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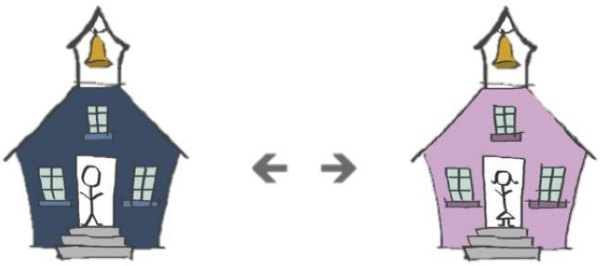
Why girls achieve academically more than boys in the Arab world? The effect of gender segregation and bullying in schools on gender achievement



MASTER THESIS

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Finally, I want to dedicate this thesis in the memory of my father for being my role model, and for being an inspiration. Without him, I would have never been the same person. This is for him.

Abstract

In mathematics, science and reading; the gender gap between boys and girls in Arab countries' schools is substantially bigger than the other countries in favour of girls. This difference may hinder boys in Arab countries from having sufficient skills in their future studies and jobs. The main goal of this research is to find possible reasons behind the gender gap in the Arab schools. The literature suggests that school type (single-sex or mixed-sex school) could be one of the reasons for the gender gap. It is suggested that in all-boys classes the class climate is more violent which leads to more bullying and this has a negative impact on achievement. While in all-girls classes, the environment tends to be more calm and cooperative, which reduces bullying and enhance achievement. This study investigates if school type and bullying are related to achievement and if this is one of the reasons behind the gender gap in achievement in Arab countries.

Using data from the Trends in International Mathematics and Science Study (TIMSS) 2015 assessment of grade 8 students in 7 countries, a series of t-tests in addition to a multilevel regression model were conducted to determine the effect of school type and bullying on student achievement. The results showed that bullying is common in the Arab countries' schools and is negatively associated with student achievement. No correlation between bullying and school type was found. However, school type and school socioeconomic status were related and this might be one of the explanations for the achievement gap between grade 8 girls and boys in the Arab countries.

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Introduction

In the current competitive global economy, an important factor that determines a country's economic success is to make use of each citizen's full capacity. From this perspective, it is important to ensure that men and women can develop the skills that enhance their potential. As a result, many countries have succeeded to narrow the gender gap in education, which made them ensure that both genders have the same skills to enter the job market (OECD, 2015). Enhancing gender equity in education, gives the students the required skills that enable them to perform better in their careers, which empowers the economy of the country. In addition, it is an important factor of well-being, satisfaction and happiness for human beings ("Closing the Gender Gap: Act Now," 2012). However, the gap between male and female in education is larger in Arab countries than most of the other countries in favor of females (OECD, 2015).

According to the international large scale data published by TIMSS 2015 and PIRLS 2016 for grade 8 students, girls achieve substantially higher than boys in reading, boys achieve moderately higher than girls in mathematics, and boys achieve slightly higher than girls in science. However in Arab countries, the gap is bigger in favor of girls. Hence, girls achieve slightly better in mathematics, moderately higher in science and substantially higher in reading (Mullis, Martin, Foy, & Hooper, 2016a; Martin, Mullis, Foy, & Hooper, 2016; Mullis, Martin, Foy, & Hooper, 2017). This gender gap was confirmed by two studies that explored the gender differences in mathematics and science achievement for students in the last grade of high school over a 10-year period in The United Arab Emirates. In both studies, the girls outperformed boys in mathematics and sciences (Alkhateeb, 2001; Hassan & Khalifa, 1999).

Although girls achieve better than boys in education within the Arab world, they do not have the same success in the job market. To illustrate, women unemployment levels in the Arab countries far surpass the levels in any other region all over the world. The reasons of this high unemployment rates are mainly because of the social traditions that prefer women to stay at home and be housewives (Sika, 2011)**.** Hence, men fill most of the critical jobs which make their skills an important factor of their countries economic success. As a result, ensuring that girls and boys gain equal sufficient skills in their education to apply in their future jobs is an important issue.

In the literature, there is no consensus about the reasons for this gender gap. A popular possible explanation for the gender gap is that in Arab countries, boys have more freedom than girls. Hence, they can spend more time outdoors, while girls spend their time indoors which make them spend extra time in school work (Alkhateeb, 2001; Hassan & Khalifa, 1999). Alkhateeb (2001) as well as Hassan and Khalifa (1999) claim that due to the strong segregated education system, females can express themselves more freely and are more encouraged to compete in mathematics and science with the males. Moreover, as mothers have more free time than fathers, they are giving more attention to their daughters by meeting and communicating regularly with their teachers (Hassan & Khalifa, 1999).

Another possible cause for the Arab gender gap in achievement is that the segregated classes cause more behavioral problems in the form of bullying for all-boys classes which leads to lower achievement, and less bullying in all-girls classes which leads

to higher achievement (Bevilacqua et al., 2017; Gray & Wilson, 2006; Osborne-Oliver, 2008). It is suggested that boys tend to interact with each other in a more physically aggressive way, while girls interact together in a more cooperative way. This can lead to a more disturbed environment in boys classes which reduces their achievement, and more calm environment in girls classes which enhances their achievement (Fabes, Shepard, Guthrie, & Martin, 1997; Hinshaw, 1992; C. L. Martin & Fabes, 2001).

The relation between school segregation, school bullying and student achievement was chosen as the focus of this study for two reasons. First, there is a lack of research on bullying within single-sex schools (Silbaugh, 2013). A report published by the U.S. Department of Education in 2005 reviewing the previous research regarding single-sex and coeducational schools reported that the association between bullying and school type did not appear in any study with sufficient quality (Mael, Alonso, Gibson, Rogers, & Smith, 2005). Similarly, Johnson and Gastic (2014) mentioned in their study that there is very little known about patterns in bullying in single-sex schools. Second, the absence of literature and research regarding the benefits and drawbacks of the single-sex education system in the Arab countries (Hamdan, 2010). Although there are several studies about the effects of single-sex schools in western countries, the results are inconsistent (Bracey, 2006). In addition, the difference in culture values and educational systems could be a barrier to generalize previous research results which were mainly held in western countries (E. Pahlke, Hyde, & Mertz, 2013).

Chapter 1
Theoretical background

The achievement gender gap in mathematics, science and reading in the Arab countries is wider than the rest of the countries (as shown in Figures 1, 2 and 3). One of the suggested reasons behind this gender gap is the popularity of segregated schools in the Arab region. It is assumed that in all-boys classes violence and bullying are more frequent than in all girls classes, which leads to lower achievement for boys. In this chapter, a review of what is known about the advantages and disadvantages of single-sex versus mixed sex schools and the reasons of segregated schools popularity in the Arab countries is presented. In addition, school bullying, it's reasons and effects regarding students achievement and the possible relation between school bullying and class type (single-sex versus mixed-sex) are discussed.

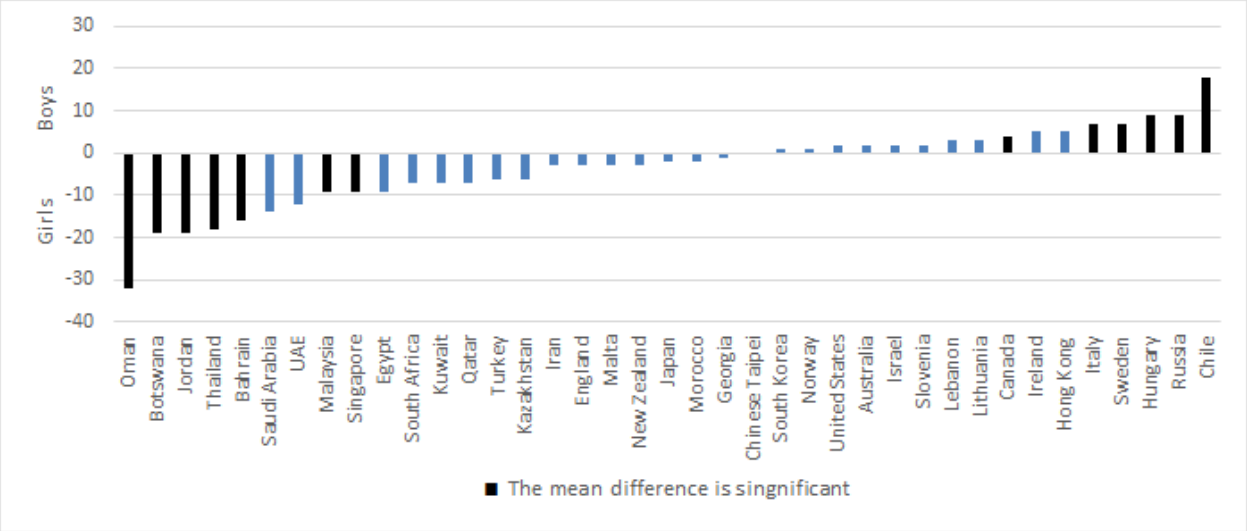

Figure 1. The mean difference between boys and girls mathematics achievement across countries. The figure is a representation of the data from Mullis et al. (2016a)

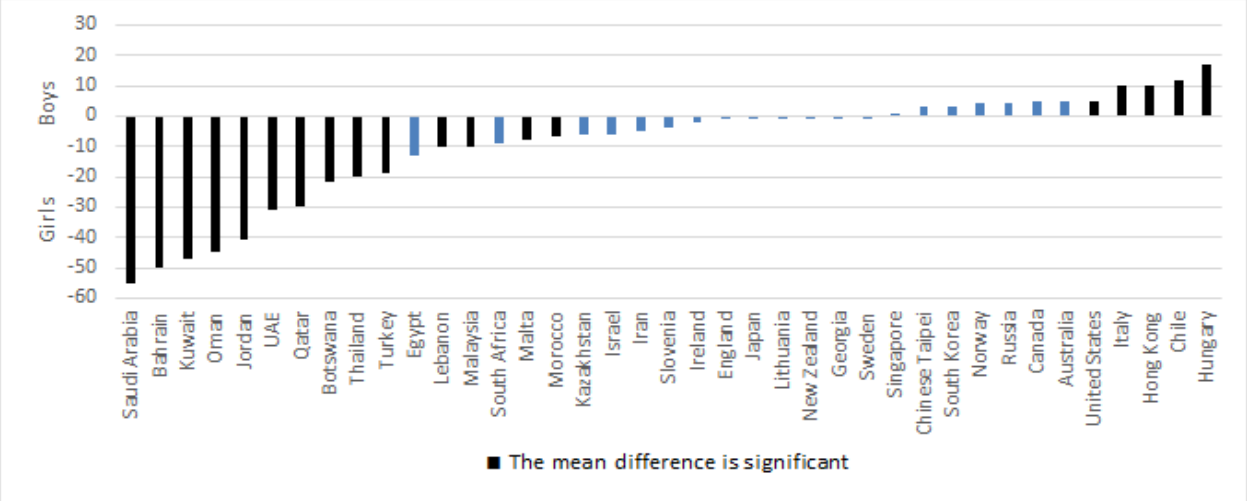

Figure 2. The mean difference between boys and girls science achievement across countries. The figure is a representation of the data from Martin et al. (2016)

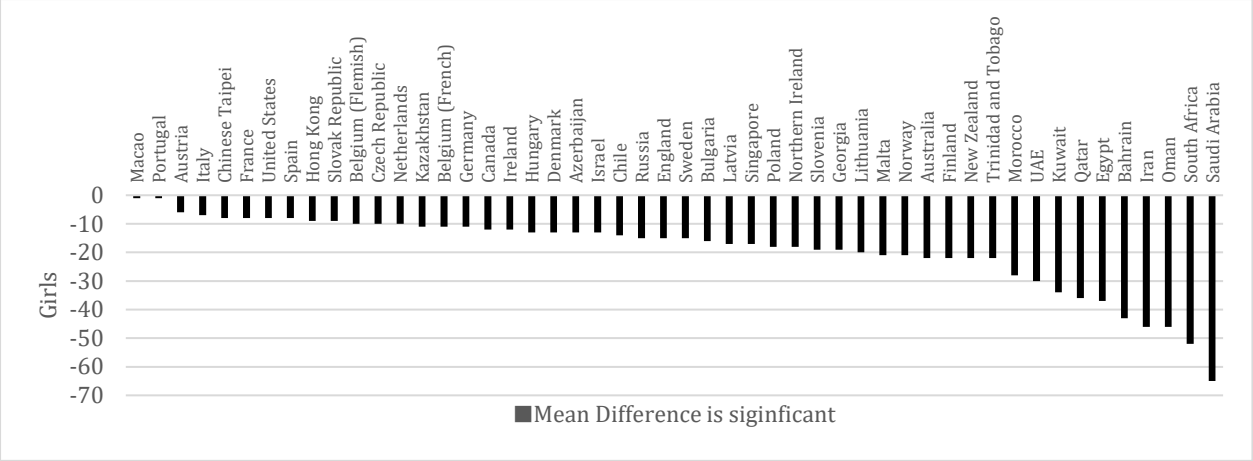

Figure 3. The mean difference between boys and girls reading achievement across countries. The figure is a representation of the data from Mullis et al. (2017)

1.1 Single-sex and mixed-sex schools in the Arab world

Arab countries have a strong single-sex education system with most of the schools segregated by gender (Hamdan, 2010; Marsh et al., 2013). According to the data of TIMSS 2015 (grade 8), most of the schools in the Arab countries (except Morocco and Lebanon) are segregated by gender as shown in Figure 4 (Foy, 2017).

