, were important variables that impacted on student's mathematical achievement in Saudi Arabia. Furthermore, results from America showed that teachers' years of experience and down to hours invested in professional development in the past two years, and teacher's gender were important variables which impacted students' mathematical achievement.

3.5. Impact of Teachers' Perception of TIMSS and Educational Environment

A study by Wardat et al., (2022) was focused on the perceptions and self-reported practices of mathematics teachers in their teaching of the subject in student preparation for TIMSS in Abu Dhabi schools of the UAE. The study employed sample questionnaires administered to a population of 522 mathematics teachers across schools in Abu Dhabi schools during the 2020–2021 academic year. Four variables were tested using one-sample t-test, Independent Sample t-test, and ANOVA tests. The variables included teachers' perceptions of TIMSS, instructional practices, readiness of students for TIMSS, and the school and classroom environment for TIMSS.

The study found that perceptions of both male and female teachers towards the school and classroom environment presents a critical issue. The authors encouraged the creation of conducive and suitable learning environment for students so as to promote healthy and competitive settings to enhance their performance in mathematics and other science disciplines, which may lead to success in TIMSS. This is because having this kind of setting is a stimulant for preparedness for TIMSS for students in the UAE. For instance, Davis et al., (2018) attempted to understand the readiness of students for TIMSS and the role learning environment played in the process to positively or negatively impact on their learning. The authors found that an excellent learning environment with talented instructors and a class setting that is well managed, and also the overall ambiance of the classroom strongly affect how students performed in mathematics in the year 2015.

3.6. Socioeconomic Consideration

Scholars have investigated into the role or impact of students' socioeconomic status on their achievement in mathematics and other science related disciplines (Borman and Dowling, 2010; Gibbs and Poskitt, 2010). They have shown that students from families with higher education and higher socioeconomic advantage tend to out-perform students from homes with less socioeconomic advantage as a result of students from socioeconomically advantageous homes having more educational resources to work with which, according to Al-Mutairi and Bennour, (2011), helps them perform better in mathematics and other science subjects.

3.7. Method of Teaching

The way and method of teaching have been found to be crucial if students' learning outcomes in mathematics and other science disciplines must be improved in relation to TIMSS (Akiba & Liang, 2016). One of such methods that has proven effective teaching practice is the student-centered approach, according to Corkin et al., (2019). This approach is one in which students are allowed the freedom to interact with one another, rubbing minds and ideas and connect new ideas to already existing knowledge. This can help facilitate better understanding and performance at mathematics and other science related discipline in relation to TIMSS.

4.Objectives Of The Study

Countries participating in international studies have become dependent on the results of those studies in evaluating their educational systems, as these studies provide evidence about the reality of educational systems,

so this study aims in this direction by trying to determine the source of the discrepancy in achievement in mathematics using the data of the TIMES study Which may contribute to reconsidering some educational policies that could have an impact on students' achievement in mathematics.

On the other hand, this study will open the door for researchers to develop more effective statistical models to explain the differences in achievement between students on the one hand, and between schools on the other.

5. Rationale

The results of the TIMSS study (2019) showed that the average achievement of students in the Kingdom of Saudi Arabia in mathematics is lower than the international average, and since the learning and teaching of students and thus their achievement is affected by many contextual variables related to the characteristics of the student, teacher and school, and because the study of TIMSS (TIMSS 2019) Detailed data is provided about these variables through the student's questionnaire, the teacher's questionnaire, and the school's questionnaire. Therefore, the study problem is focused on analyzing the relationship of some of these variables to students' achievement in mathematics, by trying to answer the following questions:

6. Research Questions

The following research question are developed to guide this study:

To what extent do teacher factors (teacher preparation for teaching (gender/qualification/experience), instructional time, instructional clarity, and use of instructional technology reveal a significant relationship in math achievement for eighth graders in timss2019?

- Does the teacher's gender and/educational qualification/experience affect the mathematical achievement of eighth graders in timss 2019?
- Does instructional clarity/use of educational technology/teaching time affect the mathematical achievement of eighth graders in timss 2019?
- Are there statistically significant differences in the mathematical achievement of eighth grade students in timss2019 according to the variable of using educational technology due to the gender variable?

