

## PRINCIPALS' AND TEACHERS' PERCEPTIONS OF STUDENTS' LEARNING IN MATH CLASSES IN SINGLE-SEX VERSUS CO-EDUCATIONAL PUBLIC SCHOOLS IN BEIRUT - LEBANON

Zeina Hariz Khaddaj\* and Dalal Moukarzel

Saint-Joseph University of Beirut, Lebanon

\*Corresponding author: Zeina Hariz Khaddaj

[harizzeina@hotmail.com](mailto:harizzeina@hotmail.com)

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### ABSTRACT

**Hariz Khaddaj, Z. and Moukarzel, D. 2018. Principals' and teachers' perceptions of students' learning in math classes in single-sex versus co-educational public schools in Beirut – Lebanon. Lebanese Science Journal, 19(3): 486-507.**

*The purpose of this mixed study was to explore school principals and teachers' perceptions about (a) students' performance in mathematics in single-sex versus co-educational schools in Lebanon, (b) instructional methods used according to student gender, and (c) the effect of teachers' gender on students' behavior. Quantitative and qualitative data were collected to validate the results found. The sample consisted of nine public school principals and seventeen teachers. Three instruments were used for data triangulation: an interview with principals, a survey completed by teachers, and a classroom observation grid; the survey was piloted prior utilizing it and its analysis passed through an expert panel to secure its validity and reliability. Results showed that students performance was not affected by the gender of the classes or schools as per the principals and teachers feedback; however, other factors such as classroom size, parental involvement, boys versus girls' concentration in class, parents' carelessness, and girls' socio and cultural economic background were of concern to the participants in the study. We also found that principals and teachers did not write different lesson plans based on gender in class; moreover, based on the principals' interviews and classroom observations, female teachers were more tolerant than male teachers towards disruptive behavior. Recommendations for further studies were suggested as to investigate students' perceptions towards mathematics in both types of schooling.*

**Keywords:** Single-sex and co-education, instructional strategies in mathematics, public schools, students' attitude.

## INTRODUCTION

For many years, the effort to reduce gender disparities in achievement and increase academic standards is a topic that has been of interest for researchers (Gray & Wilson, 2006).

Single-sex education is defined as “education at the elementary, secondary, or postsecondary level in which males or females attend school exclusively with members of their own sex” (U.S. Department of Education, 2005).

Although co-education is considered nowadays more beneficial than single-sex education, by many schools and parents, the debate is still open in numerous countries. A report published by UNESCO (2007) stated that single-sex schooling has increasingly been the subject of research for its role in improving gender equality in education. Based on the above, studying whether the schooling system positively or negatively impacts education is vital for improving the level of education in schools around the world. In the Middle East, for instance, there is a significant difference between the educational achievements of girls and boys, and the highest levels of disparity between sexes in education worldwide occurred specifically in math classes (Linver et al., 2002, The WEF Global Gender Gap Report, 2012); therefore, research on the achievement gap between males and females in mathematics in the Middle East becomes essential.

However, with regard to Math in particular, Hassan (2001) found in a study that boys slightly outperform girls but not significantly in elementary and middle private schools in Lebanon. Similar results were obtained in the West, where gender differences appeared in middle school and were emphasized in high school (Tapia & Marsh, 2004). Ayyash-Abdo (2007) found in a study on the Lebanese educational system that Lebanon still suffers from gender discrimination in various areas including the choice of schooling and career orientation. Sarouphim (2010) added that mathematics is still considered a male domain. Previously, Shapka and Keating (2003) stated that this issue was important at the intermediate level. They further stated that “mathematics appears to act as a critical filtering process which often prohibits prospective students from entering post-secondary programs that require a background in advanced math and science, thereby diverting them from subsequent career pathways” (p. 930).

The purpose of this study was to investigate school principals and teachers' perceptions about (a) students' performance in mathematics in single-sex versus co-educational schools in Lebanon, (b) instructional methods used according to student gender, and (c) the effect of teachers' gender on students' behavior.