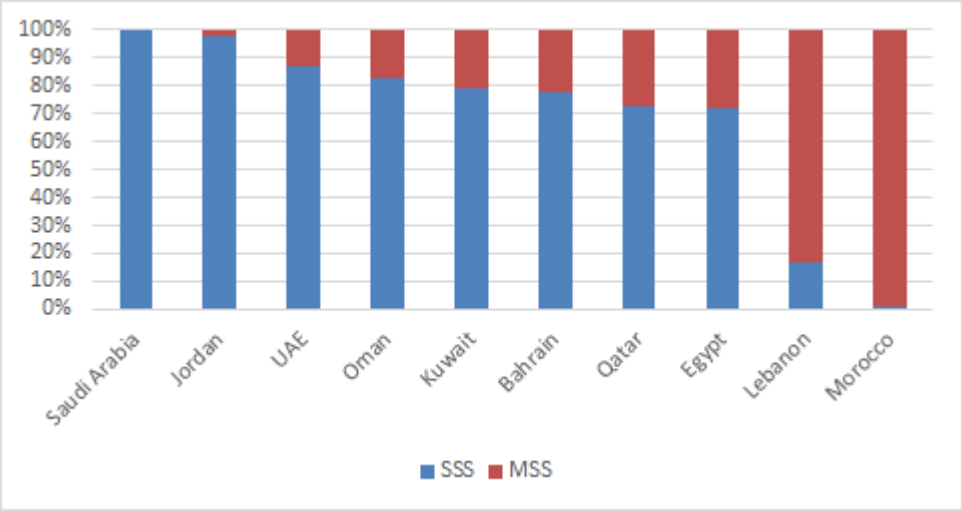

Figure 4. SSS vs. MSS percentage in the Arab countries

Arnot (2002) (as cited in Hamdan, 2010) debates that this segregation is due to the belief that men and women have different rules in the Muslim society. As a result, girls in schools are prepared explicitly and implicitly for being housewives and mothers while men are prepared for the labor market and future employment. On the other hand, Halstead (1991) argues that this is not the reason for segregation, as Islam gave men and women equal rights. Hence, women have a choice to be wives and mothers or pursue a career in addition to the family responsibilities.

According to the Muslim believes, separating girls from boys can give them the chance to develop a balanced mutual understanding of the opposite sex in a protected environment, free from sexual harassment or sins (Halstead, 1991; Hamdan, 2010). In

addition, segregation can give girls the freedom to perform some school activities like dancing, physical exercise and swimming without being exposed to boys (Halstead, 1991).

1.2 The debate of single-sex vs. mixed-sex schools

In the last few decades, there was a debate in many western countries (mainly in the USA) whether single sex schools (SSS) are beneficial for student achievement in comparison to mixed sex schools (MSS) (Pahlke & Hyde, 2016).

Single-sex schools supporters have two reasons to favor SSS. First, the differences between boys and girls in terms of learning styles, psychology and biology (Else-Quest & Peterca, 2015). For instance, the assumed difference in hearing in favor of girls which requires instructions to be louder in all-boys classes than all-girls classes. Moreover, it is suggested that teachers can use more movement and physical activities in boys classes than girls classes (Erin Pahlke & Hyde, 2016). Second, in mixed classes, boys get most of the teachers attention which boost their confidence and enable them to dominate the classroom. As a result, boys make negative comments on girls' abilities which de-motivates girls in participation -especially in STEM subjects- (Pahlke et al., 2013; Pahlke & Hyde, 2016; Thompson & Ungerleider, 2004). In addition, Garcia-Gracia and Donoso Vázquez (2016) argue that girls achieve better grades in mathematics in SSS, while boys obtain better results in languages. This means that SSS compensate the differences between boys and girls in mathematics and languages.

On the other hand, MSS supporters argue that SSS are not better than MSS as there is no evidence that there are differences psychologically, biologically and in learning styles between boys and girls. For example, there is no proof for hearing differences between boys and girls (Halpern et al., 2011). Moreover, little is known about the differences between the males and females brain (Pahlke et al., 2013; Pahlke & Hyde, 2016). In addition, separating boys and girls increases gender stereotypes as students fail to develop intergroup relations (Halpern et al., 2011).

According to Mael et al. (2005), most of the past studies equally found that there is advantage for SSS over MSS or there is no difference, while few studies observed advantage for MSS. Bracey (2006) concludes that although hundreds of empirical studies were conducted, the results are contradictory and hard to interpret. In addition, most of the studies were conducted in USA, where most of the single-sex schools have better status, more strict selective criteria and better funding. This suggests that studies in favor of SSS are not accurate, because of the presence of confounding factors in favor of single-sex schools and their students (Else-Quest & Peterca, 2015; Pahlke et al., 2013).

Although most of the past studies have concluded that SSS are better for student achievement than MSS or there is no difference, boys achieve less and girls achieve more in SSS in the Arab countries. There are few studies that are consistent with the Arab countries results. A study among 11th grade low income students in an urban neighborhood in the USA, indicated lower achievement for boys and higher achievement of girls for mathematics in SSS than MSS (Else-Quest & Peterca, 2015). Riordan (1990) (as cited in Garcia-Gracia & Donoso Vázquez, 2016) controlled in his study for initial differences (capacities, social origin, school policies, school environment, ethnic group and social class). The results revealed that

boys in single-sex schools scored lower in assessments than boys in mixed schools. However, girls scored higher in SSS than MSS.

Hence, Else-Quest and Peterca (2015)**,** and Riordan (as cited in Garcia-Gracia & Donoso Vázquez, 2016) concluded that both boys and girls achieve better results when they have female classmates. One suggestion is that the presence of girls has positive effects on the learning climate. Van de Werfhorst, Bergstra, and Veenstra (2012) argued that students in classrooms with more than 60% boys, experience more classroom disruption. This phenomenon could be explained due to the evolution of behavior in each school type. To illustrate, it was found that the bullying behavior for boys is directly proportional with the time they spend with other boys. In contrast, the bullying behavior for girls is decreasing when they spend more time with other girls (Gray & Wilson, 2006; Jackson, 2002).

1.3 Bullying and achievement

Bullying is defined as intentional and repetitive physical or psychological harm that is done by an individual or a group towards a victim that cannot defend himself or herself (Olweus, 1993). Bullying is a type of aggression and it takes place due to the unbalance of power between the bully and the victim. There are two forms of bullying, direct and indirect bullying. Direct bullying can be in the form of physical harm by causing body harm or of verbal harm by teasing or intimidation. Indirect bullying can be in the form of relational bullying, for instance, by social exclusion, rumor spreading and the cyberbullying that occurs through electronic communication (Menesini & Salmivalli, 2017; J. Wang, Iannotti, & Nansel, 2009). Four participants take place in the bullying situation who are: the bully (perpetrator of bullying behavior), the victim (recipient of bullying behavior), the bully-victim (victim with some individuals or groups, and a bully with others), and the bystander (witness of bullying behavior) (Obermann, 2011; Solberg, Olweus, & Endresen, 2007).

The power imbalance happens due to the difference in physical strength between the victim and the bully (Olweus, 1994; OMOTESO, 2010). Moreover, it could happen using the victims weaknesses against him (for example: the victim's appearance, learning disabilities, family status and personal traits) (Gray & Wilson, 2006; Hong & Espelage, 2012). Students with a poor relationship with their parents who lack effective supervision, in addition to students who are mistreated by their teachers are more exposed to school victimization. Students who experience neglect, rejection or aggression from their parents are more likely to be school bullies (Amodei & Scott, 2002; Chaux, Molano, & Podlesky, 2009; Hong & Espelage, 2012; Juan, Zuze, Hannan, Govender, & Reddy, 2018; OMOTESO, 2010; J. Wang et al., 2009)**.**

Research is starting to explore how gender and bullying are closely connected. Boys are more likely to experience physical bullying and victimization than girls. Girls are more involved in verbal and relational bullying (Juan et al., 2018; J. Wang et al., 2009; W. Wang et al., 2014). Additionally, strong negative relations between homophobic and non-conforming students (students whose gender expression differs from stereotypical expectations, such as "feminine" boys, "masculine" girls) with victimization from the other students were observed (Johnson & Gastic, 2014; Kimmel & Mahler, 2003).

Bullying is a major issue for parents, schools and the community due to its destructive consequences for bullies, victims and bully-victims. In short term, research points out that victims and bully-victims are more vulnerable to health, emotional and behavioral problems. Victims are more associated with poor social and emotional adjustment, depression, insomnia, loneliness, anxiety and suicide thoughts (Copeland, Wolke, Angold, & Costello, 2013; Fleming & Jacobsen, 2010; Nansel et al., 2001; Sourander et al., 2007).

Previous studies have shown that students who face school victimization are getting lower academic achievement than students who do not face it (Al-Raqqad, Al-Bourini, Al Talahin, & Aranki, 2017; Ponzo, 2013; Popp, Peguero, Day, & Kahle, 2014; Strøm, Thoresen, Wentzel-Larsen, & Dyb, 2013; W. Wang et al., 2014). This happens as a result of the fear and weakness the victims feel. This fear distracts them from focusing in the classroom as well as on their studies, and may reduce the willingness to go to school. In addition, they may lose the chance to participate effectively in the classroom and school activities (Al-Raqqad et al., 2017). On the other hand, Woods and Wolke (2004) found in their study for school students in the UK no association between victimization and achievement. They suggested that victims can be more motivated to study as an escape route.

Research has found that at the school level, students attending schools with high levels of bullying achieve less than students attending schools with less levels of bullying (Strøm et al., 2013). Strøm et al. (2013) explain these results by stating that bullying is a group phenomenon that affects everyone, even the bystanders that react emotionally to the bullying incidents. Al-Raqqad et al. (2017) add that academic achievement decreases also for school bullies as bullying reduces their motivation for learning and focus on school. Moreover, bullying can affect classroom behavior which impacts the teachers' quality of instructions as teachers focus on classroom management rather than teaching (Wentzel, 1993).

1.4 School type and bullying

Single-sex schools advocates claim that SSS is proposed as a way to deal with the boys' difference from girls, for example, adapting the teaching to the boys high physical activity. However, it is questionable if some of these differences could be a disadvantage, for instance, boys higher vulnerability towards bullying (Silbaugh, 2013). A study held among 39 countries using TIMSS 2007 dataset found that the percentage of female composition of schools is negatively associated with the level of reported violence (Agnich & Miyazaki, 2013).

A Colombian study among ninth graders observed that bullying was more prevalent in all-boys classes than all-girls classes. However, the study results might be questioned as the bullying measuring instrument that was used included only physical and verbal bullying and did not include relational and indirect bullying which are known as the girls' bullying preference (Chaux et al., 2009). Likewise, 15 single-sex classes teachers were interviewed in a study in Northern Ireland. The teachers stated that single-sex classes have raised the competition and bullying especially in boys classes (Gray & Wilson, 2006).

A dissertation by (Osborne-Oliver, 2008) concluded that a higher percentage of females in coeducational classes were identified to be bullies or victims than females in

single-sex classes. This study was conducted with 104 elementary school girls in The USA. In the same direction, (Johnson & Gastic, 2014) have explored the association between students' possibility of being bullied and their gender conformity according to their school type. Gender non-conforming female students were significantly less likely to experience bullying if they attended a single-sex school. On contrast, non-conforming males had significantly more risk of bullying in single-sex schools.

The reason behind the difference in gender behavior regarding class type is explained by Maccoby (1990) (as cited in Martin & Fabes ,2001) who argued that boys tend to interact in more rough and physical ways. They demonstrate hierarchical order and a lot of competition (Maccoby & Jacklin, 1987) (as cited in Martin & Fabes ,2001). On the other hand, girls interact in less hierarchical order and more cooperative ways and this leads to a more positive social atmosphere (Maccoby, 1990) (as cited in Martin & Fabes ,2001). Moreover, girls do not accept in their groups others that do not show the same calm and friendly attitude, which force others to adapt to have calmer behavior (Fabes et al., 1997). Martin and Fabes (2001) claim that due to this nature of interaction, the more time boys spent with boys, the more likely they become more active and aggressive. However, the more time girls spend with girls, they have less activity and aggression levels. Martin and Fabes (2001) add that these behaviors are open to change and this can be noticed even in a short period of time (within a few months).

These behaviors and interactions are transferred into the classrooms. In the all-boys classroom setting, boys compete to get attention by bullying weaker students. This turns their classes to be more disruptive with more noise and fighting (Gray & Wilson, 2006; Jackson, 2002). To clarify, Askew and Ross (1990) (as cited in Jackson, 2002) indicate that in boys-only environments, boys bully their weaker colleagues to prove their masculinity and hierarchy. On the contrary, girls' classrooms tend to be more peaceful and supportive environments (Jackson, 2002).

In the same line of the previous results, Bevilacqua et al. (2017) found that all-boys classes have more bullying than all-girls or mixed classes. However, this association was obvious only with students of lower socioeconomic status. This raises the question if students socioeconomic status has an effect on the gender bullying.

