Investigation the Association of Some Variables with Mathematics Achievement Gap Between Rural and Urban Jordanian Students

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Abstract
The present study aims to investigate the association of some variables with mathematics achievement gap between rural and urban Jordanian students using TIMSS 2015 database. Due to nested structure of the TIMSS data, hierarchical linear model, was used in this study. To this end the data for 6541 students in 232 schools was analyzed. According to study findings 21.4% of total variation in mathematics achievement was due to the differences between schools. Moreover, the study results revealed that school emphasis on academic success, and school discipline problems as school-level variables were discovered to have statistically significant effect on mathematics achievement gap between urban - rural students in Jordan. Furthermore, concerning student-level variables, student like learning mathematics was the only associated significantly with the urban-rural gap in mathematics achievement. The study recommended the necessity of enhancing the capabilities of rural schools to focus on school success, enhancement discipline, increasing students' enjoyment of learning mathematics to enhance their love of this subject, as well as conducting other studies to explore the causal relationships between variables.
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1. Introduction

Many educational systems, especially in developing countries are struggling to eliminate educational disparities between different groups of students. Where, inequalities are manifested between males and females, between urban and rural students, between overcrowded schools and underutilized schools. Throughout the world, countries have revised their educational policies to overcome inequities, but it seems that many countries still have a long way to go to accomplish this objective (OECD, 2012).

The UNESCO report (UNESCO, 2008) points out that access to education vastly depends on the wealth of a country and the wealth of a family in the case of developing countries. However, wealth is not the only factor of disparities in access to educational opportunities. Girls continue to be neglected, and disadvantages based on language, race, ethnicity, and rural and urban inequality are still well established. For example, in Senegal, urban children have a very high probability of access to primary education than rural children (UNESCO, 2008).

The issue of disparities in academic achievement between urban and rural students has not received considerable attention in Jordan, as the strategic plan of the Ministry of Education for the years 2018-2022 did not include explicitly any goals related to reducing the gap between urban and rural students. However, the plan included six domains: early education and early childhood development, access and equality, support the educational system, educational quality, human resources, and vocational education. In the domain of access and equality, the focus was limited to the achievement gap between females and males, and the academic gap between Jordanian students and Syrian students. But it is worth noting that, the strategy included objectives to improve the achievement of Jordanian students in international students' assessment studies; Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA). The omission of this vital issue has helped to deepen the distortions in the educational system. The distribution of learning achievements in Jordan varies; for example, urban schools outperforming rural schools, schools in some governorates doing better than others, and girls, overall, perform better than boys; in addition to that, there is a concern about the effectiveness of various educational interventions in improving the quality of learning outcomes in Jordan (MoE, 2018).

International and national studies highlight these levels of inequality, for example, the National Assessment for Knowledge Economy Skills (NAfKE) study conducted in 2014 showed that the average achievement of fifth-grade urban students in mathematics was 33.3 (on a scale from 0 to 100) while the average achievement of rural students was 27. The average achievement of the ninth-grade urban students was 37.5 while the average

achievement for rural students was 35 (Abu-Lebdeh, Tweissi, and Ababneh, 2014). On the other hand, the results of the PISA-2015 study showed that the average achievement of urban students in mathematics was 391 compared to 343 for rural students (Ababneh, Abu-Lebdeh and Tweissi, 2017). In addition to that, the results of TIMSS-2015 showed the same trend of the gap between urban and rural students, where the urban students' average was 392 compared with 362 for rural students. In 2011, the difference almost was with the same amount, where the urban students scored 415 compared with 384 for rural students (Abu-Lebdeh, Tweissi and Ababneh, 2017).

Educational literature in Jordan does not provide much information on the fundamental differences between rural and urban students, and the factors that make such differences in academic achievement possible. However, it includes documented information on the achievement differences between rural and urban students. Therefore, this study is to provide some evidence on the factors that contribute to the difference in achievement between rural and urban students in mathematics, as Jordanian students, in general, show an apparent weakness in mathematics achievement.