7.Population And Sample

The research utilized the TIMSS 2019 dataset. TIMSS is the OECD's Program for International Student Assessment. TIMSS accesses mathematics and science achievement at two grade levels and TIMSS has two target population (all students enrolled at the fourth grade and all students enrolled at eight grade) but in this study, we consider the dataset for students in eighth grade. Two versions were used to scale the student 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.

For this analysis, the students background data and teacher's background data were merged together as recommended by TIMSS if the two dataset are analysed simultaneously. TIMSS report 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 Values (PV) were computed and averaged to computed a final estimate. Sampling variance and imputation variance was also computed and combined to produce final standard error.

Although we tested teacher's variables in the study, however, the analysis was done in the context of the students. After the teacher's data and student's background data were merged together, 5563 students that participated in the survey in the Kingdom of Saudi Arabia were selected and to meet the TIMSS standard sampling precision, national student samples should provide for a standard error not greater than .035 standard deviation units for the country's mean achievement.

7.1.Statistical Techniques Used in the Present Study

The data was extracted from TIMSS international database and analysis was executed using the recommended IEA's IDB Analyzer software (IEA, 2021) for analyzing the TIMSS 2019 data in conjunction with SPSS (IBM Corporation, 2020). Descriptive statistics were presented using mean values, standard deviations, frequency distributions and percentages for univariate analysis, for bivariate analysis mean differences, and correlation were used to examine the whether there's a statistically significant differences in student's mathematical achievement by the independent variables while a multivariate linear regression model was used to examine the multivariate effect of selected variables on mathematics achievements of the students. The tables and charts indicate the extent to which teacher factors such as their gender, qualification, experience, instructional time; instructional clarity and use of instructional technology influence the mathematics achievement for eight graders in tims2019. Through the use of various statistical techniques, the variable of study will be describing and the statistical conclusion will be made to conclusion on our stated hypotheses.

10.2. Data Analysis and Interpretation

Table 1: Descriptive Analysis of all Variables

Variable	N	Percentage (%)	Plausible Value (Mean)	S.D
Sex of Teachers				
Female	2704	50.33	400.20	74.73
Male	2623	49.67	386.16	80.62
Teachers Level of Education completed				
Bachelor's	4367	98.82	392.14	77.74
Master's	141	1.18	403.63	88.06
Age of the Teacher				
Under 25	29	0.31	412.63	86.85
25 – 29	773	16.24	378.00	80.12
30 – 39	2971	54.91	391.98	77.21
40 – 49	1378	25.38	404.04	77.64
50 – 59	159	3.15	407.77	67.46
Sex of Students				
Girl	2884	49.38	402.52	74.49
Boy	2791	50.62	385.36	80.27
Instructional Clarity in Mathematics Lessons/IDX				
High Clarity	3256	60.24	404.49	76.67
Moderate Clarity	1787	31.53	381.99	78.07
Low Clarity	521	8.23	373.98	71.99
Student agree that Teacher gives clear Answers				
Agree a lot	3329	64.20	402.40	77.59
Agree a little	1272	23.01	387.26	76.91
Disagree a little	496	8.46	387.13	75.71

Disagree a lot	249	4.33	363.09	7 2.49
Teacher's years of Experience	5563		11.37	7. 32
Time spent in Math	4934		222.02	9 9.62
Mean Math Plausible value	5563		393.96	7 8.05

The table above shows the descriptive statistics of all the variables. From the table above, the percentage distribution of the teachers engaged in the research study, 2704 (50.33%) of the teachers are females with a mean plausible value (400.20) and standard deviation of (74.73) while the reaming 2623 (49.67%) were males with a mean plausible value of (386.16) and standard deviation of (80.62). The result shows that students taught by female teachers achieve higher in maths compared to students taught by male teachers. Similarly, students taught by teachers with a master's degree have higher mean plausible values in maths (403.63) compared to students taught by teachers with a bachelor's degree (392.14).