1.5 Socioeconomic status and bullying

Students' socioeconomic background have an influence on their bullying and victimization experience. At the individual level, Denny et al. (2015) found that students with lower socioeconomic backgrounds have higher likelihood to be school victims. At the school level, some studies claim that socioeconomic inequality in a school leads to more bullying and victimization (Contreras, Elacqua, Martinez, & Miranda, 2015; Due et al., 2009). At the country level, Contreras et al., (2015) have explored the correlation between students' physical victimization and the income inequality in 52 countries. They found that physical victimization in countries with high income inequality is 5 times more frequent than in countries with low income inequality. Similarly, social victimization was more obvious in countries with high socioeconomic inequality (Contreras et al., 2015; Due et al., 2009; Elgar, Craig, Boyce, Morgan, & Vella-Zarb, 2009).

This can be explained in many ways. First, societies with larger economic inequality are more segregated by hierarchies and status. This discrimination between adults can be mimicked by students and tolerated by school officials, and this can lead to behaviors related to status differences like bullying (Chaux et al., 2009; Due et al., 2009). Second, students with lower status can feel ashamed of their status which can lead to regain it by maintaining their power over any weaker group. Third, this status difference can create more competition for a better status and success, which can lead to teasing, rejection, and humiliation which can lead to bullying (Elgar et al., 2009). Fourth, economic inequality in societies reduce social cohesion and trust, and raise group division, stress and aggression. This can be reflected to the younger generation in the form of bullying (Pickett & Wilkinson, 2015; Van de Werfhorst & Salverda, 2012).

1.6 Socioeconomic status in the Arabic countries

According to the GDP per capita published by UNESCO in 2017 (as illustrated in Table 1), Arab countries have some of the richest countries in the world like Qatar, United Arab Emirates and the other Gulf countries. There are some average Arab countries in terms of GDP like Iraq, Lebanon, Jordan and the other middle North African countries. Besides, the Arab region has some of the poorest countries like Yemen, Syria and Somalia ("UNdata," 2019).

In addition, the Gini index is used to measure income inequality across countries, with zero Gini index for perfect income distribution and 100 for perfect inequality. According to the data collected by the World Bank (as described in Table 1), there is no data available about the Gulf countries. The middle eastern and north African countries have average income inequality and the Afro-Arab countries have high income inequality ("GINI index (World Bank estimate) | Data," 2019). Hence, it is questionable whether this great variance across the Arab countries in terms of wealth and distribution of income has an effect on school bullying.

Table 1
Arab countries GDP per capita and Gini index

Country	GDP per capita	Gini index	Gini index year
Qatar	$ 63 506		
UAE	$ 40 699		
Kuwait	$ 28 897		
Bahrain	$ 23 668		
Saudi Arabia	$ 20 761		
Oman	$ 15 267		
Lebanon	$ 8 778	31.8	2011
Iraq	$ 4 756	29.5	2012
Algeria	$ 4 055	27.6	2011
Jordan	$ 4 196	33.7	2010
Libya	$ 3 942		
Tunisia	$ 3 475	32.8	2015
Morocco	$ 3 070	39.5	2013
Sudan	$ 2 967	35.4	2009
Palestine	$ 2 946		
Egypt	$ 2000	31.8	2015
Djibouti	$ 1 928	41.6	2017
Comoros	$ 1 330	45.3	2013
Mauritania	$ 1 129	32.6	2014
Yemen	$ 990	36.7	2014
Syria	$ 831	35.8	2004
Somalia	$ 104		

1.7 Bullying phenomenon in the Arab region

In spite of the rising focus of research regarding understanding, measuring and prevention of school bullying for decades in the western countries, the interest in school bullying has emerged more recently in the Arab region (Kazarian & Ammar, 2013).

School bullying is a common behavior in many of the Arab schools. A study was conducted by Al-Raqqad et al. (2017) on two hundred 6th and 7th grade school teachers in Jordan. Teachers acknowledged the existence of bullying in all private and public schools. Another study in Saudi Arabia among students in grades 7 to 12 claims that 26% of students got exposed to bullying in the last 30 days, and one out of three reported getting exposed to physical violence at school during the last year. Males were more exposed to bullying than females (Albuhairan et al., 2017).

In another study, Fleming and Jacobsen (2010) investigated the frequency of bullying among middle-school students in 19 low- and middle-income countries using the data from the Global School-based Student Health Survey. The results in the 19 countries showed that 34.2% (32.6% females and 36.0% males) of the students were bullied in the month before the survey took place. The results for the Arab countries are 44.2% (40.4% females and 49% males) for Jordan, 33.6% (29.3% females and 38.8% males) for Lebanon, 31.9% (23.4% females and 41.1% males) for Morocco, 39.1% (39.1% females and 38.6% males) for Oman, and 20.9% (17.4% females and 24.7% males) for the United Arab Emirates. The variance of school bullying in Arab countries was close to the variance of the other countries, however, the gender difference in exposure to bullying was more obvious in Arab countries (except for Oman) in comparison to the other countries in favor of males.

Another study conducted by Abdulsalam, Al Daihani, and Francis (2017) to explore the prevalence of bullying among grade 7 and 8 students in Kuwaiti public schools reported a prevalence of 30.2% (3.5% bullies, 18.9% victims, 7.8% bully victims). Males were substantially more vulnerable to bullying and victimization than females. Students with physical disabilities, non-Kuwaiti parents, divorced/widowed parents were more likely to be victims. Similarly, a study conducted by Habashy Hussein (2013) on Egyptian schools among grades 6 and 7, indicates that bullying is more common among boys than girls. He explains that the reason behind that is the Egyptian culture which considers aggressive behavior of boys as a good sign of manhood. In contrast, girls are more encouraged to show politeness, kindness and passiveness. In Beirut (Lebanon), a study was held by Khamis (2015) to investigate bullying in schools for grades 7-9. The results stated that a large proportion of the students were involved regularly in bullying and victimization activities. Bullying was more common with boys than girls. In contrast to past studies, bullying and victimization were not associated with academic achievement.

According to the TIMSS 2015 data, bullying in Arab countries is very common especially in Oman, Bahrain, Morocco, Lebanon and Egypt as seen in Figure 5 (Mullis, Martin, Foy, & Hooper, 2016a).

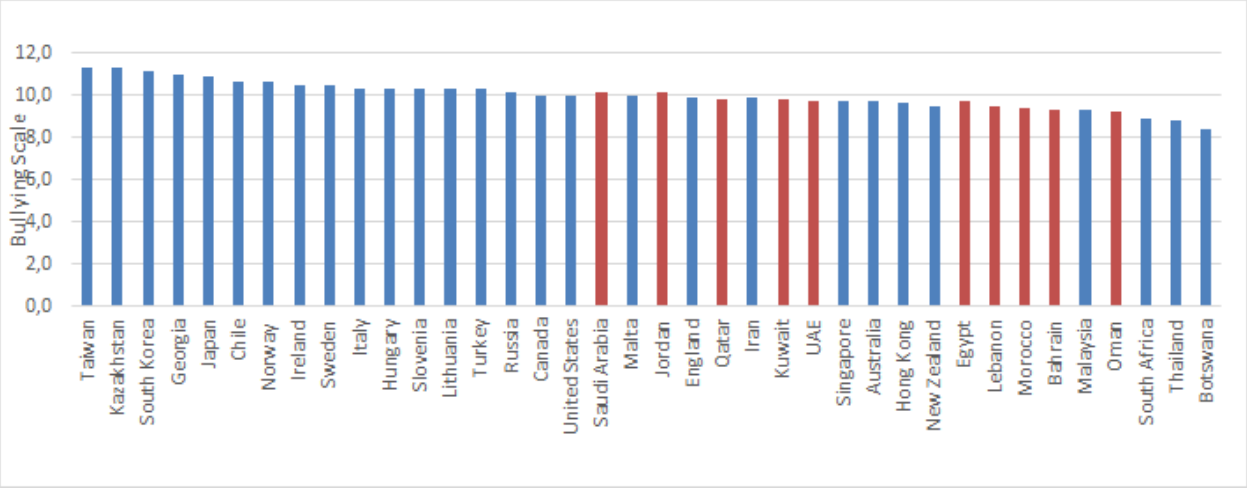

Figure 5. Bullying scale across the countries

* Arab countries are represented in orange bars.

* Bullying scale is inversely proportional with the bullying occurrence (for example, UAE is 9.7 and Oman is 9.2, means that bullying is less common in The UAE than Oman).

Chapter 2
Research questions and model

The review of the literature has shown that there is an ongoing debate regarding advantages and disadvantages of SSS and MSS. However, research has indicated that in all-boys classes bullying is occurring more often than in mixed or all-girls classes. Furthermore, there seem to be some empirical evidence that bullying is related to lower achievement. In turn, the occurrence of bullying might be related to school type and students' socioeconomic status. In all-girls classes, it is suggested that the environment is more calm and cooperative than in all-boys classes. This means less bullying, a better leaning climate and a higher self-confidence of students resulting in higher achievement. Moreover, schools or countries with low socioeconomic level or high socioeconomic inequality may suffer more bullying which lead to lower student achievement. Finally, bullying is a common phenomenon in the Arab world, and more widespread among boys than girls.

This study explores the relationships between gender, school type, bullying, socioeconomic status and achievement. The main research question is:

To what extent do girls and boys perform differently in mathematics and science achievement in single and mixed-sex Arab secondary schools, and to what extent are achievement differences between these school types related to differences in bullying?

Sub-research questions:

1. To what extent do girls and boys perform differently in mathematics and science in SSS than in MSS in Arab countries?
2. To what extent are there differences in the experiences of bullying between girls and boys in SSS and MSS in Arab countries?
3. To what extent is bullying related to student achievement in Arab countries?
4. To what extent does bullying account for achievement differences between class types, taken into account students' socioeconomic status?

Based on these research questions, the model illustrated in Figure 6 will be used to guide the analyses for this study. The independent variables in this research are school type (mixed vs. single-sex) and gender. The dependent variables are student achievement in mathematics and science. The control variables are amount of bullying and students' socioeconomic status. Series of t-tests in addition to two-level regression model will be used to examine the relationship between the variables.

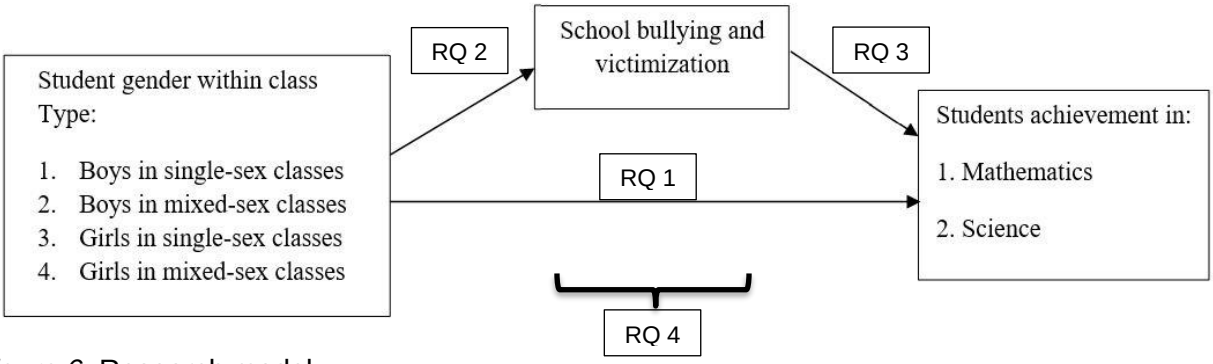

Figure 6. Research model

Hypotheses

Taking into consideration the gathered research literature, the following is hypothesized:

1. Girls perform better in SSS than MSS.
2. Boys perform worse in SSS than MSS.
3. Girls face less bullying in SSS than MSS.
4. Boys face more bullying in SSS than MSS.
5. Bullying is negatively associated with student achievement.
6. Gender differences in achievement between SSS and MSS decrease when controlling for bullying.

Chapter 3
Educational Background of Arab Countries

To get more familiar with the background of the countries included in this research, this chapter discusses the history of education in the Arab region. Further, details about the current education system of the participating countries are addressed.

Education in the Arab world has a rich history, witnessing a lot of religious, political, economic and social movements. The population in Arab world is 5% of the world's population. The Arab league consists of 22 countries located in Southern Mediterranean, Northern and Central Africa, and Western Asia. Although, there are a lot of social and cultural diversities in the region, Arabs share a common language (Arabic), religion (Islam with 90% of the population), history and political systems (Herrera, 2007; Tabutin, Schoumaker, Rogers, Mandelbaum, & Dutreuilh, 2005).

As displayed in Figure 7 the Arab region is divided into 4 main groups: North African countries (Algeria, Morocco, Tunisia, Egypt, Libya), middle east (Palestine, Iraq, Lebanon, Syria and Jordan), The Afro-Arabs (Comoros, Somalia, Mauritania, Sudan and Djibouti), and The Gulf region or Arab Peninsula (Kuwait, Bahrain, Qatar, UAE, Oman, Yemen and Saudi Arabia). All the Gulf countries except Yemen currently have one of the highest per capita income in the world due to the oil resources, in addition to social and political stability. On the other hand, the northern African, Afro-Arab and middle eastern countries are performing worse economically in addition to the political instability ("UNdata," 2019).