Differences in achievement between urban and rural areas are evident in developing countries. These differences are due to cultural and social factors as well as other factors related to differences between urban schools and rural schools (Tayyaba, 2012). The international educational literature in this subject shows a significant interest in demonstrating the factors associated with the achievement gap between students in urban and rural schools. According to Tayyaba, the recent educational research has shown rural-urban gaps in achievement and school conditions; his study sought to report rural-urban disparities in achievement, student, teacher, and school characteristics of grade four students from four provinces of Pakistan. The results showed that rural and urban students had comparable levels of achievement in some of the tested learning areas. In Balochistan province, rural students outperformed their urban counterparts in three out of the four tested subjects. In Punjab and Sindh, urban students performed significantly better in social studies and language tests; scores on social studies and language did not differ significantly across locations in the North West. The study found that the differences appeared to be partly explained by variation in school conditions, students' home background, and teachers' characteristics. Teachers' training turned out to be decisive in determining students' achievement, whereas the availability of resources and multi-grade teaching was less critical (Tayyaba, Ibid, 2012).

Amponssa and Siwa (2015) conducted a study to investigate the critical factors that affect the academic achievement of senior high school students in Ghana. The study adopted the qualitative-quantitative research approach with the interview, observation, and questionnaire administration. The results revealed that urban schools perform better than rural and peri-urban schools because they attract and admit junior high school graduates with excellent Basic Education Certificate Examination (BECE) grades, have better infrastructure, more qualified teachers, prestigious names, and character that motivate their students to do well.

An analysis of the science achievement by location (rural vs. urban) using all available waves of the TIMSS (eighth-grade data) from five countries: Lithuania, Romania, the Russian Federation, Hungary, and Slovenia demonstrated that students attending rural schools had significantly lower science scores and that the rural disadvantage grew between 1995 and 2011 in some countries, but became non-significant in others. Overall, family socioeconomic status played an important role in determining the educational outcomes of rural students (Kryst, Kotok and Bodovski, 2015).

Deidra (1998) examined the differences in student achievement between rural and urban schools in Western Australia, after controlling for student background variables. His study showed that students attending rural schools were not performing as well as students from urban schools. Alordiah, Akpadaka, and Oviogbodu (2015) conducted a study to investigate the influence of gender, school location, and socioeconomic status (SES) on students' academic achievement in mathematics. The result showed that male students performed better than female students; urban students performed better than rural students and students of parents with high SES performed better than students of parents with low SES.

A study of the student, classroom and school factors influencing mathematics achievement in the United States (USA) and Australia using data from the TIMSS found that classroom differences account for about one-third of the variation in student achievement in the United States and over one-quarter in Australia. Much of the classroom variation was due to compositional and organizational factors (Lamb and Fullarton, 2001).

Onoyase investigated the difference in academic achievement among students of urban, semi-urban and rural secondary schools in Oshimili South Local Government Area of Delta State Nigeria. The researcher collected data on the Senior School Certificate Examination results conducted by the West African Examination Council (WAEC) in the year 2001. The subjects selected for analysis were English, mathematics, biology, chemistry, and geography. The study showed that: there was a significant difference in the academic achievement among students in urban, semi-urban and rural secondary schools in English, mathematics, biology, chemistry, and geography. The study suggested that the difference in academic achievement may be due to the disparity in the provision of educational

facilities (Onoyase, 2015)

Skouras (2012) suggested that many contextual variables such as: school resources, teacher characteristics, teachers' training, student attitudes towards teachers. In addition to the family, school and social environment influences students' achievement. Caponera and losito (2016) confirmed that a high socio-economic status has a significant and positive effect on student achievement compared with students from socio-economic disadvantaged schools, students from advantaged schools performed better in mathematics achievement.

Ker (2016) conducted a study to investigate the variables that contribute to the interpretation of the variation in the achievement of Singaporean and American students using the TIMSS 2011 data set. The results of his study were: Singaporeans and Americans students' achievement was influenced by student confidence in learning mathematics and teacher confidence. Furthermore, learning resources have been the most influential in American students' achievement. Student's attitudes, motivation, and student's ambition are the most important in explaining differences in Singaporean students' achievement.

Ghagar, Othman and Mohammadpour (2011) conducted a study aimed at investigating the disparities in the achievement of Malaysian and Singaporean students as a result of differences in student and school factors. The study used the TIMSS 2003 database, the number of Malaysian students (5314) enrolled in (150) schools, the number of Singaporean students (6018) enrolled in (164) schools. The study used HLM analysis to achieve its goal, and reached several results; 57.28% of the Malaysian student's achievement variation is due to differences between schools compared to 5.9% for Singaporean students' achievement. In addition to that, the results revealed that the student's concept of himself as the most crucial student's level factor affecting the achievement in both countries. The school environment is the most important variable at the school's level that affects achievement.