Three questions guided our study: (1) what were the public school principals' and teachers' perceptions about students' performance in single-sex *versus* co-educational schools? (2) To what extent did math teachers adjust their instructional methods according to class gender? (3) To what extent did teacher gender affect student behavior?

To answer the second and third research questions, the following hypotheses were considered: (a) there was a significant difference in instructional methods used in math class based on gender in single-sex classes *versus* co-educational classes, and (b) female teachers were more tolerant of disruptive behavior than male teachers in math classes.

## LITERATURE REVIEW

Many research tackled the issue of gender at the school level, not only in developing countries but also in what is called developed ones, such as the United States of America, Australia, and Britain to name but a few. All had arguments for and against single- sex education and the effect on students' performance.

### Arguments for and Against Single-Sex Education

Bryk & Lee (1986) considered that single-sex schools have a varied effect on students' academic performance when compared to co-educational ones. In his book *Why Gender Matters*, Sax (2006) stated that boys and girls differ biologically and psychologically including differences in brain anatomy, seeing, hearing, language development, and social interest. The National Coalition for Women & Girls Education (2009) added that learning habits are not gender specific: both genders respond similarly to different educational approaches since it is unnecessary to have girls and boys separated into different classrooms. On the other hand, The American Association of University Women (2009) stated that the co-educational system motivated girls to progress towards higher degrees and opportunities in life, while single-sex education lowered their self-esteem and academic motivation (AAUW).

Moreover, Rex and Chadwell (2009) assert that single-sex schools deprive children of a real co-educational experience of work and family. They argue that single-sex schools do not always prompt better results in mathematics and languages.

On the other hand, the proponents of single-sex education cite a variety of reasons why such schools are more appropriate than co-educational ones. Salomone (2003) asked whether "separating the sexes at certain points in the educational experience can alleviate to any degree the negative effects of the differences between boys and girls" (p. 239). She added that there is no indication that single-sex schools harm students academically; contrarily, in fact, girls benefit academically and

“psychosocially” from single-sex schools that provide them with greater comfort, increase their self-confidence, and widen their interests.

Divya (2008) explored the idea that people around the world have different cultural and religious beliefs which might enforce certain restrictions on the relationship between males and females. He insists on the idea that in this case, it is better for girls to be taught in single-sex schools than to remain uneducated. Divya adds that, in certain countries, female students are more likely to be victims of abuse from males in co-educational schools.

It is clear that advocates of both kinds of schooling have their convincing arguments. Meanwhile, other researchers pointed out that single-sex and co-educational settings have their own advantages and disadvantages. Kirner (2013) elaborated on pros and cons for single-sex education; the pros are that it can (a) “make boys less competitive and more cooperative”, (b) “make girls feel less pressure as they grow-up”, (c) “increase teacher awareness of gender differences”, (d) “improve peer interaction”, and (e) “make classes less distracting than those of co-educational classes”. These characteristics could be based on Bruner and Vygotsky for the necessity of social interaction and cooperation that help in the acquisition of new knowledge and development of new skills in some sorts of continuous process (Cooper, 2009). On the other hand, Kirner considered the cons for single-sex classes as means to (a) “promote gender stereotyping”, (b) hinder students’ preparation “for work or family life”, (c) reduce the value of “diversity”, and (d) “deprive access to mainstream activities” (p.12).

Examining teachers and principals perceptions of single-sex education, research shows that teachers have a momentous influence on student achievement, since they “directly affect how students learn, what they learn, how much they learn, and the ways they interact . . .” (Korkmaz, 2007, p. 390). Their beliefs, attitudes, and expectations determine the success or failure for single-sex programs (Fry, 2009); if teachers are supportive, they are able to assist students and raise their achievement level by reducing their anxiety and stress (Hubbard & Datnow, 2005).