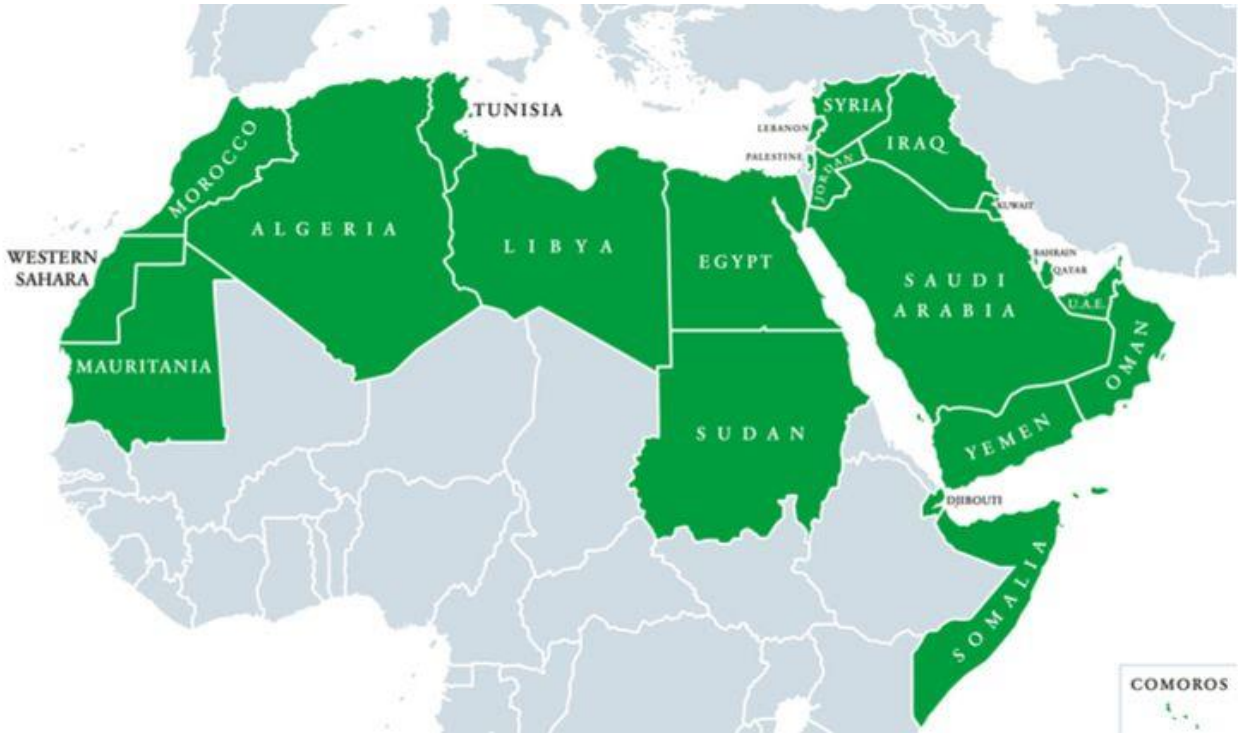

Figure 7. Arab region map (retrieved from, "Arabic Speaking Countries," 2018)

3.1 Education history in North Africa and Middle East Arab countries

Since the rise of Islam in the seventh century, El Madrasa (The School) was the place where children can learn about Quran (religion), Arabic language and religious sciences (Findlow, 2008; Herrera, 2007).

The Arabic science and mathematics has advanced and flourished from 9th till the 15th century, especially in Egypt, Iraq, Morocco and Syria. In the following four centuries, the Islamic empire was dominated by the Ottomans (Turkish). Due to the European industrial revolution and the rise of their institutions (including educational institutions), the Ottomans started translating their sciences into Arabic and Turkish. In the 19th century, the Ottoman province of Egypt sent a group of students to learn in Europe, and they came back to transfer the knowledge they gained. In the following decades, Egypt used this knowledge to build schools and colleges specialized in diverse fields. Meanwhile, foreign communities in Egypt represented by non-Coptic Christians and the Jewish population started their own schools, which made them holding the highest literate percentage in the country. On the other hand, Muslim boys were attending Kuttab (Quran learning school), while Muslim girls did not enroll in the Kuttab as girls education was not blessed culturally (Herrera, 2007).

After the two world wars with the European colonial collapse, a strong nationalistic anti-colonial movement started in the Arab region. Hence, Egypt, The Maghrib (Morocco, Tunisia and Algeria), and the Levant (Syria, Lebanon, Iraq, Jordan and Palestine) started building national schools that could compete with the foreign minority schools. This education movement allowed slightly more women to pursue their education, and helped to increase the literacy rates among middle class youth (Herrera, 2007).

Since the 1970s, a rise in Islamic ideology has occurred in the Arab region which influenced almost every life aspect . As a result, religion became an obligatory subject in almost every Arab country and segregated schools became more common. On the other hand, after the signature of the Camp David peace accords in 1978 between Egypt and Israel, a new movement started which is culture opening to the Western world (mainly The USA). This resulted in teaching modern sciences in schools, learning English or French as a second language and more female education. These movements of western modernization and Islam fundamentalism have reformed the educational system and policies in a complex way (Findlow, 2008; Herrera, 2007; Massialas & Jarrar, 2016).

After the Arab Spring revolutions that started in 2010, the region has faced political conflicts, violence, terrorism and even wars. This has affected negatively the economy of Egypt, Tunisia, Libya, Iraq and Syria. This has a great influence on educational resources, teacher salaries and satisfaction (Mirkin, 2013). Moreover, the oil boom in the Gulf countries has led to inter-Arab migration of skilled teachers from the poorer countries (mainly Egypt, Syria and Lebanon) to the Gulf countries which affected the development plans of these countries (Findlow, 2008; Massialas & Jarrar, 2016).

In recent decades, schooling in the region has risen dramatically, however, the education quality is questionable (Campante & Chor, 2012; Herrera, 2007).

3.2 Education history in Gulf Arab countries

The Arab Gulf region was an isolated area from the modern societies. However, it was an important trade route from Basra (Iraq) to India. This made the region part of the British empire since the beginning of the 19th century. In this period, the region economic activities were based on merchandise and trade. The education for young boys was given by the Imam of the local mosque who was rarely literate, and it was based on learning about the Islamic religion. In the end of the 19th century, pearling industry has flourished which brought wealth to the region. Hence, some wealthy families and Arab expatriates especially Egyptians and Palestinians started building few secular schools that follow the Egyptian curriculum which includes simple mathematics, regional geography and Arab history. After the second world war, the pearl industry collapsed and the region went into poverty which lead to closing the expatriates' schools until the oil boom in the 1970s (Davidson, 2008).

Due to the oil boom in the 1970s in The Gulf region, a social and economic transformation has occurred in this area leading to paying more attention to education by supplying it with finances and resources (Herrera, 2007). Ministries of education were formed, schools were built and foreign teachers were recruited as the majority of the citizens were illiterate. Recently, the literacy rates have risen dramatically which led to forming a national system and curriculum with more national teachers (Mullis, Martin, Goh, & Cotter, 2016b).

Gulf states are more strict into Islamic principles (Wahhabi Islam) than the other Arab countries, especially Saudi Arabia and to a lesser degree Kuwait. This lead to gender segregation from primary stage, and limited access for females to some university domains that are assumed to be male domains (Findlow, 2008; Herrera, 2007).

3.3 Education history in Afro-Arab countries

In 1956, Sudan gained its independence from Egypt and Britain. Since that time, there were a lot of conflict and civil wars between the northern and southern parts, until the southern part got their independence in 2011 to form another country under the name of South Sudan. The main reason for this conflict was due to the difference in ethnicity, in which the northern part are Arab Muslims, while the southern part has different ethnic backgrounds and believes. After independence in 1956, Islam had a great influence in Sudan in the country's laws, lifestyle and education. Education is mainly focused on Quran literacy, even in subjects like mathematics and science. Due to the continuous conflicts inside the country that resulted in splitting the country in 2011 and a recent military coup in 2019, the economic and political conditions are not stable in Sudan which limited the resources spent on education (Breidlid, 2005; "Publications — Central Intelligence Agency," 2019).

Mauritania faced multiple coups, terrorism and political tensions between different ethnic groups since their independence from France in 1960. With an economy highly dependent on foreign investment and a low literacy rate (50% of the population), education in Mauritania is poor with high dropout rates and discriminative laws that impede female access to schooling. Similarly, Comoros is considered one of the world's poorest countries with political instability, multiple coups and internal conflicts, extreme weather, poor health services and electricity crises. All these conditions have led to poor educational facilities and services, with hard conditions like forced children labor and the absence of high education

universities. Likewise, although Djibouti's strategic location and political stability since 2005, the country suffers from 40% unemployment rate, droughts, floods, high illiteracy rates, children forced labor and trafficking. As a result, education is poor with gender and socioeconomic inequality ("Publications — Central Intelligence Agency," 2019).

3.4 Education system overview

The data available in TIMSS 2015 for this study is only for 7 Arab countries. Hence, this section presents detailed information about the education system for the 7 countries participating in this study. Table 2 presents a summary of the main characteristics of the education system of each country.

3.4.1 Bahrain, Kuwait, Oman and Qatar

According to the law, education is free of charge for all school grades in Bahrain, Kuwait and Qatar, and for a very small fee in Oman. However, parents can choose to pay education fees by sending their children to private schools. Private schools can be national or international schools. In the four countries, a national curriculum is developed by the ministry of education. This curriculum is followed by public and national private schools. On the other hand, international private schools have their countries curriculum (for example, British schools follow British curriculum) after getting approval from the ministry of education ("مجلس التعليم," 2019 ; Mullis et al., 2016b).

As Arabic is the official language in the four countries, it is the language of instruction in all public schools in all subjects including mathematics and science. However, private schools can choose their language of instruction, in which English is the most popular. All public schools in Bahrain, Kuwait and Qatar are segregated by gender in all stages. In Oman, all schools are mixed by gender for grades 1 to 4, and segregated for grades 5 to 12. On the other side, private schools have the choice to be single or mixed-sex schools ("International Bureau of Education," 2010; "Overview of the Education System in Kuwait," 2014; Mullis et al., 2016b).

Mathematics and science are compulsory subjects throughout basic education from grade 1 in the four countries. The eighth grade mathematics curriculum in the four countries consists of the following main topics: Numbers and Operations, Data Analysis and Probability, Algebra, Geometry, and Measurement. The eighth grade curriculum in Bahrain consists of the following topics: Nature of Science, (Science, Technology and Society), and Physical Science. While in Kuwait, it consist of the following topics: Life Sciences, Natural Sciences, and Earth Science and Astronomy. In Oman, the science curriculum is based on the following topics: Life Science, Physical Science, Earth and Space Science, Nature of Science, and Science, Technology, and Society. Finally, the science curriculum in Qatar is based on the following topics: Life Science, Materials, Earth and Space and Physical Processes (Mullis et al., 2016b).

In Bahrain, the school year consists of two semesters. The students are assessed based on their classroom activities, midterm and end-of-the-term exams. In Kuwait, the academic year consists of 32 weeks, with mathematics and science are taught five 45-minutes periods per week. The year is divided into four quarters with four exams to assess student achievement. In Oman, the academic year is 36 weeks, with 40-minutes periods per

week, 7 of them are allocated for mathematics and 6 for science. The students results are based on two end-of-term exams. In Qatar, science and mathematics are taught in five lessons per week, each lesson is 40-50 minutes. The assessment is based on homework grades, written and verbal assessment by the end of semesters (Mullis et al., 2016b).

Holding a bachelor degree in education with specialization of their respective subject is the minimum requirement to teach mathematics or science for grade 8 in Bahrain, Oman and Qatar, while holding a bachelor of education is enough for Kuwait. Teachers are provided with further training to enhance their professional development in the four countries. Public schools are provided from the ministry of education with student textbooks, teacher guides and instructional materials. Schools have science laboratories, calculators, computers and electronic classrooms (Mullis et al., 2016b).

3.4.2 United Arab Emirates

The United Arab Emirates (UAE) provides free public education for every citizen through all the stages of education. However, students can choose paying education fees by joining national, community or international private school. 36% of students (excluding Dubai with 10%) attend public schools. In Abu Dhabi public schools, 77% of the students are Emirati and the rest are expats. While, 24% of the private school students are Emirati. In Dubai, 80% of the students are expats as the majority of the population (87%) are foreigners. A national curriculum developed by the ministry of education is applied in all states, except in Abu Dhabi in which the Abu Dhabi Education Council are responsible for its national standard curriculum. On the other hand, private schools have the option of following the national curriculum or developing their own curriculums that should get approved by the ministry of education (Mullis et al., 2016b).

The official language in The UAE is Arabic, which makes Arabic the language of instruction for mathematics and science in all states, except Abu Dhabi where these subjects are taught in English. While, private schools can choose their language of instruction. Students are segregated by gender in all stages, while private schools can choose to offer segregated or co-educational classes. (“Gender segregation - The Official Portal of the UAE Government,” 2018; Mullis et al., 2016b).

It is mandatory to learn mathematics and science from the first grade. The mathematics curriculum consists of the following topics: Numbers and Operations, Algebra and Patterns, Geometry and Measurement, Data Analysis and Probabilities. The science curriculum consists of these topics: Earth and Space Sciences, Life Sciences , Physical Sciences (Mullis et al., 2016b). .