Alwahsha (2010) conducted a study aimed at identifying the factors contributing to the achievement of secondary school students in Jordan by using multiple regression method. The study used a random cluster sample of (562) students from the sampling frame. The results indicated that the IQ variable accounts for (2%) of the students' achievement, and the housing location adds (1.2%) on the total explained variance provided by other variables.

Nelsen and Gustafsson (2014) examined whether changes in school emphasis on academic success (SEAS) and safe schools (SAFE) explain the increased science achievement in Norway between TIMSS 2007 and 2011.They used two-level structural equation modelling(SEM), where they fitted two mediation models, one using subdomain scores of science as manifest dependent variables and one in which these scores are indicators of a latent science achievement variable. SEAS fully mediated the change in the latent science variable, but this model did not explain changes in earth science achievement, which increased more than the other subdomains. In the model with subdomain scores as manifest dependent variables, SEAS mediated the improved achievement of all four subdomains of science. SAFE did not explain increased science achievement but did have a positive impact on SEAS. Furthermore, Nicholas, John, and Eric (2016) conducted a study aimed to determine the level of discipline and extent of impact of discipline on academic performance among class eight pupils in the sub-county's public primary schools. The results of the study showed that the discipline related positively with, and accounted for 23% of variance in the pupils' academic performance.

Yalcin, Demirtasli, Dibek, and Yavus (2017a) investigated the effect of teacher and student characteristics on TIMSS 2011 mathematics achievement of fourth and eighth grade students in Turkey. According to findings of the study, for both grade levels, of all teacher-related variables, only school emphasis on academic success were discovered to have statistically significant impact on schools' mean mathematics achievements. Moreover, concerning student-level variables, being bullied at school, confidence in mathematics, being engaged in mathematics and parental involvement had statistically significant effect on students' mathematics achievement for both grade levels. Another study was conducted by Yalcin, Demirtasli, Dibek, and Yavus (2017b), The study explored the relationship between student characteristics (perception regarding peer bullying, students' confidence in mathematics, students' like learning mathematics and students valuing mathematics) which affect mathematics achievement of eighth grade students in Turkey and teacher characteristics (working conditions of teachers, teacher's emphasis on academic success and collaboration with colleagues in order to enhance teaching) which are dealt with at school level. The most important results of the study are: no significant relationship between students' mathematics achievement and teachers' working conditions and teachers' collaboration for improving teaching variables were found in the 2007 and 2011 assessments, and students' performances in TIMSS 2007 and 2011 mathematics exams have a significant relationship with students not being subjected to bullying at school and students' like learning mathematics variables on student level. Students' confidence in mathematics variable has a significant effect in achievements in 2011, which is not the case in 2007 and students valuing mathematics variable does not have a significant relationship with students' mathematics achievement in either year.

Based on the review of the existing literature, the present study aims at investigating what factors related to the school characteristics (school composition student background, school emphasis of academic success, school

discipline problems) and student context (SES, students like learning mathematics, students confidence in mathematics, students value mathematics, engaging teaching in math lessons, weekly time spent on math homework) influence the gap in mathematics achievement between rural and urban students using TIMSS 2015.

2.Study Objective and Research Question

   The results of the TIMSS-2015 study showed that the average achievement of Jordanian students in mathematics was lower than the international average. The average achievement of students in this cycle declined from 406 in TIMSS-2011 to 386 in TIMSS-2015. In addition to that, the Jordanian students' achievement rank also declined at the international and regional levels. The achievement gap between rural and urban students were significant, where the gap was 31 points in TIMSS 2011and 30 points in TIMSS2015.
   Therefore, the achievement gap between rural and the urban brings the attention of the concerned authorities in the country, as the educational authorities seek to develop educational policies to address this disturbing phenomenon. So this study comes to perhaps contribute to identifying some of the factors that are related to the achievement gap between rural students and urban students in mathematics. As a result, the study may have implications for educational policies, by answering the research question: What are the main factors associated with the schools and students that contribute to the gap in mathematics achievement between rural and urban students?

