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**Gender and School Location
Differences in Mathematics
Achievement Using TIMSS Test for the
Grade Eight in Jordan**

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Abstract:

This study examines potential gender and school location differences in the mathematics achievement of the Jordanian schools. The sample size consisted of more than (400) students for both genders and school location at (10) schools randomly selected in the Ma'an governorate in the scholastic year (2014/2015) second semester. To achieve the objective of the study, the mathematics achievement test was constructed by adopting TIMSS items after verifying its validity and reliability. The results for both genders and school location were compared. The results showed that the male students higher achievement in mathematics than the female students, and students in urban schools achieved higher scores than their peers in rural and badia schools.

Keywords: (Gender, School Location, Mathematics Achievement, TIMSS Test, and Grade Eight)

الفروق بين الجنسين وموقع المدرسة في تحصيل الرياضيات باستخدام اختبار TIMSS للصف الثامن في الأردن الملخص:

هدفت الدراسة الحالية لفحص الفروق المحتملة لكل من النوع الاجتماعي وموقع المدرسة على التحصيل في الرياضيات في المدارس الأردنية. تكونت عينة الدراسة من أكثر من (400) طالب وطالبة تضمنت كلا من الجنسين وموقع المدرسة (مدنية، وريف، وبادية) من عدد (10) مدارس تم اختيارها عشوائياً من محافظة معان للعام الدراسي (2015/2014). ولتحقيق هدف الدراسة، تم إعداد اختبار في التحصيل الرياضي بنيت فقراته من اختبار (TIMSS). تمت مقارنة النتائج فيما يتعلق بالنوع الاجتماعي وموقع المدرسة، وأظهرت النتائج تفوق الذكور في تحصيل الرياضيات على الإناث، وتفوق طلبة المدارس في المدينة على نظرائهم في الريف والبادية.

كلمات مفتاحية: النوع الاجتماعي، موقع المدرسة، تحصيل الرياضيات، اختبار TIMSS، والصف الثامن

Introduction:

The mathematical sciences are essential to the national interest of any modern society. To continue to advance in mathematics achievement, Jordan and other countries are concerned with high quality math instruction received by all students.

Mathematics achievement in relation to gender differences has been studied intensively over the past more than three decades (Ackerman, 2006; Ai, 2002; Deborah, 1989; El Hassan, 2001; Kessels & Hannover, 2007; Low & Over, 1993; Uekawa and Lange, 1998; Young, 1994). Many researchers have found no relationship between gender and mathematics achievement, for example, Young (1994) studied 3, 7, and 10 grades in Western Australia in relation to gender differences in mathematics achievement, he found that both genders in grade 3 and grade seven had identical mean scores in achievement tests. Moreover, Zabel and Nigro (2001) found that juvenile offenders exhibited no significant relationships between gender and some topics of mathematics. In addition, for grades (7-10) in Los Angeles, Ai (2002) reported that no relationship between two groups of high achieving students in their initial status and growth rate in relation to mathematics scores. Similarly, Ackerman (2006) considered that both gender have the same cognitive ability.

Low and Over (1993) studied gender differences in the two experiments for students in grades 10th and 11th in Australia. These experiments contain (36) algebraic word problems (The algebraic problems denote to general mathematics achievement). Both genders asked to classify these problems in terms of whether these problems contained missing, sufficient, or irrelevant information for answer. The results found no gender differences in mathematics achievement for the grade 11. In a comparative study in Korea and United States, Uekawa and Lange (1998) found no correlates between gender differences and mathematics achievement in grade eight in the US, although girls outperforming the males were found for Korea. Also, El Hassan (2001) studied the gender differences in secondary schools in Lebanon in specific subjects including mathematics, he found no statistically significant difference between males and females in mathematics achievement.

Contrary to these results, other researchers have found relationships between mathematics achievement and gender, whether favouring males or females. For example, Baya'a (1990) studied 9th grade to 12th grade Arab students at the private and comprehensive Arab high school in occupied Palestine. This study aimed to see whether males and females differences in mathematics achievement. The sample size of the study was (418) students; (214 male students and 204 female students). The mean grades in the mathematics final tests for the last four trimesters were used to measure mathematics achievement. The results showed there was a significant difference between the mathematics achievement of males and females, in favour of males. In addition, Gabriel et al. (2006), conducted a study on gender and course selection in upper secondary education (Effects of academic self-concept and intrinsic value). They investigated gender differences of achievement in mathematics and biology using data from (1148) students in grade 10 in Germany. In relation to mathematics achievement tests the results showed that males outperformed females, and they

reported higher mathematics self-concepts and intrinsic values. Females scored higher on the biology self-concept and intrinsic value scales.