The school year in the UAE consists of 2 semesters. Students are assessed through mid-year and end-of-year written exams, in addition to classroom activities like presentations, reports, quizzes, and practical activities. Students pass to the following grade by getting 50% score or more (Mullis et al., 2016b).

There are some prerequisites to be a mathematics or science teacher in the UAE. First, holding a bachelor degree in mathematics or science, and preferably an education diploma. Second, having an ICDL (International Computer Driving License) certificate.

Finally, teacher should pass a written exam and a professional interview. Additionally, in Abu Dhabi teachers must have an IELTS (International English Language Testing System) certificate with a minimum score of 6.5. Foreign teachers should have all these requirements in addition to at least 2 years teaching experience (for Abu Dhabi) or 3 years (for the other states). Teachers performance is assessed by their supervisors, and accordingly, supervisors recommend the workshops and trainings the teachers need. Moreover, teacher professional development programs are held regularly (Mullis et al., 2016b).

The ministry of education provides schools with the needed facilities for learning like: Laboratories, learning resources rooms, computers, calculators, students books and instructional materials (Mullis et al., 2016b).

3.4.3 Lebanon and Egypt

In both countries, public schools are financed by the government to offer cheap education, while national and international private schools are financed by students fees. A standard curriculum is developed by the ministry of education and followed by all public and national private schools. However, international schools can develop their own curriculum in some subjects like mathematics, English and science, while they are obliged to teach some of the same national curriculum in Arabic and Religion subjects ("Ministry of Education," 2014.; Mullis et al., 2016b).

Arabic is the official language in Egypt and Lebanon. Hence, Arabic is the language of instruction of mathematics and science in Egypt for all grades. While in Lebanon, both subjects are taught in Arabic till grade 6 and in English or French from grade 7 to 12. However, private schools can choose their language of instruction, in which English is the most popular in Egypt, and English or French in Lebanon. In Lebanon, the majority of public schools are mixed-sex schools, while the majority of Egyptian public schools are segregated by gender ("Ministry of Education," 2014.; Mullis et al., 2016b).

The school year is divided into 2 semesters. Mathematics and science are taught in 5-6 lessons per week, 40-50 minutes each. Students got assessed by monthly exams as well as 2 end-of-term exams. Mathematics and science are taught as separate subjects from grade 1. Mathematics curriculum for grade 8 is based on three topics: Algebra, Geometry and Statistics. While science curriculum is based on the three topics: Life and Earth Sciences, Chemistry and Physics ("Ministry of Education," 2014.; Mullis et al., 2016b).

Mathematics and science teachers must have at least a university degree in their subject in addition to one year pedagogical diploma. Teachers are provided by training sessions and programs to develop their teaching skills. Students books can be bought from the ministry of education, and using technology or laboratories is not obligatory in schools ("Ministry of Education," 2014.; Mullis et al., 2016b).

Table 2

Main characteristics of the Arab countries education system

	Bahrain UAE Kuwait Qatar	Oman	Lebanon	Egypt
Educational fees	Free		Small fee	
Public schools	Financed by parents. Private schools can be national or international schools.			
Curriculum	In public and national private schools, a national curriculum is developed by the ministry of education. International private schools have their countries curriculum (for example, British schools follow British curriculum) after getting approval from the ministry of education.			
Language	As Arabic is the official language, it is the language of instruction in all public schools in all subjects including mathematics and science. However, private schools can choose their language of instruction, in which English is the most popular. In Lebanon, science and mathematics are taught in Arabic until grade 6, afterwards they are taught in English or French.			
Public school segregation	Segregated by gender in all stages	Mixed in grades 1 to 4, and segregated in grades 5 to 12.	Most schools are mixed	Most of the schools are segregated.
Private schools segregation	Private schools have the choice to be single or mixed-sex schools.			
Learning science and mathematics	Mathematics and science are compulsory subjects throughout basic education from the first grade.			
Assessment	The students are assessed based on their classroom activities, midterm and end-of-the-term exams.		The students are assessed based on their classroom activities, monthly and end-of-the-term exams.	
Teacher qualification and training	Holding a bachelor degree in mathematics or science, and preferably an education diploma is the minimum requirement to be a mathematics or science teacher. Teachers are provided with further training to enhance their professional development.			
School resources	The ministry of education provides schools with the student textbooks, teacher guides, instructional materials, and needed facilities for learning such as: Laboratories, learning resources rooms, computers, calculators, students books and instructional materials.		Students books can be bought from the ministry of education, and using technology or laboratories is not obligatory in schools.	

Chapter 4
Methodology

In this chapter the research design, data source. respondents, instrumentation and data analysis are discussed.

4.1 Research Design

The data used for this study was taken from TIMSS 2015 (Trends in International Mathematics and Science Study. TIMSS assessments have been conducted every four years since 1995 at the fourth and eighth grades by collecting data on student achievement and extensive data on students' mathematics and science learning contexts. TIMSS has been conducted in more than 60 countries to facilitate their decision making regarding developing their educational policies based on evidence (Mullis, Martin, & Loveless, 2016d).

In TIMSS 2015, more than 580,000 students from 57 countries and 7 benchmarking entities (states or provinces) have participated. The assessments consisted of 200 item for each curriculum area per grade to assess students reasoning and applying skills by focusing on content and cognitive dimensions. Moreover, questionnaires were filled out by students, teachers, parents, school principals, and curriculum specialists to measure the classroom, school and home learning contexts (Mullis et al., 2016d).

Other large scale assessments like Progress in International Reading Literacy Study (PIRLS) and Program for International Student Assessment (PISA) were initially also considered to be used as data sources, because they also include Arab countries. PIRLS was not used as it focuses on reading literacy in which females are better achievers on average in most of the countries (including Arab countries), which does not make it as a unique phenomenon in the Arab countries (Mullis et al., 2017). PISA was not considered because the student data consists of a school samples of 15-year-old students from different classes which make it hard to identify if the students are attending to mixed-sex or single-sex classes (OECD, 2016).

4.2 Respondents

Grade and curriculum

TIMSS assesses students in mathematics and science in grade 4 and in grade 8. Eight Arab countries and benchmarking entities have participated in grade 4, and ten Arab countries and two benchmarking entities have participated in grade 8. Hence, grade 8 students were chosen for this study to include more countries.

However, three countries (Saudi Arabia, Morocco and Jordan) were excluded, because they have very few or no students from one of the class types (single-sex or mixed-sex) which is a main variable in the current study. Dubai and Abu Dhabi were excluded because most of the states' habitats are foreigners which can affect the results due to the states relatively different culture (Mullis et al., 2016b). This means that the analyses were conducted using the data of seven countries (Bahrain, Egypt, Kuwait, Lebanon, Oman, Qatar and United Arab Emirates). Hence, the data of 53,414 students is included in this study.

Sampling

Main participants are students in their eighth year of formal education counting from the first year of the International Standard Classification of Education (ISCED) Level 1 ("UNESCO UIS," 2019), with a minimum mean age of 13.5 years (LaRoche, Joncas, & Foy, 2016). TIMSS applies two stage random sampling, first stage is sampling schools, and the second one is sampling full classes within the chosen schools. All the schools that have full time students are part of the target population, without excluding schools that do not fall under the authority of the national Ministry of Education. Mostly, TIMSS requirements are satisfied with a sample of 150 schools and 4,000 students per grade. The sampled schools are stratified into groups with common criteria, for example: geographic area, school source of funding, language of instruction, level of urbanization, socioeconomic status and school performance. This step is done to ensure that there is no exclusion for a specific portion of the target group (LaRoche, Joncas, & Foy, 2016).

The minimum conditions of a national sample to be accepted are: 85% of school participation rate based on originally sampled schools, 95% of classroom participation rate from originally sampled and replacement schools, and 85% of student participation rate from sampled and replacement schools. An alternative is at least 75% school, classroom, and student participation rate combined based on originally sampled schools, taking into consideration the exclusion of classrooms with less than 50% student participation (LaRoche, Joncas, & Foy, 2016).

4.3 Instrumentation

For this study, the mathematics and science achievement items, students' context questionnaires were developed by TIMSS & PIRLS International Study Center in collaboration with different parties (Mullis, Cotter, Fishbein, & Centurino, 2016c; Hooper, 2016).

Mathematics and science achievement items

The mathematics and science achievement items development process is conducted by the TIMSS & PIRLS International Study Center at Boston College. The items development process was conducted in multiple steps with collaborative efforts between different parties (Mullis et al., 2016c).

The development process steps were: First, the mathematics and science frameworks were discussed with the National Research Coordinators (NRCs) and updated to match the participating countries' principles and curricula. Second, according to the updated frameworks, items and their scoring guides were developed in collaboration between NRCs, experienced item writers from the participating countries and staff from the TIMSS & PIRLS International Study Center. Third, a field test was carried out in each participant country for around 30 schools with a minimum of 200 students response per item. According to the field test results, items were removed due to insufficient measurement characteristics, like being very easy or hard or having low discrimination. Fourth, assessment items were chosen in accordance with frameworks, field test results, and previous cycle items. Finally, the final version of the assessment instruments were received by the participating countries. Then, the participating countries translated, culturally adapted, printed the assessments, and arranged the data collection process (Mullis et al., 2016c).

The TIMSS international version was prepared in English and consequently translated to each of the participating country's languages by the NRC. The main construction of the TIMSS assessment is based on content and cognitive dimensions. The context area in both science and mathematics is based on knowing, applying, and reasoning. The content area in mathematics is based on numbers, data and chance, algebra and geometry. And for science, biology, chemistry, physics, and earth science. The TIMSS mathematics and science assessments consisted of 268 items each, 134 content and 134 context items (Mullis et al., 2016c).

Matrix sampling was used in the science and mathematics tests to keep the student's load to a minimum. This was accomplished by splitting the test items into smaller tests. As a result of conducting different tests on the students, test scores were recorded as 5 plausible values (derived through multiple random imputations on the students item scores) for each student (Adams, Wu, & Macaskill, 1997).

Context questionnaires

Students and their teachers, parents and principals provided questionnaire data about the student's community, school and classroom context. The TIMSS questionnaires were developed in many review cycles with the collaboration between TIMSS & PIRLS International Study Center team, Questionnaire Item Review Committee (QIRC), and the participating countries NRCs (Hooper, 2016).

First, the questionnaires framework was updated using the previous cycle (TIMSS 2011) data in addition to the latest research and policies. Second, according to the updated framework, the TIMSS & PIRLS International Study Center team added and modified some questionnaire items. Third, The QIRC and the NRCs checked the questionnaires and modified them when needed. Fourth, field tests were conducted to test the new items. Finally, the field test results were used to make the final assessment (partly new items from the field test and partly items from TIMSS 2011) and questionnaires that was used (Hooper, 2016).

In this study, two scale variables were used from the student background questionnaire. First, the Home Educational Resources scale was derived from 3 questions about parents education, number of books and study support at home (see Figure 9). Second, the student Bullying scale was derived from 9 questions about different kinds of bullying (see Figure 10). The two scales were derived using the Rasch partial credit model (Martin et al., 2015).

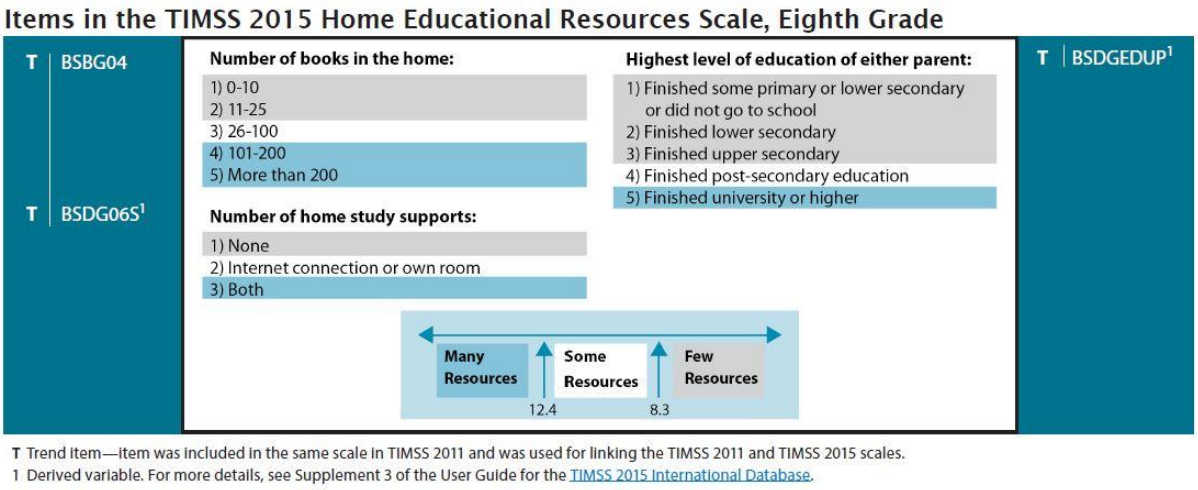

Figure 9. Home Educational Resources scale retrieved from (M. O. Martin et al., 2015)