Younger teachers (under 25) and older teachers (above 40) resulted in higher mean plausible values in maths for the students compared to teachers withing the ages 30 – 49. The sex of the students also shows that girls achieve better in mathematics (M = 402.52) compared to boys (M=385.36) in the Kingdom of Saudi Arabia. Also, the table shows the students instructional clarity in mathematics and out of the 5675 sampled, the results inferred those 3256 (60.24%) students that received high instructional clarity had highest maths achievement (M = 404.49, S.D = 76.67), 1787 (31.53%) students that received moderate instructional clarity had a mean plausible value of 381.99, S.D = 78.07, while students who received low instructional clarity had the lowest maths achievement. Similarly, students that agree that teachers give clear answers had better math achievements compared with students that disagreed. The average Teacher's years of experience was 11.39 and standard deviation of 7.32. The result shows that years of experience was associated with an increase in math achievement. Similarly, time spent learning math was also positively associated with an increase in mean math value.

Figure 1: Teacher sex and math achievement score graph
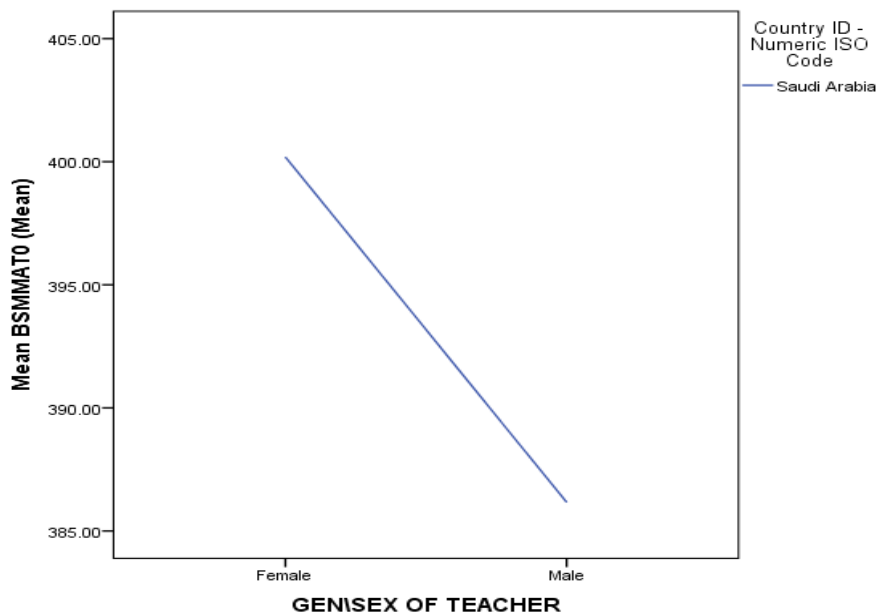
The graph above shows the gender of the teacher relative to the mean of the math achievement score. From the graph above it can be inferred that students with female teachers have better math achievement compared to students with male teachers.

Figure 2: Teacher experience and math achievement score graph
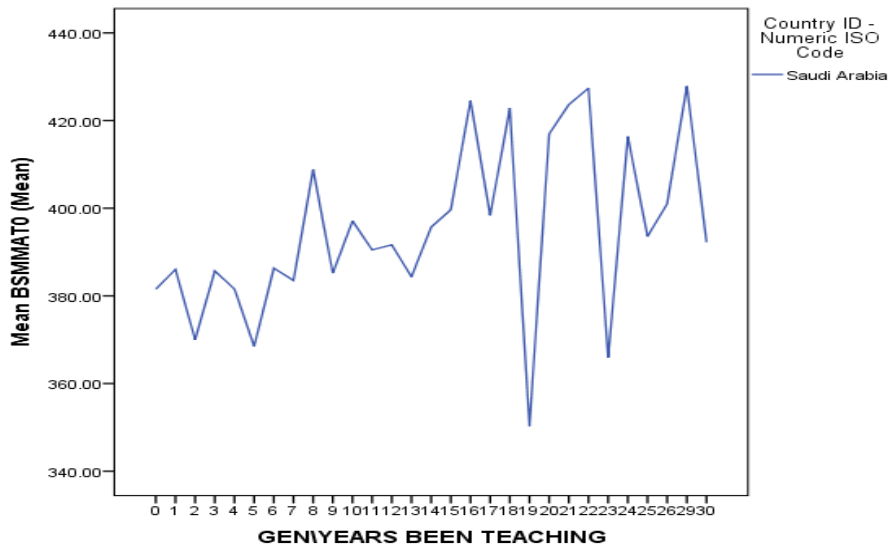
The above graph shows the years of experience of the teacher's relation to student math achievement score. The graph shows that, generally, as teacher's years of experience increases, the mean of math achievement score also increases although there was a decline in math score during some period that years of experience increased.