Also, Low and Over (1993) found the same result for students in 10th grade and Young (1994) found that grade 10 males outperformed females in mathematics achievement. Moreover, Leonidas and Panayiotis (2009) found in Cyprus that males outperformed females on the hardest items in mathematics test for four different classes of primary schools.

In contrast, other researchers have found no gender differences or females outperforming males in mathematics. For example, Randhawa and Hunt (1987) studied grades three, seven, and 10 in Canada and reported that females outperformed males in mathematics computation. Also, Ibrahim & Al-Sarimi, (2007), conducted a study in Oman, which consisted of (125) of 11th grade, with of 65 males, they found that there was no gender difference on mathematical thinking.

In addition, Leonidas and Panayiotis (2009) found that females outperformed males on the easiest items. Brandon, Newton and Hammond (1987) conducted a study to investigate any gender differences in mathematics achievement test reasoning and computation in Hawaii public schools for different ethnic groups. The results showed that, overall, females outperformed males, although in the computation subscale males achieved higher than females in mathematical reasoning. Nevertheless, high-achieving females had higher scores than high-achieving males.

The Jordan results of TIMSS-test (2003) show that 8th grade females outperformed males in mathematics achievement in both content and cognitive. This happens in nine countries with Jordan being one of these. Also, in TIMSS-test (2007, 2011 and 2015), females had higher scores than males in some countries in mathematics achievement with Jordan, again being one of these countries. In the national test conducted by the Ministry of Education (2001) in Jordan for grade nine in mathematics, the overall mean test scores for females, were higher than for males. These results are consistent with Cook's (2000) study which also found that females did better than males, when tested alone.

Moreover, Eraikhuemen (2003) studied the effect of gender and school location on mathematics achievement at secondary school. The researcher tested than more (400) students. In relation to gender differences, the study found males achieved higher scores than females. In contrast finding, Mubark (2005) conducted a study to investigate any gender and school location differences in mathematics achievement for the grade 11 scientific stream in Jordan. According to gender difference the researcher found females outperformed males.

In a study by Zaman (2011) which was quantitative and qualitative study, in relation to quantitative part the study aimed to exam any gender and school location (private versus public schools) differences in mathematical thinking and mathematics achievement for 9th grade students in Pakistan. The results showed that males achieved higher scores than females in math. Moreover, Anjum (2015) in his study in four cities in India, the researcher tested (147) males and (160) females.

females in mathematics achievement developed by National Council of Educational Research and Training (NCERT), New Delhi (2007). The results revealed that females outperforming males on mathematics achievement.

There are a number of studies that either have not found any relationship between the location of a school and the mathematics achievement or found any relation (Eraikhuemen, 2003; Monk & Haller, 1986, Mubark, 2005, Zaman; 2011). Monk and Haller (1986) studied in New York state any possible differences in location school gap in different subjects including mathematics achievement. They found no significant location school in mathematics achievement. In Eraikhuemen (2003) study, in regard to differences in school location (urban versus rural) and mathematics achievement, the results indicated that students in urban schools did better than their peers in rural schools. Also, the results showed there was significant interaction effect between gender and school location in mathematics achievement. Zaman (2011) found students in private schools outperformed students in public schools in all aspects of mathematical thinking and mathematics achievement. However, Mubark (2005) found in his study students in suburban outperformed their peers in urban and rural schools, but there was no gap location difference between urban and rural.

Summarizing Pervious Studies:

Some of previous studies indicated that there is gender differences in mathematics achievement (Baya'a, 1990; Gabriel et al, 2006; Mubark, 2005). Whereas other studies that there is no gender difference in mathematics achievement (Ai, 2002; Ackerman, 2006; Hassan, 2001). According to the differences between school location and mathematics achievement, many foreign studies investigate these variables (Eraikhuemen, 2003; Monk & Haller, 1986, Mubark, 2005, Zaman; 2011), However, this study is considered one of the rare Arabic studies that took into consideration the difference between the school's location and mathematics achievement

The Educational System of Jordan

The educational system of the governmental schools in Jordan, as those of the Middle East countries, is based on single sex schools. Two levels of education in Jordan: basic (Primary) education (6-16 years old) which is compulsory followed by secondary education as optional level (16-18 years old) till now. The studying in all governmental schools is free of charge (Ministry of Education, 2000). More than two-third of governmental schools in Jordan are females or co-educational (till grade three) schools. Moreover, more than fifty governmental schools in urban and the other schools in rural and Badia (MOE, 2018). Before 1990, the primary education was extended from nine years to 10 years, to increase the students' achievement rates.

The Problem of the study:

The importance of mathematics at primary stage in Jordan is reflected in its objectives which stress to enable students to acquire mathematical concepts and its application. Mathematics is viewed as a difficult internationally (Kurukkan, & AbdulGarfoor, 2015) and situation in Jordan is almost the same showing low achievement among primary school particularly in grade 8 (TIMSS, 2011, 2015). Therefore to enquire about the problem of low achievement, in this study

focused on gender differences, and school location in mathematics achievement among students of primary school in Jordan. This study attempted to answer the following questions:

Question One: Do male and female students differ in mathematics achievement?