According to Resnick (1987), socio-constructivism focuses on the ways learners actually generate understanding; it recognizes how society labels what it means to be a girl or a boy. Society may define gender differences in academic achievement by relating girls’ achievement to their effort and hard work and boys’ achievement to their ability or luck. Vygotsky (1978) proposed the “social development theory” where he stressed the role of social interaction in the expansion of cognition. The major theme of Vygotsky’s theoretical framework is that the potential for cognitive development depends upon the “Zone of Proximal Development (ZPD)”, a stage of development achieved when kids engage in social behavior to boost their cognitive development since many skills are acquired faster in personal interaction.

According to a study by the South Carolina Department of Education (2008a), 80% of teachers agree that single-sex classrooms have enhanced student performance in at least one of the following areas: self-esteem, self-confidence, attitude, independence, behavior, collaboration, and desire to succeed.

The U.S. Department of Education (2005) and Demartino (2008) studied principals' perception and showed that single-sex education decreased disruptive behavior, increased positive interactions and achievements, improved peer to peer interaction, and increased emphasis on academics and gender differentiated instruction. They insist that teachers should alternate their teaching methods between single-sex and co-educational classes, especially regarding books read in language classes, seating arrangement in the classroom, and acceptable forms of behavior in class. Fabes et al. (2015) stated that principals of single-sex schools insisted that this type of education improved student achievement, while co-educational school principals did not find teachers' gender as a factor impacting student performance and achievement.

However, Thomas (2006) found in a study related to the effect of teacher's gender on nearly 25000 8<sup>th</sup> graders boys' and girls' progress and engagement in US schools, that gender was a factor that shaped communication between the teacher and the pupil. He asserted that the teacher acts as a role model that students are keen to imitate, and thus the identification to the same gender happens more easily.

### **Student Performance**

Thompson (2003) stated that it is a common educational belief in co-educational schools that boys have a tendency to attract their teachers' attention in math classes; in single-sex classrooms, girls are not forced to compete with boys for the teacher's attention - they are given the chance to be among the top students in classes like math and science which are known to be male dominant. Sax (2006) added that the percentage of girls rating their confidence in math and computer abilities at the beginning of their college years is 10% higher for those coming from single-sex schools than for girls coming from co-educational schools. Furthermore, Guarisco (2010) found that in single-sex classes, students tend to achieve better because teachers focus more on different teaching methods especially in mathematics and language classes.

Alkhateeb (2001) conducted research in public schools in the UAE and showed that there are no significant differences in achievement between boys and girls, but girls slightly outperformed boys in the last six years of school. In Cyprus, Georgiou et al. (2007) research results in public schools did not show significant difference between boys' and girls' achievements in math; however, they found that boys tend to believe their success was due to their intellectual abilities more than girls do. These researches could lead to look deeper in how teachers plan for their courses, activities and assessment in mathematics. Basing himself on Bloom's taxonomy (1956), Hameline (1998) insisted on the importance of lesson planning that should trigger students'

cognitive skills at the higher level of thinking through activities that include different types of questioning, which was observed in science, Arabic and social science classes in a study done on Qatari schools (Moukarzel, 2011).

When it comes to education, the gap between girls and boys in the Middle East is still wide despite governmental and administrator efforts to narrow it down. In Lebanon, Akkari (2004) stated that in recent decades, many countries in the region gave more importance to the education sector in order to improve the quality of education.

Results from the 2007 TIMSS Mathematics Achievement Test revealed that in nine out of 14 participating countries in the Middle East, girls in grade 8 scored higher in mathematics compared to boys (TIMSS 2007 International Mathematics Report); this difference goes along with the international average, which is also in favor of girls. In Lebanon, a study by Sarouphim and Chartouny (2016) showed negligible differences between the mathematics scores of boys and girls and student attitudes toward mathematics across all grades in private schools. Their study could not be done in public schools because they could not secure an authorization for their study from the Ministry of Education.