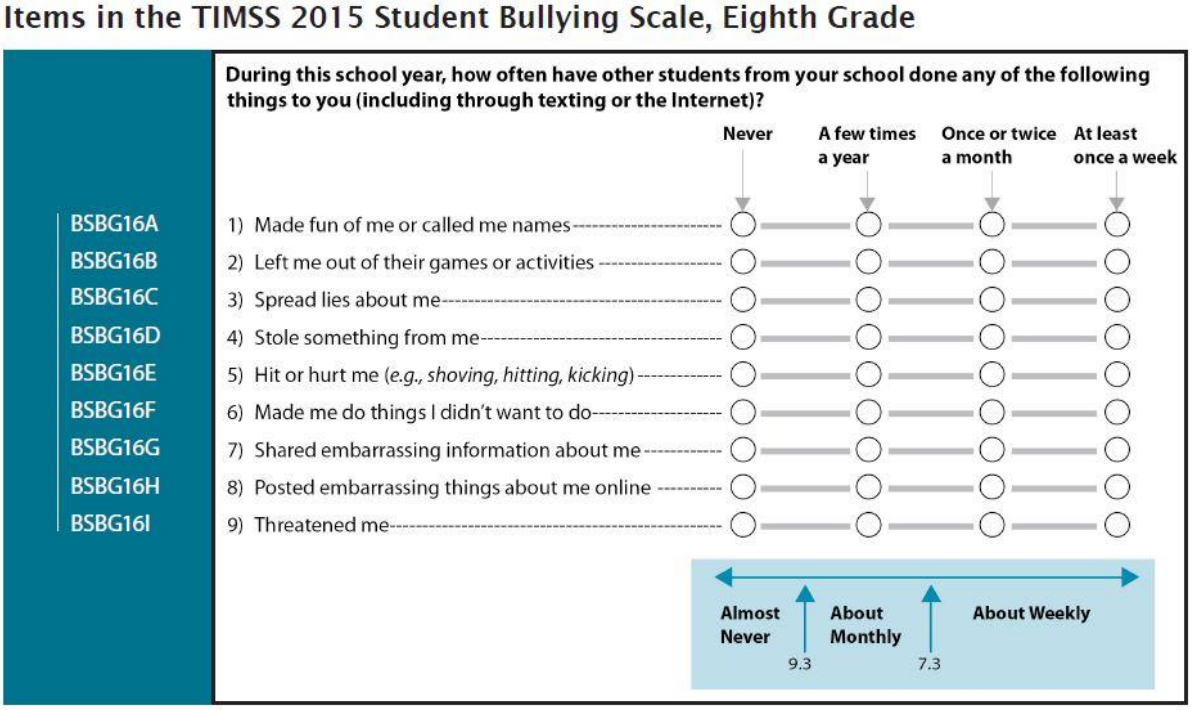

Figure 10. Student Bullying scale retrieved from (M. O. Martin et al., 2015)

4.4 Procedure

The TIMSS 2015 data for eighth grade was downloaded from the TIMSS and PIRLS official website. The data was in the form of SPSS files divided by countries and different questionnaires (Foy, 2017).

4.5 Data Analysis

SPSS (IBM Statistics Version 24), IDB Analyzer software (Version 4), Microsoft Excel, and HLM (Version 7) were used to conduct the analysis. SPSS is the format of the data files in TIMSS website, moreover, it was used for data pre-processing (re-coding variables). Microsoft Excel was used to make the charts. IDB Analyzer was chosen to

perform the descriptive analysis and the t-tests as it is able to handle sample weights and plausible values. HLM was chosen to perform the 2-level regression analysis, due to its ability to perform multilevel modeling analysis with taking into consideration sample weights and plausible values.

First, the data files were merged using IDB Analyzer software. In this step the students needed variables and the countries for this study were merged into one file with the exclusion of the other variables and countries. Second, new variables were constructed to be used as interaction effects in the regression analysis (for example, gender*achievement). Class_type was constructed as a new variable to measure if the student is studying in single-sex or mixed-sex classroom. This variable is coded as a dummy variable with (1) single-sex and (0) mixed-sex classrooms. Gender was re-coded as dummy variable in which (1) male and (0) female. Third, descriptive analysis was conducted to explore means and correlations of the variables used in the study. Finally, multiple 2-level regression analysis was conducted to find the effect of class type and gender on mathematics and science achievement with taking into account the students socio-economic status and bullying as control values.

Two-level regression model was chosen because in classes, the effects on the students are confounded with the effects of the classes. Hence, it is hard to distinguish if the effects are due to students or their classes. In a multilevel model, the effects of both types of variable can be estimated.

While using IDB analyzer software, plausible values were taken into consideration, sampling weight was the software default which is recommended by Rutkowski, Gonzalez, Joncas, and von Davier (2010), and pairwise deletion method was used. While using HLM software in the multilevel model, variables were centered around the grand mean, plausible values were taken into consideration, and sampling weights were used according to the recommendations by Rutkowski et al. (2010). Listwise deletion of missing data was performed, however missing data did not exceed 10% of the total sample in any of the countries.

Chapter 5
Results

5.1 Research question 1

To what extent do girls and boys perform differently in mathematics and science in SSS than in MSS in Arab countries?

To examine the effect of single-sex and mixed-sex classes for each gender achievement, a series of t-tests were conducted separately for girls and boys as seen in Tables 3 and 4. The difference in achievement between school types separated by gender is illustrated in Figures 11 and 12.

As shown in Table 3 and Figure 11, a significant difference in mathematics achievement in favor of mixed-sex classes was noted for both genders in five out of seven countries. Egypt and Lebanon are the exceptions. According to Table 4 and Figure 12, a significant difference in science achievement in favor of mixed-sex classes was found for both genders in Bahrain, Qatar and UAE. No significant difference between class types was discovered in Egypt and Lebanon. In Oman and Kuwait, boys in all-boys classes achieved significantly worse ($p < .05$) than boys in mixed-classes, however, no significant difference was discovered for girls.

Additionally, a multilevel regression model was conducted as shown in Tables 6 to 19. In Model 4, an interaction effect between class type and gender is statistically significant in all countries except Bahrain (only on mathematics achievement) and Egypt.

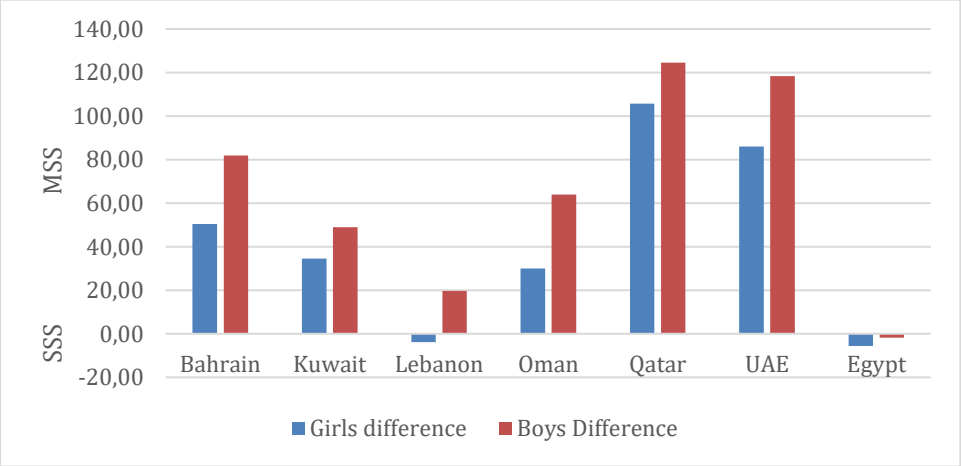

Figure 11. The difference in mathematics achievement between school types separated by gender

Table 3
Mathematics achievement by school type (SSS vs. MSS) separated by gender

	Girls			Boys		
Country	Single-sex class *M (SD)*	Mixed-sex class *M (SD)*	*t (p)*	Single-sex class *M (SD)*	Mixed-sex class *M (SD)*	*t (p)*
Bahrain	452.95 (69.51)	503.43 (71.65)	8.10 (< .001)*	428.54 (78.03)	510.46 (83.13)	19.23 (< .001)*
Kuwait	388.48 (77.66)	423.08 (93.11)	2.09 (.036)*	375.36 (91.67)	424.36 (105.68)	2.75 (0.006)*
Oman	416.17 (87.91)	446.14 (87.00)	4.28 (< .001)*	378.46 (98.02)	442.48 (95.66)	6.43 (< .001)*
Egypt	398.43 (93.69)	392.87 (105,43)	-0.44 (.66)	387.97 (96.31)	386.13 (104.95)	-0.14 (0.888)
Lebanon	444.41 (66.56)	440.59 (75.83)	-0.39 (.694)	426.48 (72.55)	446.11 (93.77)	1.34 (0.18)
Qatar	415.00 (85.76)	520.78 (82.48)	16.52 (< .001)*	401.49 (95.02)	526.00 (86.81)	13.49 (< .001)*
UAE	460.79 (86.35)	546.88 (86.44)	6.89 (< .001)*	442.78 (98.25)	561.22 (80.97)	16.30 (< .001)*

* two-tailed significance at 5%

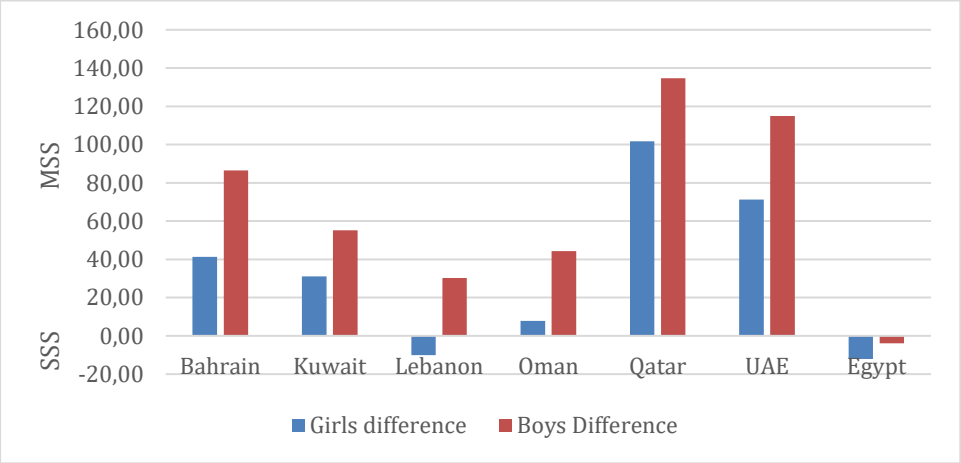

Figure 12. The difference in science achievement between school types separated by gender

Table 4
Science achievement by school type (SSS vs. MSS) separated by gender

	Girls			Boys		
Country	Single-sex class *M (SD)*	Mixed-sex class *M (SD)*	*t (p)*	Single-sex class *M (SD)*	Mixed-sex class *M (SD)*	*t (p)*
Bahrain	484.38 (89.57)	525.60 (86.53)	4.88 (< .001)*	422.87 (107.21)	509.42 (104.34)	11.69 (< .001)*
Kuwait	428.11 (90.76)	459.12 (98.45)	1.94 (.053)	370.46 (113.15)	425.57 (125.66)	2.68 (.007)*
Lebanon	411.43 (83.47)	401.35 (101.35)	-0.81 (.418)	365.78 (99.45)	396.08 (105.30)	1.35 (.177)
Oman	476.99 (87.78)	484.88 (84.40)	1.25 (.211)	426.65 (102.11)	470.92 (95.49)	4.06 (< .001)*
Qatar	446.99 (93.77)	548.77 (82.86)	14.56 (< .001)*	406.39 (108.34)	541.16 (89.35)	13.39 (< .001)*
UAE	483.81 (92.09)	555.10 (84.97)	6.40 (< .001)*	445.96 (109.78)	560.82 (84.08)	15.33 (< .001)*
Egypt	381.00 (108.68)	368.95 (119.62)	-0.89 (.374)	365.07 (114.98)	361.17 (119.44)	-0.28 (.779)

* two-tailed significance at 5%

5.2 Research question 2

To what extent are there differences in the experiences of bullying between girls and boys in SSS and MSS in Arab countries?

To examine the effect of single-sex and mixed-sex classes for each gender bullying, a series of t-tests were conducted separately for girls and boys as seen in Table 5. The difference in achievement between school types separated by gender is illustrated in Figure 13.

As shown in Table 5 and Figure 13, single-sex classes had significantly more bullying for boys in Bahrain, Qatar, UAE and Egypt. Mixed-sex classes had significantly more bullying for girls in Bahrain.