Question Two: Do urban, rural, and Badia students differ in mathematics achievement?

The Importance of the Study

The importance of the study was to find any possible gender and location differences in mathematics achievement in Ma'an governorate. All public primary schools are single-sex throughout Jordan; however, sometimes in small areas these schools are coeducational up to the 6th grade.

Delimitations of the study

The delimitations of the study as the following:

Instrument limit: The study was limited with four subjects from the curriculum of mathematics namely (Number and operations, Algebra, Geometry and Data chains)

Spatial limit: Schools in Ma'an governorate, Jordan.

Time limit: Second semester of the scholastic year (2014/2015).

Human limit: A random sample of grade 8 students in Ma'an governorate schools.

Methodology

The mathematics achievement test measured on a single aspect incorporating curriculum factors and reflecting the central school achievement tests. The researcher considered TIMSS-test items to investigate mathematics achievement. The mathematics achievement test was constructed by adopting TIMSS-test items for middle schools and, where necessary (by translating the items to Arabic language). The items were re-written for the particular study focus and to be more suitable for the grade eight in Jordan. Mathematics is considered a particularly important subject for the grade 8 students due to the well-known ramifications of students' interest and subject-matter achievement during the middle grades. The achievement test consisted of (25) multiple choice items with four mathematical subjects (Number and operations, Algebra, Geometry and Data chains), six items for each subject except Data and chains with seven items. The researcher tested (416) students, from both genders and both school location for the second semester in the scholastic year (2014/2015). The test takes one hour and half.

The sample for the study selected randomly using simple random sample from schools in Ma'an governorate, for convenience with the researcher was work place. Ma'an governorate contains of four directorates: 1-Ma'an directorate, 2-Petra directorate, 3- Southern Badia directorate, 4- Al-Shobak directorate. Students involved in the study were selected randomly from the four directorates. The sample size involved (236) male students and (180) female students. The breakdown of students by gender in each directorate is displayed in Table 1.

Table 1: Numbers of Students by Gender in Each Directorate

#	Directorate	Gender		Total
		Male	Female	
1	Ma'an	76	60	136
2	Petra	60	40	100
3	Southern Badia	56	44	100
4	Al- Shobak	44	36	80
5	Total	236	180	416

The researcher considered Ma'an and Petra as urban areas (236 students, see Table 2) due to Ma'an is considered as the governorate center and Petra as a tourist area is close of its properties as urban area. However, the researcher considered southern Badia and Al-Shobak directorates as rural and Badia, Al-Shobak as rural since it's contains gathered villages and southern Badia as Badia (180 students see Table 2). The researcher assumed that rural and Badia as one category for his belief they had the same properties and close to each other in relation to socio-economic status (SES). The breakdown of students by location and gender is displayed in Table 2.

Table 2: Number of Students by Location of School and Gender

#	Location Gender	Urban Students	Rural and Badia Students	Total Students
1	Male	136	100	236
2	Female	100	80	180
3	Total	236	180	416

Validity and Reliability of Mathematics Achievement test

To satisfy the requirement of content validity, the researcher sent the items to specialists in educational mathematics academic staff at some Jordanian universities, specialists in Ministry of Education such as mathematics supervisors and teachers, for their suggestions and comments. Some of their comments related to unclear translation due to the items were in English language or need for specific changes. Also, some items were too easy or too difficult for the students at grade eight. Based on their comments, the researcher omitted some items, reworded other items, and then the researcher improved the mathematics achievement test until a final version of the test was developed. The mathematics achievement test was initially consist of (24) items, after the feedback the researcher added three items and omitted two items until the mathematics achievement test was consist of (25) items-test. This test was designed to measure general abilities in mathematics extracted from TIMSS and consistent with the grade 8 syllabus in Jordan. However, the construct validity of mathematics achievement test was confirmed by principal component factor analyses.

Reliability test: the researcher applied the test on the pilot sample of (30) females for the grade 8 second semester scholastic year 2014/2015 out of the study sample. The overall mathematics achievement reliability test by using Cronbach's Alfa was 0.83 which considering in acceptable range (Madan & Kensinger, 2017; Odeh, 2005).

The Results of the Study:

All ten schools involved in this study were single-sex, as is the case throughout Jordan for all students. Any differences in mathematics achievement that might exist between the public schools, (4) being schools for male students, and (6) being schools for female genders would also be related to school differences. The male and female student mean scores on mathematics achievement were compared using t-tests. There was a significant gender difference for total mathematics achievement scores. Male students achieved significantly higher scores than female students. The mean scores and standard deviation by gender are shown in Table 3.