3.Method

   Since the beginning of the sixties, educational researchers have emphasized conducting international studies aimed primarily at comparing the trends and levels of achievement of students from a group of countries in the world, as well as studying the variables that affect the achievement and trends (Abu-Lebdeh, Tweissi, and Ababneh, 2017).
TIMSS is one of the most famous international studies; the study is carried out every four years and supervised by the International Association for the Evaluation of Educational Achievement (IEA). Jordan participated in this study since 1999 for grade eight, the number of non-Arab international participants in TIMSS 2015 cycle was 39, and the Arab participation was ten countries. A sample of eighth grade Jordanian students was selected from public schools, private schools, and UNRWA schools.

3.1 TIMSS Design and Instruments

   TIMSS employed a stratified two-stage cluster sample design. For the first sampling stage, schools are sampled with probabilities proportional to their size (PPS) from the list of all schools in the population that contain eligible students. The second sampling stage consists of the selection of one (or more) entire class from the target grade of each participating school.
http://timssandpirls.bc.edu/timss2015/frameworks.html
   TIMSS-2015 included 212 mathematics items classified into four domains: numbers, algebra, geometry. The items covered the expected cognitive skills; knowing, applying, and reasoning. About 51% of the items were of multiple-choice types, and the other items were of the constructed response items. Moreover, the study included a set of questionnaires: 26-items student questionnaire, 18-items school's questionnaire, 26-items mathematics teacher's questionnaire, and 26-items science teacher's questionnaire.
Ours is an exploratory study that utilizes Trends in International Mathematics and Science Study (TIMSS-2015) eight-grade dataset for Jordan. The original dataset contains 7865 students from 252 schools. There were missing values and "I do not know" reply, approximately 100 – 400 observations, to some survey questions. They were replaced by the median values of the respective variables. Different variables at the student and school level were explored through the multilevel linear modeling technique (Raudenbush and Bryk, 2002; Goldstein, 1987) to identify their influence on the **urban-rural** gap in mathematics achievement.

3.2 Two-Level Model (Schools – Students)

   The unconditional mean model facilitates examining variation in the outcome variable (mathematics achievement score) across level-2 units (schools).
   Level 1 (student level): $y_{ij} = \beta_{0j} + e_{ij}$, $e_{ij} \sim N(0, \sigma^2)$
   Level 2 (school level): $\beta_{0j} = \gamma_{00} + u_{0j}$, $u_{0j} \sim N(0, \tau_{00}{}^2)$
This gives the combined model: $y_{ij} = \gamma_{00} + u_{0j} + e_{ij}$
   In the context of our analysis, these variables can be redefined as follows:
y_{ij}: Achievement score of student i in school j

β_{0j} : mean achievement score for school j

γ_{00}: (Grand mean) or mean of the means of achievement score of each school

u_{0j}: Random effect of the jth school on the intercept

e_{ij}: Random error associated with student i in school j

σ^2 is known as the within-group variance, and $\tau_{00}{}^2$ is known as a between-group variance.

3.2.1 Random effects

The unconditional model serves to partition the variance between level 1 and level 2 units. The results can be summarized by the interclass correlation coefficient (ICC) given as ICC $= \frac{\tau_0{}^2}{\sigma^2 + \tau_0{}^2}$. The ICC can be interpreted as the proportion of variance in the outcome accounted for by the level 2 unit (school) membership and represents a measure of the strength of association since it represents a proportion of variance. In addition, the ICC can be interpreted as the expected correlation between two randomly drawn level 1 units (students) within a given randomly drawn level 2 unit (school). The magnitude of this measure can be interpreted in the same way as a correlation coefficient, it represents an effect size index (Snijders and Bosker 2012).

Table 1. Mathematics Achievement by School Location

School Immediate Area	% of Students	Mean (Math)	Standard Error
Urban	75.9	392.9	3.52
Rural	24.1	362.1	6.40

3.3 Study Variables

3.3.1 The dependent variable

The dependent variable in this study is the mathematics achievement scores for Jordan students who participated in TIMSS-2015 which was reported on a universal scale (all participant countries) with mean 500 and standard deviation 100. TIMSS assesses the ability of the whole student body based on a large number of assessment items. However, to keep the individual student burden to a minimum, it administered a limited number of assessment items to each student. As a result, student scores are transformed using Item response theory (IRT) into 5-plausible values to characterize student participation in assessment, given their background characteristics. Plausible values represent what the achievement of an individual on the entire assessment might have been, had it been observed. We use these 5-plausible values in this study.