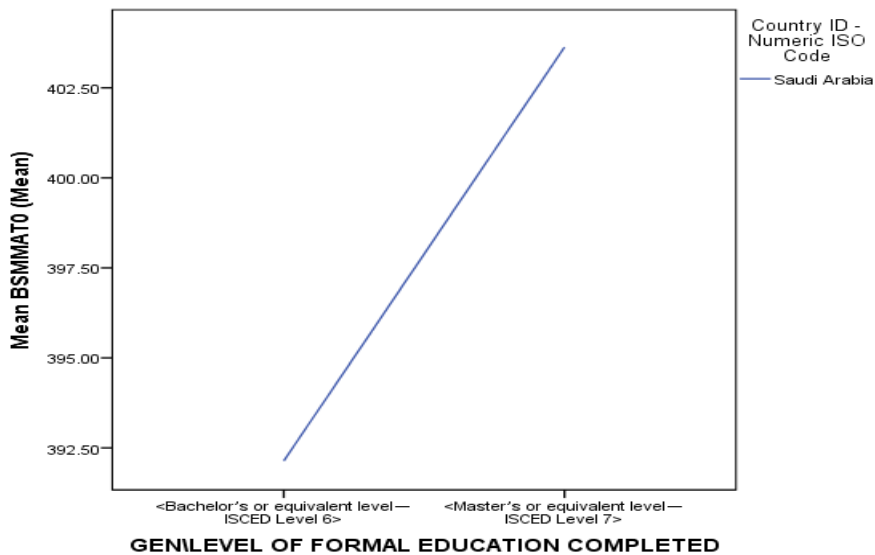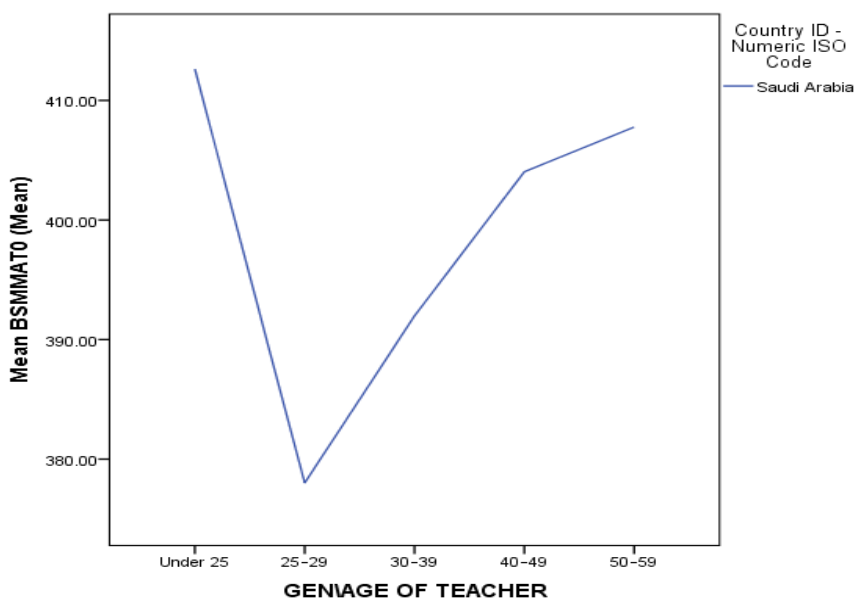## Figure 3: Educational qualification and math achievement score graph

Figure 4: Teacher age and math achievement mean score.