Table 5
Bullying by school type (SSS vs. MSS) separated by gender

	Girls			Boys		
Country	Single-sex class *M (SE)*	Mixed-sex class *M (SE)*	*t (p)*	Single-sex class *M (SE)*	Mixed-sex class *M (SE)*	*t (p)*
Bahrain	9.93 (.06)	9.56 (.13)	-2.52 (.012)*	8.66 (.07)	9.35 (.18)	3.60 (<.001)*
Kuwait	10.25 (.09)	10.08 (.20)	- .79 (.430)	9.46 (.09)	9.45 (.11)	-.06 (.952)
Lebanon	10.27 (.33)	9.72 (.11)	-1.53 (.126)	8.90 (.43)	9.08 (.13)	.40 (.689)
Oman	9.49 (.05)	9.29 (.12)	-1.64 (.101)	8.94 (.06)	8.86 (.10)	-.70 (.484)
Qatar	10.44 (.07)	10.20 (.10)	-1.87 (.062)	9.20 (.07)	9.59 (.08)	3.67 (<.001)*
UAE	10.17 (.04)	10.17 (.08)	.05 (.960)	9.21 (.05)	9.75 (.08)	6.27 (<.001)*
Egypt	10.15 (.10)	10.12 (.14)	-0.22 (.826)	9.00 (.12)	9.35 (.13)	1.97 (.049)*

* two-tailed significance at 5%

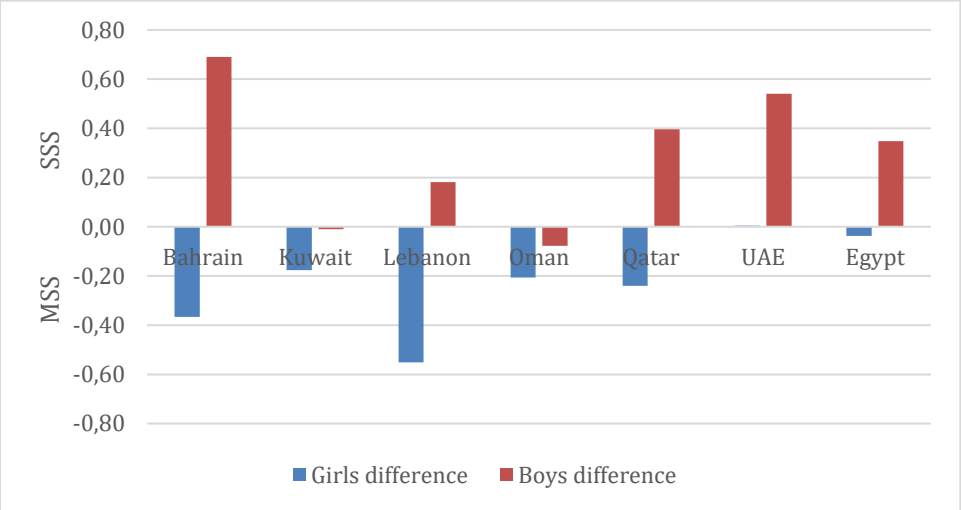

Figure 13. The difference in bullying between school types separated by gender

5.3 Research questions 3 and 4

To what extent is bullying related to student achievement in Arab countries?
To what extent does bullying account for achievement differences between class types, taken into account students' socioeconomic status?

To answer the research questions 3 and 4, a multilevel regression model was conducted as shown in Tables 6 to 19. Model 1 explores the gender differences on achievement taking into account the socioeconomic effect at individual and class level. Model 2 examines the class type effect on achievement, including the socioeconomic effect at individual level. Model 3 investigates the class type effect on achievement, taking into consideration the socioeconomic effect at individual and class level. Model 4 includes all the variables in Model 3, with adding interaction effects between gender, bullying, class type and socioeconomic status.

5.3.1 Bullying effect on student achievement

In Model 3, the bullying effect on student achievement is statistically significant in all countries except Kuwait. In Model 4, the bullying effect on students achievement is statistically significant in all countries except Lebanon (only on mathematics achievement).

5.3.2 The interaction between bullying with class type and gender

In Model 4, the interaction effect of bullying and class type is only significant in Oman for science achievement. In Model 4, the interaction effect of bullying and gender is only significant in Kuwait (both on mathematics and science achievement) and Oman (only on science achievement).

5.3.3 Effect of socioeconomic status as a control variable on students achievement

At the individual level, the socioeconomic status effect on student achievement is statistically significant ($p < .05$) in all countries in Models 1, 2, 3 and 4. The interaction effect between socioeconomic status and gender is not significant in any country except Qatar.

At the classroom level, the socioeconomic status effect on student achievement is statistically significant in all countries in Models 1, 3 and 4. In Model 4, the interaction effect between classroom socioeconomic status and gender is significant in Bahrain (only in mathematics achievement), Kuwait (only on science achievement), Egypt and Qatar. The interaction effect between classroom socioeconomic status and gender is not significant in Oman, UAE and Lebanon.

In Models 2, 3, and 4, the class type effect on student achievement is statistically significant ($p < .05$) in most countries. The exceptions are Oman (only on science achievement), Egypt and Lebanon. The class type effect decreases after controlling the classroom socioeconomic status, for example: In Bahrain, the students in single-sex classes achieve 62.206 ($SD = 9.173, p < .05$) points less than students in mixed-sex classes in Model 2. After controlling the classroom socioeconomic status in Model 3, the students in single-sex classes achieve 43.142 ($SD = 9.761, p < .05$) points less than students in mixed-sex classes.

5.4 Gender effect on achievement in the four models

In Bahrain, no significant differences were found on mathematics achievement in any model, while in science achievement, there was a significance difference in favor of girls in every model. In Oman, all models show significant difference ($p < .05$) in favor of girls.

In Kuwait, the significance level for mathematics achievement changed from non-significant differences in Models 1, 2 and 3 to a significant difference in favor of boys in Model 4 ($p < .05$). For science achievement, the significance level in favor of girls changed from Models 1, 2 and 3 ($p < .05$) to non-significant differences in Model 4.

In Egypt, significance level in favor of girls changed from Models 1 and 2 ($p < .05$) to non-significant differences in Models 3 and 4 for mathematics achievement. For science achievement, significance levels changed from Models 1 and 2 ($p < .05$) in favor of girls, to non-significant difference in Models 3 and 4.

In Lebanon, the significance level for mathematics achievement changed from non-significant differences in Models 1, 2 and 4 to significant differences in favor of boys in Model 3 ($p < .05$). For science achievement, the significance level in favor of girls changed from Models 1 and 2 ($p < .05$) to non-significant differences in Models 3 and 4.

In Qatar, for mathematics achievement, non-significant differences were found for mathematics achievement in Model 1, 2 and 3, but significant differences were found in favor of boys in Model 4 ($p < .05$). For science achievement, the significance level in favor of girls changed from Models 1 and 2 ($p < .05$) to non-significant difference in Models 3 and 4.

In UAE, non-significant differences were found for mathematics achievement in all Models, while for science achievement, the significance level in favor of girls changed from Models 1, 2 and 3 ($p < .05$) to non-significance in Model 4.

Table 6
Multilevel model for mathematics achievement in Bahrain

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-2.393 (4.480)	-3.901(4.310)	-2.745(4.133)	1.438(23.33)
SES	7.474(0.912)*	7.798(0.911)*	7.411(0.902)*	7.474(1.099)*
Bullying			3.106(0.657)*	3.658(0.823)*
Level 2 Variables				
Class type		-62.206(9.173)*	-43.142(9.761)*	-43.085(6.472)*
SES_2	37.421(5.295)*		21.071(5.825)*	21.207(4.217)*
Interaction Effects variables				
Bully*class_typ				-0.867(1.582)
Gen*class_typ				-15.998(9.437)
Gen*SES1				-0.093(1.723)
Gen*SES2				14.859(7.221)*
Gen*bully				-1.133(1.183)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 7

Multilevel model for science achievement in Bahrain

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-31.876(5.694)*	-32.335(5.643)*	-30.755(5.458)*	-60.895(25.127)*
SES	11.222(1.178)*	11.804(1.170)*	11.145(1.164)*	10.526(1.348)*
Bullying			4.078(1.066)*	3.305(1.248)*
Level 2 Variables				
Class type		-54.419(12.079)*	-31.879(13.216)*	-31.604(8.583)*
SES_2	37.294(6.337)*		24.876(7.038)*	24.981(5.514)*
Interaction Effects variables				
Bully*class_typ				1.084(1.894)
Gen*class_typ				-26.031(11.988)*
Gen*SES1				1.224(1.870)
Gen*SES2				15.196(8.561)
Gen*bully				0.725(1.543)

coefficient (standard error)

Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)

* two-tailed significance at 5%

Table 8

Multilevel model for mathematics achievement in Kuwait

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	7.809(6.654)	9.899(6.736)	7.122(6.718)	67.431(28.724)*
SES	8.444(1.224)*	9.306(1.245)*	8.419(1.228)*	10.299(1.619)*
Bullying			1.226(0.841)	3.459(1.064)*
Level 2 Variables				
Class type		-48.820(16.364)*	-29.549(11.133)*	-28.497(8.140)*
SES_2	53.990(7.457)*		48.707(6.486)*	48.576(5.607)*
Interaction Effects variables				
Bully*class_typ				2.787(1.494)
Gen*class_typ				-30.089(11.389)*
Gen*SES1				-3.784(1.481)
Gen*SES2				12.027(7.287)
Gen*bully				-4.014(1.481)*

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 9

Multilevel model for science achievement in Kuwait

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-22.135(7.744)*	-18.696(7.797)*	-22.501(7.604)*	-4.365(29.917)
SES	11.634(1.395)*	12.563(1.372)*	11.603(1.398)*	11.979(1.825)*
Bullying			1.765(1.286)	4.032(1.442)*
Level 2 Variables				
Class type		-49.801(18.209)*	-29.113(14.335)*	-27.333(9.434)*
SES_2	57.728(7.379)*		52.496(6.968)*	52.470(6.722)*
Interaction Effects variables				
Bully*class_typ				1.553(2.045)
Gen*class_typ				-46.692(11.368)*
Gen*SES1				-0.541(2.398)
Gen*SES2				23.176(7.872)*
Gen*bully				-4.227(1.480)*

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 10
Multilevel model for mathematics achievement in Oman

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-20.997(4.740)*	-21.383(4.682)*	-19.556(4.681)*	-34.401(19.510)*
SES	8.625(0.797)*	8.617(0.780)*	8.223(0.799)*	8.454(0.814)*
Bullying			5.006(0.783)*	4.133(0.895)*
Level 2 Variables				
Class type		-33.584(10.021)*	-29.024(11.268)*	-27.975(6.338)*
SES_2	15.643(5.081)*		13.244(4.984)*	13.512(3.210)*
Interaction Effects variables				
Bully*class_typ				3.329(1.796)
Gen*class_typ				-27.441(8.213)*
Gen*SES1				-0.445(1.412)
Gen*SES2				6.833(5.404)
Gen*bully				1.129(1.245)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 11
Multilevel model for science achievement in Oman

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-32.467(4.500)*	-32.335(4.434)*	-29.684(4.398)*	-56.045(16.169)*
SES	7.319(0.833)*	7.541(0.826)*	7.266(0.834)*	7.590(0.816)*
Bullying			6.204(0.848)*	4.592(0.884)*
Level 2 Variables				
Class type		-13.738(10.689)	-10.560(12.246)	-9.449(7.197)
SES_2	10.000(4.949)*		9.267(5.339)	9.526(3.366)*
Interaction Effects variables				
Bully*class_typ				4.243(1.972)*
Gen*class_typ				-29.834(7.947)*
Gen*SES1				-0.615(1.155)
Gen*SES2				5.318(5.004)
Gen*bully				2.402(1.172)*

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 12
Multilevel model for mathematics achievement in Egypt

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-10.779(4.665)*	-10.201(4.764)*	-1.805(4.553)	12.523(16.118)
SES	6.448(0.951)*	6.870(0.945)*	6.209(0.956)*	6.578(1.007)*
Bullying			9.819(0.668)*	10.142(0.647)*
Level 2 Variables				
Class type		1.916(9.468)	-2.924(8.574)	-3.159(6.594)
SES_2	32.917(4.330)*		32.202(4.334)*	32.844(4.228)*
Interaction Effects variables				
Bully*class_typ				-0.102(1.085)
Gen*class_typ				-4.973(8.554)
Gen*SES1				-0.682(1.024)
Gen*SES2				9.766(4.690)*
Gen*bully				-0.682(1.024)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 13
Multilevel model for science achievement in Egypt

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-12.912(5.391)*	-12.062(5.553)*	-1.932(5.208)	34.371(19.696)
SES	6.637(0.990)*	7.187(0.991)*	6.345(0.983)*	7.348(1.074)*
Bullying			11.966(0.879)*	12.789(0.929)*
Level 2 Variables				
Class type		5.951(10.282)	0.707(9.141)	0.218(7.159)
SES_2	37.306(4.427)*		36.126(4.379)*	36.920(5.558)*
Interaction Effects variables				
Bully*class_typ				0.0975(1.146)
Gen*class_typ				-7.668(9.651)
Gen*SES1				-2.279(1.602)
Gen*SES2				12.119(4.954)*
Gen*bully				-1.691(1.095)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 14
Multilevel model for mathematics achievement in Lebanon

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	4.851(2.915)	5.319(2.919)	6.159(2.894)*	-1.061(20.600)
SES	3.183(0.884)*	4.023(0.846)*	3.087(0.876)*	3.045(1.230)*
Bullying			2.014(0.732)*	1.856(0.987)
Level 2 Variables				
Class type		-0.111(8.211)	-2.261(7.383)	-4.614(6.752)
SES_2	25.364(3.608)*		25.129(3.474)*	25.311(3.472)*
Interaction Effects variables				
Bully*class_typ				-1.254(1.818)
Gen*class_typ				-27.352(12.815)*
Gen*SES1				0.104(1.766)
Gen*SES2				-0.125(3.373)
Gen*bully				0.221(1.280)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 15
Multilevel model for science achievement in Lebanon