3.3.2 Independent variables

For this study, we used indices and derived variables in the TIMSS-2015 data set. We used all of the indices and derived variables based on the items from the school questionnaire and student questionnaire. All the variables except binary that are selected to be used in the hierarchical linear models are centered around their means.

3.3.3.SES (Student-family socioeconomic status)

We used the three variables from the student questionnaire; Parent's highest education level, home educational resources, and Number of Home Study Supports to find the latent variable SES. We used R-package POLCA in the latent class analysis (Lazarsfeld, 1950). Based on the model fitting indicators Akaike information criterion (AIC), Bayesian information criterion (BIC), and usefulness indicators such as interpretability of the classes, we found 3-classes as the optimal number of classes of the latent variable SES. We labeled them as High, Middle-class, and Low SES classes respectively.

Table 2. The Percentage of Students by Student-family Socioeconomic Status

SES	% of Students	Mean (Math)	Standard Error
High	4.8	430.3	8.74
Middle Class	74.7	393.0	3.19
Low	20.5	349.7	4.08

We test the significance of the correlation coefficient between each variable in the study and mathematics achievement scores, where the variable is reserved if the correlation coefficient is statistically significant at ($\alpha = 0.05$).

Table 3.The Correlation Between Mathematics Achievement Scores and Student Indices.

Student variable	Correlation coefficient
Student Gender (Female:0, Male:1)	-0.10*
SES	-0.22*
Students like learning mathematics (ISLM)	-0.16*
Students confidence in mathematics (ISCM)	-0.35*
Students value mathematics (ISVM)	-0.14*
Engaging teaching in math lessons (IEML)	-0.10*
Students sense of school belonging (ISSB)	0.01
Weekly Time Spent on Math Homework (MWKHW)	0.04*
*: significant at ($\alpha = 0.05$).	

Table 4.The Correlation Between Mathematics Achievement Scores and School Variables.

School variables	Correlation coefficient
School composition of student background (CG03)	-0.13*
Instruction affected by Math resources shortage (CIRMS)	0.03
School emphasis on academic success (CIEAS)	-0.20*
School discipline problems (CIDAS)	-0.07*
*: significant at ($\alpha = 0.05$).	

We tested the selected variables for the statistical differences between urban-rural to include these variables in the multilevel models. We have reported these results in Figure 2. Correlation Between School Variables and Math Achievement

Table 11 Appendix 1. We further investigated the selected variables at this stage for the possibility of multicollinearity by using the Variance Inflation Factor (VIF). All of them had VIF value less than two which indicates some correlation but not enough to be a concern.

4.Statistical Analysis & Results

We used a multilevel linear model (Goldstein, 1987; Raudenbush and Bryk, 2002) and utilized the BIEFESURVEY package in R (BIFIE, 2016) to address the research question of the present study.

For the purpose of examining if there is a significant variation in level 2, one way- ANOVA with random effects without independent variables at the student and school level has been performed. This model is called the null model or unconditional mean model. The unconditional mean model facilitates examining variation in the outcome variable (mathematics achievement score) across level-2 units (schools).

4.1 Multilevel Modelling

Table 5.Result of Null Model: No Covariates

Fixed Effects	Estimate	St. Error	T-stat	P-value
Intercept: γ_{00}	387.2	3.4	115.2	< 0.0001
Variance Components				
Residual (e_{ij}): σ^2	6643.4 (77.4%)	175.8	37.8	< 0.0001
Intercept (u_{0j}) : $\tau_{00}{}^2$	1936.1 (22.6%)	281.7	6.87	< 0.0001

Unconditional mean model results (Table 5) implied that the population of student achievement scores y_{ij} has estimated mean 387.2 and standard deviation $\sqrt{1936.1 + 6643.4}$ = 92.6 and population of school means β_{0j} has estimated mean 387.2 and standard deviation of $\sqrt{1936.1}$ = 44. The statistically significant (p- value < 0.05) school-level variance reject the null hypothesis that there is no difference in achievement score across the schools. The Interclass correlation, ICC is 22.6 which is in line with ICC values of research findings (Hedges and Hedberg, 2007) report the average ICC for K-12 academic achievement is about 0.22 for students nested within schools. The result suggests that 22.6% of the variability in the students' mathematics achievement scores was due to school-to-school differences and 77.4% to student-to-student differences within schools.

To answer the research question, variable school location (urban/Rural): is added to the school level of the model to test the significant differences in achievement between students in urban schools and rural schools.