The graph above shows the age of the teacher relation to math achievement score. The graph with its U shape shows that students with younger and older teachers have better math achievements.

Figure 5: Sex of the student and math achievement mean score
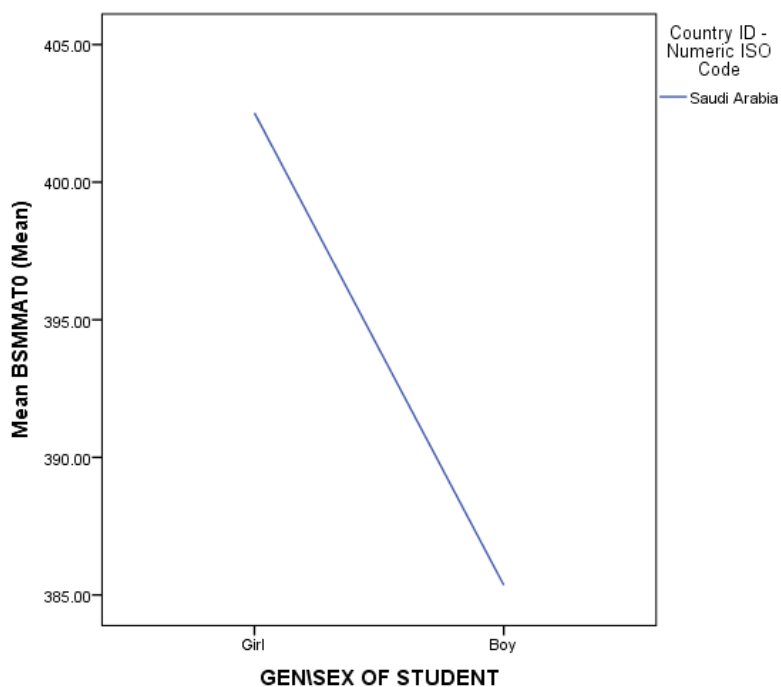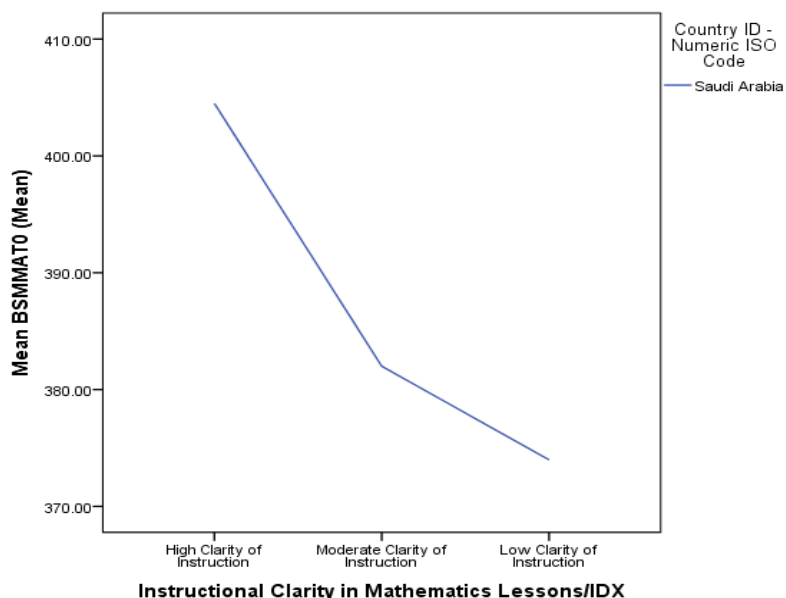
Figure 6: Instructional clarity in mathematics lessons and math achievement mean score

The graph shows the students instructional clarity in mathematics revealing that students that received high instructional clarity had highest maths achievement, followed by students that received moderate instructional clarity, and lastly students who received low instructional clarity had the lowest maths achievement.