Table 3: Results for Gender Differences in Mathematics Achievement.

#	Test	Mean (M)	Mean (F)	SD (M)	SD (F)	T- vare	Prob
1	Mathematics Achievement	11.27	10.28	5.18	3.73	1.593	0.002

The mean scale scores of mathematics achievement for each of the two locations (urban versus rural and Badia) were compared. A T-test analysis was used to examine any differences between school location and mathematics achievement. The results showed that students in urban schools achieved higher scores than their peers in rural and Badia schools in overall mathematics achievement test. The overall result for the scale is shown in Table 4.

Table 4: Results for School Location Differences in Mathematics Achievement.

#	Test	Mean	Mean	SD*	SD**	T- vare	Prob
1	Mathematics Achievement	11.37	9.88	4.98	3.52	2.538	0.001

*denote to Urban

** denote to Rural and Badia

Discussion of the Results:

According to the first question, do male and female students differ in mathematics achievement?

The results showed that males outperformed females. This result is consistent with other researches that found males generally outperformed females in mathematics achievement (Baya'a, 1990; Eraikhuemen, 2003; Gabriel et al, 2006; Leonidas & Panayiotis, 2009; Low & Over, 1993; Martin, et. Al, 1997; Young, 1994; Zaman, 2011). This result, however, is inconsistent with some researcher findings that found females achieved higher scores in mathematics achievement (Anjum, 2015; Brandon, Newton, & Hammond, 1997; Leonidas & Panayiotis; Ministry of Education (Jordan), 2001; Mubark, 2005; Randhawa & Hunt, 1987; TIMSS, 2007, 2011, 2015) or other studies that found no relationship between mathematics achievement and gender was found (Ai, 2002; El Hassan 2001; Ibrahim, & Al-Sarimi, 2007; Low & Over, 1993; Uekawa & Lange, 1998; Young, 1994; Zabel & Nigro, 2001). For TIMSS-test (2007, 2011, and 2015) in Jordan, as with some of other Arabic and Islamic countries participating in TIMSS-test during the previous sessions,

females also outperformed males in mathematics achievement. Although this result was inconsistent with studies that conducted in Jordan including TIMSS-test study, the potential reasons are different region or governorate, which leads to different sample and thus differing in the results. Moreover, the differences between males and females are due to sociocultural factors that differ (Kane & Mertz, 2012), so the other potential reasons for this finding the sociocultural factors differ among governorates in Jordan, and that these factors can be changed from time to time. Finlay, summers (2005) noted in fewer females to be employed in science and engineering careers. So, from the researcher previous experience as academic staff at Al-Hussein Bin Talal University (AHU) females from Ma'an governorate, studied humanities subjects' more than scientific subjects, which leads the females less interest than males in mathematics and will be derived males do better than females in mathematics achievement that maybe differ than other governorates in Jordan.

According to the second question: do urban, rural, and Badia students differ in mathematics achievement?

All schools in different locations in Jordan take the same curriculum as set by Jordanian Ministry of Education but school facility would vary to some extent. In relation to mathematics achievement by students in different school locations, the results showed urban students outperformed rural and Badia students. This result is consistent or slightly consistent with other researchers who found urban school students outperformed their counterparts in other locations (Cox, 2000, Eraikhuemen, 2003; Kleinfeld, et al, 1985, cited in Young, 1994, 1998; Uekawa & Lange, 1998; Young, 1994; 1998; Zaman, 2011). However, this result is inconsistent with other researchers who found there was no relationship between mathematics achievement and school location (urban and rural (Monk & Haller, 1986; Mubark, 2005). In terms of the difference in achievement between urban and rural and Badia students, the higher levels achieved by urban students could be explained by the lower value accorded educational or academic achievement in rural and areas (Mubark, 2005). While people in rural and Badia areas are becoming increasingly educated, it is possible a difference still exists urban and rural and Badia areas. Finally the socio-economic status of the rural areas may be higher than the rural and Badia areas and this may affect on mathematics achievement which support by Young (1994, 1998) studies, that found a relationship between the location of the school and the mathematics achievement of his students in favour of regions of upper socio-economic.

Conclusion

Gender and school location were an important concern in the study. Males had higher mean scores than females in mathematics achievement. In no instance did the females achieve higher than males in this study. Also, urban students had higher mean scores than their peers rural and Badia students in mathematics. It is recommended that further studies conduct interviews with students or observations to help determine study patterns or activities which may contribute to the achievement differences.

It is particularly important that students in the middle of primary school, such as Year 8, build a strong foundation of mathematical achievement. The implication is that teachers can be encouraged and assisted to focus on and emphasize to improve the mathematics achievement of their students

regardless for genders and location. It is recommended than focus on mathematics achievement, particularly in primary schools, and for students in all later stages.

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