Table 6.Result of Model 1

Fixed Effects	Estimate	St. Error	T-stat	P-value
Intercept: γ_{00}	391.9	3.6	108.7	< 0.0001
School Location: γ_{01}	-27.3	8.2	-3.3	0.0001*
Variance Components				
Residual (e_{ij}): σ^2	6645.5 (80.4%)	176.0	39.7	< 0.0001
Intercept (u_{0j}): $\tau_{00}{}^2$	1622.9 (19.6%)	200.1	8.1	< 0.0001

The results shown in model 1 (ban schools and rural schools.

Table 6) indicate a significant association between school location and mean mathematics achievement ($\gamma_{01} = -27.3$), on the average urban school score 27.3 points higher than that of a rural school. Also, the between-school variance decreased from 22.6% to 19.6%.

Table 7. Result of Model 2: SES added (control variables)

Fixed Effects	Estimate	St. Error	T-stat	P-value
Intercept: γ_{00}	391.4	3.3	117.3	< 0.0001
School Location: γ_{01}	-23.2	7.7	-3.02	0.0003*
SES: γ_{10}	-34.6	3.6	-9.7	<0.0001*
Variance Components				
Residual (e_{ij}): σ^2	6561	188	34.9	< 0.0001
Intercept (u_{0j}): $\tau_{00}{}^2$	1367	172	8.0	< 0.0001

The results indicate (Table 7) a significant association between SES and mean mathematics achievement ($\gamma_{10} = -34.6$); on average, students belong to the middle class performed significantly better than those in low class and significantly worse than those in the high class.   Moreover, the difference in mathematics achievement between urban schools and rural schools decreased from 27.3 to 23.2 by controlling the student's SES.

Table 8.Result of Model 3: Add school Variables

Fixed Effects	Estimate	St. Error	T-stat	P-value
Intercept: γ_{00}	391.1	3.4	114.7	< 0.0001
School Location: γ_{01}	-23.4	8.0	-2.93	0.0034
SES: γ_{10}	-32.3	3.6	-9.01	<0.0001
CIEAS: γ_{02}	-24.9	4.85	-5.14	<0.0001
CIDAS: γ_{03}	-11.8	4.00	-2.96	0.0031
Variance Components				
Residual (e_{ij}): σ^2	6553	187	35.0	< 0.0001
Intercept (u_{0j}): $\tau_{00}{}^2$	1116	157	5.48	< 0.0001

The results (Table 8) indicate that school emphasis on academic success ($CIEAS: \gamma_{02} = -24.9$), school discipline problems ($CIDAS: \gamma_{03} = -11.8$) associated significantly (negative relationship) with the mathematics achievement gap between urban and rural schools. All these variables are **reversed coded**, hence, overall, a school that has a high emphasis on school success, fewer discipline problems on the average had higher mathematics achievement.

Table 9.**Result of Model 4, Add Student Variables**

Fixed Effects	Estimate	St. Error	T-stat	P-value
Intercept: γ_{00}	391.0	3.4	113.8	< 0.0001
School Location: γ_{01}	-25.5	7.9	-3.25	0.0010
SES: γ_{10}	-31.1	3.6	-8.76	<0.0001
CIEAS: γ_{02}	-24.5	5.0	-4.87	<0.0001
CIDAS: γ_{03}	-11.8	4.1	-2.88	0.0040
ISLM: γ_{20}	-19.0	1.77	-10.73	<0.0001
Variance Components				
Residual (e_{ij}): σ^2	6318.7	184.5	34.24	< 0.0001
Intercept (u_{0i}): $\tau_{00}{}^2$	1122	155	7.22	< 0.0001

   Initially, the model was run with both student factors (ISLM and IEML), but Engaging teaching in math lessons (IEML) was not statistically significant and removed from the model. The result (Table 9) shows a significant association between Students like learning mathematics (ISLM) and mathematics achievement ($\gamma_{20} = -19.0$). This measure was also reverse coded, so the more the student like mathematics, the higher the achievement score. To find the effect size or compare the effect of independent variables, we used standardized variables (including School Location which is binary variable) and effects are reported in .

Table 10.