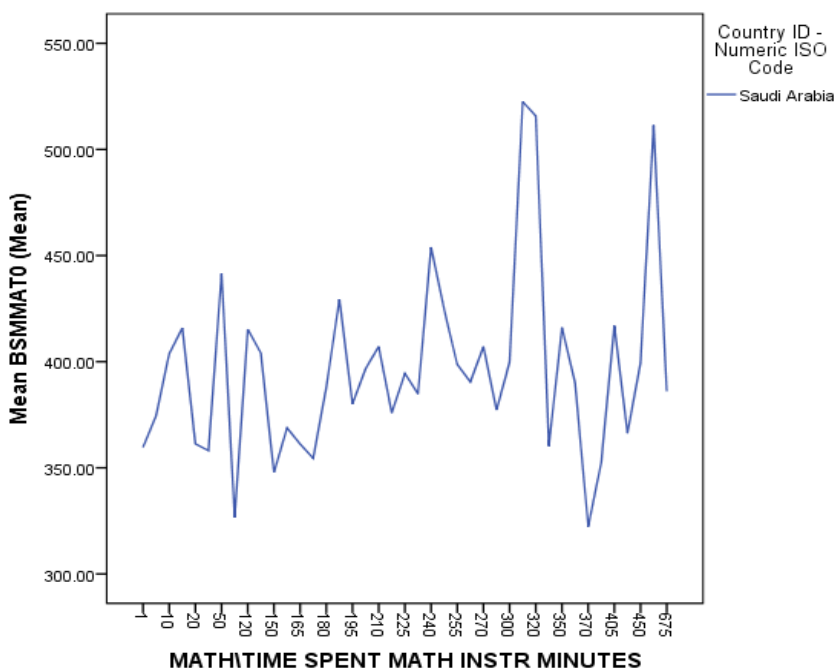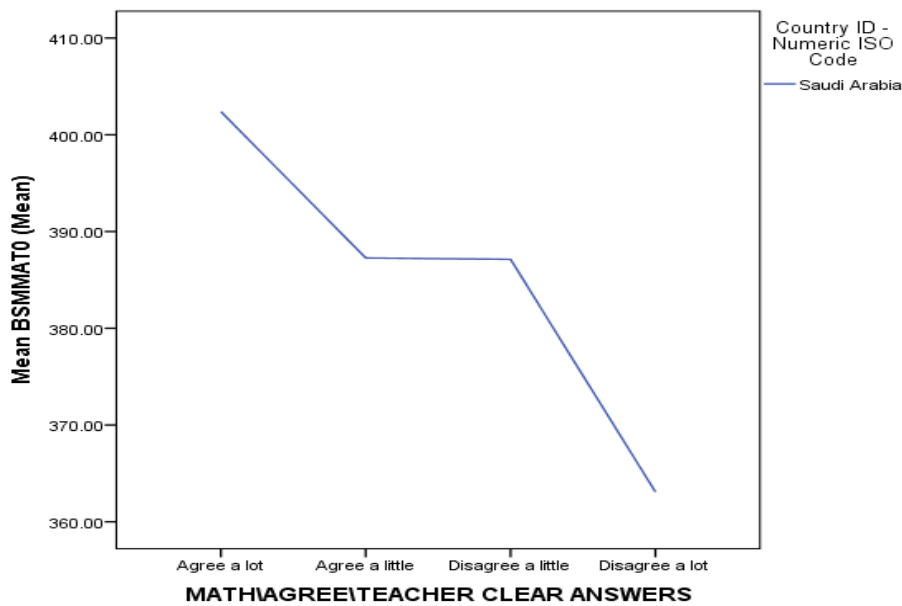### Figure 7: Math time spent and math achievement mean score

Figure 8: Students agree teacher provided clear answers and math achievement mean score

Figure 8 reveals that students that agree that teachers give clear answers had better math achievements compared with students that disagreed

Table 3: Multivariate Regression Analysis of all variables on Math Achievement (Mean Plausible Values) N=3685

Variable	Regression Coefficient	S. E	*t*-value
Constant	409.20	26.42	15.49
Teacher's years of Experience	1.16	0.69	1.67
Time spent in Math	0.04	0.04	1.11
Sex of Teachers			
Female	Ref		
Male	11.30	54.28	0.21
Teachers Level of Education completed			
Bachelor's	Ref		
Master's	19.33	49.97	0.39
Age of the Teacher			
Under 25	Ref		
25 – 29	22.01	28.10	0.78
30 – 39	31.22	.	.