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-8.192(3.418)*	-7.625(3.406)*	-5.592(3.406)	-15.033(27.236)
SES	4.866(1.188)*	5.837(1.167)*	4.674(1.170)*	4.823(1.599)*
Bullying			4.005(0.761)*	3.645(1.052)*
Level 2 Variables				
Class type		-0.019(11.776)	-3.311(10.465)	-7.062(9.401)
SES_2	37.305(5.461)*		36.870(5.171)*	37.220(5.167)*
Interaction Effects variables				
Bully*class_typ				-0.364(2.140)
Gen*class_typ				-41.362(16.700)*
Gen*SES1				-0.293(2.340)
Gen*SES2				1.417(4.638)
Gen*bully				0.625(1.501)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 16

Multilevel model for mathematics achievement in Qatar

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	5.839(4.114)	5.534(4.243)	6.741(3.918)	59.048(21.583)*
SES	13.284(0.814)*	14.143(0.793)*	13.224(0.822)*	15.964(1.130)*
Bullying			4.287(0.620)*	4.608(0.876)*
Level 2 Variables				
Class type		-104.134(8.362)*	-67.541(7.749)*	-67.889(7.762)*
SES_2	66.879(4.903)*		44.294(4.756)*	44.267(4.662)*
Interaction Effects variables				
Bully*class_typ				0.201(1.387)
Gen*class_typ				-17.275(8.608)*
Gen*SES1				-5.319(1.614)*
Gen*SES2				18.199(4.873)*
Gen*bully				-0.671(1.232)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 17

Multilevel model for science achievement in Qatar

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-11.079(4.040)*	-11.712(4.293)*	-10.406(4.203)*	20.932(24.439)
SES	13.266(0.991)*	14.168(0.972)*	13.187(1.000)*	15.378(1.547)*
Bullying			4.929(0.693)*	4.939(1.003)*
Level 2 Variables				
Class type		-106.416(7.980)*	-70.939(8.130)*	-71.071(8.192)*
SES_2	66.734(5.268)*		42.998(5.449)*	43.169(5.242)*
Interaction Effects variables				
Bully*class_typ				0.392(1.635)
Gen*class_typ				-29.648(10.017)*
Gen*SES1				-4.258(1.940)*
Gen*SES2				17.459(6.032)*
Gen*bully				-0.215(1.343)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 18

Multilevel model for mathematics achievement in UAE

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	1.208(2.818)	2.216(3.122)	2.745(2.817)	11.145(17.755)
SES	7.564(0.570)*	8.152(0.574)*	7.508(0.569)*	8.735(0.772)*
Bullying			3.163(0.377)*	2.782(0.671)*
Level 2 Variables				
Class type		-93.216(7.245)*	-28.246(7.546)*	-28.219(7.541)*
SES_2	58.880(2.741)*		51.323(3.587)*	51.135(3.556)*
Interaction Effects variables				
Bully*class_typ				0.545(1.1013)
Gen*class_typ				-17.521(8.470)*
Gen*SES1				-2.438(1.237)
Gen*SES2				5.344(4.351)
Gen*bully				0.590(0.960)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Table 19

Multilevel model for science achievement in Bahrain

Fixed Effect	Model 1	Model2	Model3	Model4
Level 1 Variables				
Gender	-11.640(2.948)*	-9.582(3.184)*	-9.258(2.932)*	-18.124(16.221)
SES	8.744(0.594)*	9.416(0.601)*	8.670(0.593)*	9.617(0.838)*
Bullying			4.250(0.410)*	3.497(0.680)*
Level 2 Variables				
Class type		-84.019(6.919)*	-17.474(7.650)*	-17.283(7.665)*
SES_2	57.483(2.993)*		52.433(3.931)*	52.217(3.869)*
Interaction Effects variables				
Bully*class_typ				0.888(1.253)
Gen*class_typ				-25.253(8.648)*
Gen*SES1				-1.873(1.246)
Gen*SES2				7.907(4.018)
Gen*bully				1.190(0.875)

coefficient (standard error)
Class type coding: MSS (0), SSS (1) Gender coding: Girls (0), Boys (1)
* two-tailed significance at 5%

Chapter 6
Discussion, limitations and conclusion

6.1 Discussion

This study set out to investigate the reasons behind the gender gap in favor of girls in The Arab countries. This gap was emphasized in many previous studies like in Alkhateeb (2001), and Hassan and Khalifa (1999), however, the literature review showed there is little empirical based information available about the reasons behind it.

This research showed that the gender difference that was initially in favor of girls disappeared or reversed after controlling for bullying, socioeconomic status and school type. This presents a remarkable finding of this research that school type, school socioeconomic status and school bullying (in a lesser degree) are mainly responsible for the Arab gender gap.

RQ1: To what extent do girls and boys perform differently in mathematics and science in SSS than in MSS in Arab countries?'

Regarding the school type effect on each gender achievement, as mentioned in the literature review, all-boys classes are expected to be more violent which leads to more bullying and less achievement. While in all-girls classes, girls environment tend to be more calm and cooperative, which reduce bullying and enhance achievement. The results indicated that boys performed much worse in SSS than MSS as expected. However, unlike the initial presumption, girls performed worse in SSS than MSS, except in Lebanon where girls performed better in SSS than MSS. Egypt was the only exception in which there was no significant difference in achievement between school types in both genders.

Egypt's results might be illustrated by the popularity of the afterschool private lessons especially in the public schools (which are mostly segregated by gender). To illustrate, classrooms in Egyptian public schools are too populated which make it hard for students to learn efficiently. As a result, students tend to have extra private lessons which can support their learning. This is confirmed by the TIMSS 2015 data, in which students were asked about the number of months they have attended extra lessons, and the results showed that students in SSS attend significantly higher number of extra lessons than MSS students in Egypt (Foy, 2017). This phenomenon might be considered a supporting factor for students in single-sex schools which might buffer the difference between the school type achievement.

RQ2: To what extent are there differences in the experiences of bullying between girls and boys in SSS and MSS in Arab countries?

As mentioned in the previous studies like Chaux et al. (2009), and Gray and Wilson (2006); the results showed that boys face more bullying in all-boys classes than mixed-sex classes in most of the countries (Oman, Lebanon and Kuwait are the exceptions with no significant difference between class types). Moreover, there was no significant difference in bullying between all-girls classes and mixed-sex classes for girls in every country except Bahrain (mixed classes faced significantly more bullying than all-girls classes). Jackson (2002) suggested that the competitive nature of boys lead them to bully weaker students to demonstrate their hierarchy and manhood. However, girls tend to be more peaceful and encouraging with their classmates. This difference between boys and girls is strengthen in all-boys and all-girls schools.

This finding is noteworthy, as this is the first research -as far as I know- that has investigated the relationship between school types and bullying with sufficient quality regarding sampling and methodology. To explain, this is the first study to be conducted using large random samples, for ordinary students (e.g. not focusing on special cases like homophobic students), and all types of bullying were included in the students' questionnaire.

RQ3: To what extent is bullying related to student achievement in Arab countries?

In the same line of the previous research, the results showed that more bullying leads to less achievement. Al-Raqqad et al. (2017) argued that the bullying victims feel powerless and fearful. This feeling switch their focus from their studies and school activities to how to deal with the bullying they face. Therefore, reducing bullying in schools would not only help the students to build a healthy character, but also to achieve better in their studies.

RQ4: To what extent does bullying account for achievement differences between class types, taken into account students' socioeconomic status?

The results suggested that there is no interaction between bullying and school type (for boys and girls) except in Oman where the interaction effect between bullying and single-sex classes is significant. As school bullying could not explain the achievement difference between the school types, further research is needed to investigate the reasons that makes SSS achieve worse than MSS especially for boys in Arab countries.

This research focused only on school bullying which is one of students' behavioral problems. It is possible that other students' behavioral problems are responsible for the achievement gap between students in MSS and SSS. Students misbehavior include disruptive classroom behavior, vandalism, violence, discipline problems and disrespect for peers and

teachers (Luiselli, Putnam, Handler, & Feinberg, 2005). A study was conducted to investigate the teachers' opinions about single and mixed-sex schools. Teachers complained that single-sex classes are associated with mis-behavior and lower achievement especially for boys. The study results showed that, majority of the teachers prefer teaching in mixed-sex classes, then all-girls, then all boys classes (Gray & Wilson, 2006).

At the individual level, students with better behavior (not violent, more disciplined and respectful for peers and teachers) are more likely to achieve more academically for several reasons. First, students' good behavior can influence teachers' preferences for students, which gives them the chance for instance to have more one-on-one instruction (Wentzel, 1993). Second, peers with more cooperative attitude are more likely to achieve more, because they share more information together, learn from each other and can interpret their teachers' instructions in a cooperative way. On the other hand, students with more behavioral problems are expected to be isolated in the classroom activities by their peers and teachers (Malecki & Elliot, 2002; Wentzel, 1993). Third, as claimed by Doyle (1986) (as cited in Wentzel, 1993), bad behavior can be a distraction for students to focus on academic activities .

At the classroom level, classes with better behavior (less disruptive, with less vandalism, and respectful for peers and teachers) are more likely to achieve more academically for several reasons. First, the classroom behavior can impact the teachers' quality of instructions as teachers can focus on teaching rather than classroom management. Second, some learning contexts are based on social settings, like cooperative learning groups, which might not be effective in a disruptive classroom (Wentzel, 1993).

Previous research stated that the effect of behavioral problems on achievement is more severe for boys than girls. Mundy et al. (2017) have examined the effect of behavioral problems on student achievement at age 8 to 9 years (N=1239) in Australian schools. The results showed that boys with behavioral problems are 3 times more likely to have poor achievements than boys with less behavior problems. On the other hand, the results were less significant for girls. In the classroom setting, McKinney, Mason, Perkerson, and Clifford (1975) examined the effect of classroom behavior on students' achievement for 90 students in The USA. The results showed that classrooms with more behavioral problems are more disturbed and students achieve less than classes with less behavioral problems. The same relationship was confirmed by Wentzel (1993), and Malecki and Elliot (2002).

The individual and school socioeconomic status are positively correlated with the students achievement in all the Arab countries. However, school socioeconomic status has a stronger effect on boys than girls in Bahrain, Kuwait, Qatar and Egypt. This means that in low socioeconomic status schools, boys achieve significantly less than girls. A possible explanation for this finding is the difference between teachers expectations towards boys and girls with low socioeconomic status. To explain, a study was conducted by Auwarter and Aruguete (2008) on

106 teachers, to find if the student gender and socioeconomic status affect the teachers expectations. The results showed that only with students of low socioeconomic status, teachers favored girls more than boys in terms of judging their personality and future achievement. Teachers predicted that boys have less promising future than girls. These expectations could affect the teachers' sense of duty and commitment towards boys with low socioeconomic status (Warren, 2002) (as cited in Auwarter and Aruguete, 2008).

6.2 Limitations and recommendations for future research

A limitation of this study is that the students who are enrolled in each school type are not randomly enrolled in the schools. To explain, students who choose to enroll in a SSS might differ from those who decide to enroll in a MSS in many ways (for example, in their parents ideology). Moreover, single-sex schools might differ from mixed-sex schools in many ways (for example, most of SSS are public schools). While taking into consideration that individual and school socioeconomic status were controlled for, there could be other co-founding factors that might have an effect on the research results.

Second limitation in this study is that TIMSS 2015 questionnaires were self-reported for the students which can cause response bias. For example, some student maybe ashamed to admit that they are getting bullied which make them fill incorrect information for the bullying questions. Third limitation is that the data that were used in the study were cross-sectional; accordingly, causal interpretations cannot be drawn from the results. For instance, it is hard to interpret if more bullying causes lower achievement or lower achievement causes more bullying.

A recommendation for a future research is analysing different age group (for example, grade 4 in TIMSS 2015) and compare the results of both age groups to track the development of the differences between the gender and class types in terms of achievement and bullying occurrence.

As mentioned in the discussion section, school bullying could not explain the achievement difference between the school types. Therefore, further research is recommended to investigate the reasons that makes SSS achieve worse than MSS especially for boys in Arab countries with the focus on other types of behavioral problems (like, disruptive classroom behavior, vandalism, violence, discipline problems and disrespect for peers and teachers).

6.3 Conclusion and practical recommendations

This study found that SSS students achieve less than MSS for boys and girls. Additionally, all-boys classes face more bullying than mixed-classes for boys. Hence, the Arab governments should experiment opening more mixed-sex schools with restricted supervision on interaction between boys and girls to avoid any undesired act or problem. This may lead to better achievement for both genders and less bullying for boys.

The TIMSS data showed that bullying is very common in The Arab countries. In addition, bullying leads to lower achievement. Kazarian and Ammar (2013) claimed that schools in the Arab world suffer the absence of planning and applying of bullying prevention programs. They add that all the Arab countries except UAE lack the vision and the needed policies to prevent bullying in schools. Accordingly, the Arab governments should design anti-bullying policies and programs to be implemented in the schools. Additionally, schools should consider bullying as a serious problem and work on reducing it.

This research suggested that school type and school socioeconomic status are mainly responsible for the Arab gender gap. Accordingly, more attention should be paid to students in SSS especially boys in order to buffer the low achievement consequences. Moreover, specific attention should be given in lower socioeconomic status schools (especially for boys), and teachers should be trained to work with lower status boys.

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