Table 10.*Results using standardized variables*

Fixed Effects	Estimate	St. Error	T-stat	P-value
School Location: γ_{01}	-0.12	0.037	-3.25	0.0010
SES: γ_{10}	-0.16	0.019	-8.74	<0.0001
CIEAS: γ_{02}	-0.15	0.030	-4.89	<0.0001
CIDAS: γ_{03}	-0.09	0.033	-2.88	0.0040
ISLM: γ_{20}	-0.16	0.160	-10.68	<0.0001

   P values (< 0.05) indicate that School Location, SES, school emphasis on academic success, school discipline problems, a student like learning mathematics are all statistically significant.
This indicates that one standard deviation increase in the student like learning mathematics is related to 0.16 expected standard deviations increase in math achievement; and that one standard deviation increase in the school emphasis in academic success variable is related to 0.15 expected standard deviations increase in math achievement, controlling for associated covariates. Indeed, the relative importance of the school emphasis on academic success is greater than the relative importance of the school discipline problems as measured by effect sizes of the variables.

5.Discussion and Conclusion
   The results showed that 22.6% of the variation in the achievement of students in mathematics is due to differences between schools. This may be explained by the differences among schools in teacher qualification level, school supply, overcrowding level, socioeconomic status of the student body, and educational practices within the school.
   According to the results of Ghagar, Othman and Mohammadpour (2011) the variation in achievement among Jordanian schools is less than that of Malaysian schools and higher than that of schools in Singapore. So as, educational policies that focus on reducing differences in school inputs quality, and monitoring of teachers practices within the schools will contribute to narrowing the gap between schools. Economic and social factors play an important role in interpreting disparities in the achievement of different student groups.
   In line with the results in (Alordiah, et al. 2015), (Kryst, et al. 2015) and (Caponera, et al. 2016), we found that there is a significant association between SES and mean mathematics achievement ($\gamma_{10} = -34.6$); on average, students belong to the middle class performed significantly better than those in low class and significantly worse than those in the high class. Moreover, the difference in mathematics achievement between urban schools and rural schools decreased from 27.3 to 23.2 by controlling the student's SES.
   For further investigation of the variables associated with the gap between rural and urban students, a set of variables has been introduced to the models. Where, some variables have emerged to be at the core of educational policies, as the differences among rural schools and urban schools revealed in term of school emphasis on academic

success. Where, it seems that the teachers in the urban schools are better in understanding the goals of the curriculum, and succeed more in applying the curriculum within the classrooms, they work together to achieve the best results. This finding is consistent with the findings of (Yalcin, et al. 2017a), and it is somewhat consistent with what was suggested by a study conducted by (Nelsen, et al. 2014)

In addition to that, the finding of the study showed that rural schools seem to have more discipline problems than urban schools, where frequent student absenteeism, delayed access to school, destroy school property, and classroom disruptions are manifestations of these problems. However, such problems are more common in male schools than in female schools.

Teacher training can be vital to control such behaviors. As, the teacher licensing system, which Ministry of Education intends to apply, may have an impact on raising the capacity of teachers and the school administration to improve their classroom management skills. This result is consistent with the results of (Nicholas, et al. 2016) in terms of the effect of the level of discipline on academic performance, and it is in line with the findings of (Yalcin, et al. 2017a).

In general, Jordanian students do not like to learn mathematics, as they consider it an abstract course, and it does not approach the reality of their daily life. Despite the efforts led by the Ministry of Education to develop mathematics curricula, as well as the efforts exerted to train teachers on the developed curricula and modern teaching and evaluation strategies, students' achievement in mathematics has remained poor over time (Abu-Lebdeh, et al, 2017). The gap in math achievement among rural and urban students has persisted over time, and rural students have shown less enthusiasm for learning mathematics than urban students. This less enthusiasm naturally affects students' motivation to learn mathematics and reduce their ability to solve the real problems facing them in mathematical ways. This result is in line with the findings of (Yalcin, et al. 2017a) and (Yalcin, et al. 2017b).

There are some limitations to this research and its results, as this research did not examine the causal relationship between independent variables on the one hand and the dependent variable on the other hand, so this research is classified as a descriptive research concerned with correlational relationships and not causal relationships between variables, so it is possible to conduct other research that is oriented towards experimental research or analyzes that aims to detect causal relationships. From other side, the focus of this study is on mathematical literacy, but other studies may study scientific literacy. Moreover, other variables may be included for further investigation in any future research such as teacher's variables and home background.

In practical terms, the current study has shown the importance of including educational policies variables related to learning mathematics, such as increasing student enjoyment in learning mathematics, and thus stimulating the student's love for learning mathematics. This, of course, will interfere with the possibility of encouraging and training rural schools to put in place the necessary measures to focus more on success at the school and the student level.