40 – 49	33.09	26.96	1.23
50 – 59	41.03	33.22	1.23
Sex of Student			
Girl	Ref		
Boy	-47.78	54.81	-0.87
Instructional Clarity in Mathematics Lessons/IDX			
High Clarity	Ref		
Moderate Clarity	-25.88	5.09	-5.08
Low Clarity	-24.97	11.25	-2.22
Student agree that Teacher gives clear Answers			
Agree a lot	Ref		
Agree a little	-0.79	5.06	-0.16
Disagree a little	7.30	8.34	0.87
Disagree a lot	-18.61	11.34	-1.64

The table above shows the multiple regression of the variables and the math achievement score (plausible values).

The total Number of observation is N = 3685 and the constant which indicate the estimated average mathematics achievement score of female teachers in Saudi Arabia with regression coefficient of 409.20 and standard error of 26.42 while the male teachers in Saudi Arabia had a positive average mathematics achievement difference from 11.30, with an estimated standard error of 54.28 and t-value of 0.21, for the teacher's level of education, taking bachelor's degree as the reference group the regression coefficient is 19.33, with an estimated standard error of 49.97 and t-test of 0.39. The t test for both sex of the teachers and teacher's level of education are less than the 1.96 of the (t-tabulated of the 95% confidence interval) which indicate that the variables are not statistically significant with math achievement at the 95% confidence interval.

For age of the teacher, considering "under 25" as the reference group, the regression coefficient for age 25-29, 30-39, 40-49, 50-59 are (22.01, 31.22, 33.09, and 42.03) with an estimated standard error of (28.10, 26.96 and 33.22) and t-test of (0.78, 1.23 and 1.23) respectively. From the t-test results, all the t-test are less than 1.96 of (t-tabulated of the 95% confidence interval) which indicate that the math achievement is not statistically significant at 95% confidence interval.

For Sex of the student's, taking "girl" as the reference group the regression coefficient is - 4.78 with an estimated standard error of 54.81 and t-test of – 0.87 which is less than 1.96(t-tabulated of the 95% Confidence interval). This indicates that math achievement is not statistically significant at 95% confidence interval. Also, for the instructional clarity in mathematics lessons and considering "high clarity" as the reference group, the regression coefficient is -25.88 for the moderate clarity and – 24.97 for the low clarity with an estimated standard error of 5.09 and 11.25 and t-test of -5.08 and - 2.22 respectively which are both less than 1.96 of t-tabulated of the 95% confidence interval and indicate that math achievement is not statistically significant at 95% confidence interval.

For the item "students agree that teacher give clear answer", considering "agree a lot" as the reference group, the regression coefficient is -0.79 for agree a little, 7.30 for disagree a little and -18.21 for disagree a lot with an estimated standard error of 5.06, 8.34 and 11.34 and t-test of -0.16, 0.87 and -1.64 respectively. This shows that math achievement is not statistically significant at 95% confidence level in relation to whether students think that the teacher gives a clear answer.

7.2. DISCUSSION

Following results from this study, it was found that students who are taught by female teachers achieve higher results in maths when compared to students taught by male teachers. This result is corroborated by Mullola et al., (2011). The scholars sought to understand relationship that exist between the age and gender of teachers and student's mathematical achievements in Finland. Findings from this present study is also corroborated by Al-Harbi et al., (2020) who found a positive relationship to exist between the gender variable and student outcomes/achievement in the study of mathematics. Al-Harbi et al., (2020) and Alomiear and Alreshidi (2022) also found that student taught by female mathematics teachers achieve higher in the subject than their male counterparts. At this juncture, the role of femininity would be called to question in terms of its asset to teaching and learning. Further research, however, need to be carried out in this area of the character of femininity, teaching and learning to determine whether a positive or negative relationship exist between the two.

In terms of teaching experience and its relationship between student achievement in the mathematics, finding from this study is supported by Al-Harbi et al., (2020). The scholars found that female teachers in Singapore who had less than five (5) years' experience achieved more with the students in terms of their performance, as opposed to teachers with more than and twenty (20) years' experience. This present study found students of teachers under the age of 25 were more plausible to achieve success in mathematics than older teachers (above 40). This is seen in figure 4 where the graph above shows that the age of the teacher is positively related to math achievement score.

Furthermore, results from this study found that students taught by teachers with a master's degree have higher mean plausible values in maths (403.63) compared to students taught by teachers with a bachelor's degree (392.14). What this means is that these students from teachers with masters' degree/advanced degrees tend to perform better when compared to students whose teachers are first degree holders. In other words, for this set of students, professional development of their teachers play a vital role in their academic development in the subject of mathematics and other sciences. This is seen in figure 3.

However, findings from Ambusaidi and Yang (2019) disagreed and found no impact teacher qualifications had on student achievement in Taiwan. Instead, teacher participation in professional development activities was found to have a positive effect on student's learning mathematics in Oman. Also, this study found students' instructional clarity to impact on students' outcome of mathematics by 60.24%, while students who received low instructional clarity had the lowest maths achievement. Instructional clarity is classified as good teaching practice to which the adoption of good teaching principles has been said to be a good way to give students the best learning experience which could, in turn, impact on their learning outcomes (Aglazor, 2017).

Lastly, findings from this study show that the sex of the students has an impact on their achievement. For instance, this study found that girls achieve better in mathematics (M = 402.52) compared to boys (M=385.36) in the Kingdom of Saudi Arabia. This position is supported by Elsayed et al (2022). The authors aimed to understand how and why boys were underperforming and underachieving academically in the KSA. Their results are consistent with this study. Elsayed et al (2022) found that a huge performance gap in academics exist between boys and girls in the MENA region at large. They also found that from the entire MENA population, boys in the KSA were consistently outperformed by their girl counterparts.

8. Recommendations

Firstly, teachers of mathematics in the KSA should adopt more creative methods of teaching given that methods of instructions are still largely teacher-centered. Creative student-centered methods would contribute immensely to effective learning and will also make classes more lively, active, conducive, and fun. Knowledge in mathematics should be applicable to real life situations such that the students can easily relate with some of its concepts.

Secondly, there should be ways and methods of positive reinforcement, of encouraging students, as well as giving constructive feedback on their performance in tests, or exams or assignments or just general performance in class. Teachers must develop ways encouraging open communication in both the teacher-student dynamic and the student-student dynamic. This system has been trialed and proven in countries like Finland and Canada with good results.

9. Conclusion

The results from this significantly shed light on the performance of the KSA in the last TIMSS assessment of 2019. The study indicated different variables and the extent to which they influenced the outcomes of students in mathematics and other science fields. The instruction to this study began with an ambition of the KSA and their move towards building a knowledge-driven economy (O'Sullivan, 2016). This would ultimately mean the prioritization of education across all levels.

The literature review, on the other hand, examined the views of other authors who had contributed to the field and sought to understand factors that influence student achievement in TIMSS (Mullis et al., 2020). From reviews of these literatures, it was found that computational skills were could aid students' learning such that they would have the mental capacity to perform and achieve in mathematics and other science subjects (Alyahya and Alotaibi, 2019). Computational skills here include critical thinking, creative thinking, algorithmic thinking, problem-solving, and cooperative thinking. The application of algorithmic thinking, problem-solving, and critical thinking were found to yield potent results for improved efficiency in mathematics and other sciences (Shute, Sun, and Asbell-Clarke, 2017). Other influential variables included teacher quality such as experience, professional qualifications, teaching practice. These were all found to impact on students' achievement in relation to how their teachers teach them.

The results from this study have established that while some of the findings of these literatures were similar with this study, further research still need to be carried out in certain areas of study such as relationship between femininity/muscularity and student learning in mathematics. This speaks to the popular conclusion that students taught by female teachers achieved higher as opposed to students taught by male teachers.

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