The results of the study indicate the importance of working in several areas to reduce the gap between rural and urban students in the medium and long term, it may be necessary to revise teacher training modules, and curriculum framework to increase students' engagement in learning mathematics. It is necessary to focus on enabling teachers of rural schools to achieve the competencies of specialist teachers of mathematics now being developed by Jordan Ministry of Education. In conclusion, the results of this study may be useful to develop educational policies related to the elimination of various forms of inequality between rural and urban schools.

6.Study limitations

The results of the current study are subject to some limitations; where TIMSS-2015 was carried out in April 2015. So as the educational reality may differ. In addition to that, the objectivity of respondents' responses to the study questionnaires may not be achieved. Another limitation is missing data; the effect of the schools, teachers, and students dropped can't be known on the statistical results.

7. Availability of Data and Materials

The study represents a secondary data analysis of the public use TIMSS 2015 file provided by IEA. The TIMSS2015 data for Jordan have been made publicly available by IEA, and can be accessed at. https://timssandpirls.bc.edu/timss2015/international-database/

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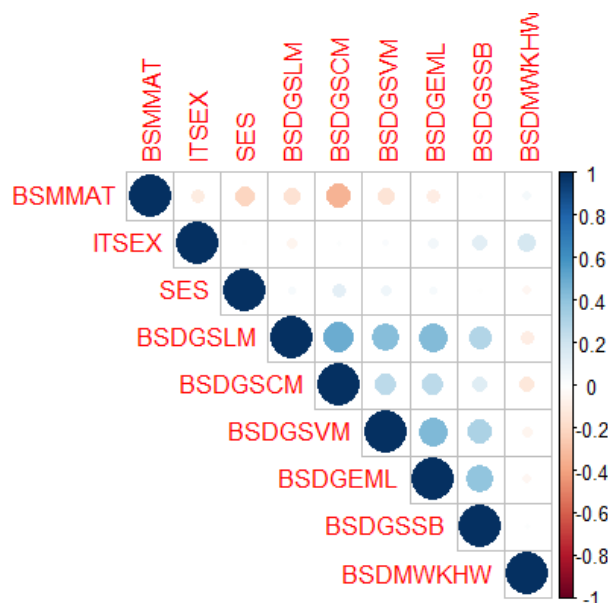
Appendix

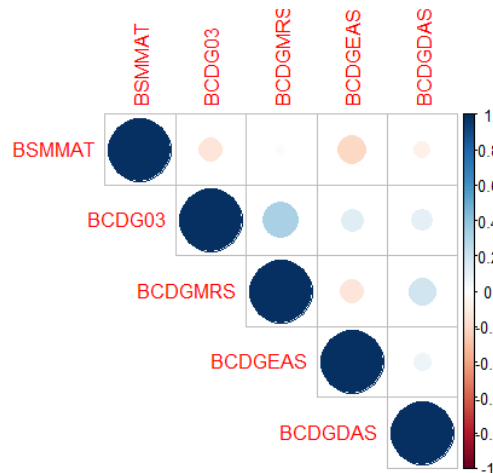Figure 1. Correlation Between Student Variables and Math Achievement

Figure 2. Correlation Between School Variables and Math Achievement

Table 11. Urban-rural Differences of Variables Correlated with Math Achievement

Index	School Location	Mean	Standard Error of the Mean
School composition student background (CG03)	Urban	2.58	0.05
	Rural	2.67	0.09
School emphasis of academic success (CIEAS)*	Urban	2.48	0.05
	Rural	2.72	0.07
School discipline problems (CIDAS)*	Urban	1.97	0.07
	Rural	1.64	0.09
SES*	Urban	2.14	0.01
	Rural	2.26	0.03
Students like learning mathematics (ISLM)*	Urban	1.88	0.02
	Rural	1.79	0.04
Students confidence in mathematics (ISCM)	Urban	2.17	0.01
	Rural	2.17	0.03
Students value mathematics (ISVM)	Urban	1.40	0.01
	Rural	1.40	0.02
Engaging teaching in math lessons (IEML)*	Urban	1.40	0.02
	Rural	1.32	0.02
Weekly Time Spent on Math Homework (MWKHW)	Urban	2.56	0.01
	Rural	2.53	0.03