### **Context of the Study**

Lebanon is a country in the Middle East that has a strong educational system based on three types of K-12 schools: public schools (managed by the government), free-private schools, and fee-based private schools (Farha, 2012). Public schools in Lebanon are of three types: (a) male single-sex schools, (b) female single-sex schools, and (c) co-educational schools. About 29% of Lebanese students are enrolled in public schools. Arabic is the official language taught; a second language is required English or French. All public schools in Lebanon have to follow a unified curriculum and use the same textbooks assigned by the Ministry of Education. Public schools are managed by principals who take care of all administrative issues and they are supported by academic inspectors who visit schools to discuss instructional and curricular problems for different subject-matters (Bahous & Nabhani, 2008).

The Lebanese educational system is divided into primary education (K-6), intermediate education (Grades 7-9), and secondary education (Grades 10-12). At the end of grade 9, students sit for the Lebanese Brevet official exam, which allows them to proceed to the secondary level, while at the end of Grade 12 students sit for the Lebanese Baccalaureate official exams (Sedgwick, 2006). The Lebanese Official Exams are designed and administered by a committee whose members are assigned by the Ministry of Education in Lebanon. The degree obtained is required for admission into a higher education institution.

Students in public schools face many problems such as socioeconomic issues (CERD, 2011), and inequalities between girls' and boys' enrollment at school based on

parents' beliefs (Thompson, 2003), leading to high dropout rates starting from grade 4 (Ministry of Education [MEHE], 2013).

### **Significance of the study**

Earlier studies have focused on research from Western developed nations with low spotlight on gender segregation. Our exploratory research was meant to contribute to literature on single-sex versus co-education in public schools in Lebanon and the Middle East to help educators understand how male and female students learn in different contexts, identifying the factors that can influence their achievement, and ultimately create different environments that support both genders.

While sending students to single sex schools is mostly based on cultural preferences and not on educational reasons, our study shed light on aspects that could encourage looking at the issue of students' learning from a different perspective such as teaching methodologies. To our knowledge, few studies were done in Lebanon regarding this aspect, and no studies were found on Lebanese public schools regarding the relationship between genders and teaching strategies' effect in single versus co-education settings.

## **METHODOLOGY**

In this exploratory study, the mixed research approach combined data from qualitative and quantitative instruments to understand public school principals and teachers' perceptions about students' performance in math mainly in view of teachers' gender and the teaching strategies used in single-sex *versus* co-educational schools. The exploratory approach we used in our study was essentially based on the ethnographic method where we looked at the public schools' setting, observed what was happening, the reasons behind principals, teachers and students behaviour in single and co-educational schools, and what their behaviour could mean in terms of engagement in the teaching and learning process, as advised by the ethnographers Schensul, J. and LeCompte M.D. (2013). While we had research questions in mind to enter the field of gender in public education, these were meant to help us understand how to move on with our study for subsequent steps based on our findings. Furthermore, we based ourselves on essentials required for data collection in an ethnography study, as non-participant-observers. We went through the three different approaches to observational processes, developed by Werner and Schoepfle (1987, 262-64): the "descriptive observation" at the beginning of the process to record details of the single and co-educational schools' settings, the "focused observation" where we found out significant factors during our interviews and contact with teachers, and "selective observation" where we focused on class interactions.

The research is a case study that took place at intermediate and secondary public schools that teach math programs either in English or in French as a second language, thus this is a natural setting in Lebanon. A mixed ethnographic methodology

was considered through integrating socio-constructivist theories into findings from prior studies; the purpose was to gain a better understanding of the instructional strategies used in both single-sex and coeducational classrooms in middle and high public schools. Utilizing an ethnographic methodology helped us focus on classroom interactions between teachers and students in order to explore the relation between gender and learning. For the purpose of triangulation, data was collected from semi-structured interviews with principals, teachers' questionnaire, and classroom observations. All instruments were piloted, reviewed and validated by experts in the fields.

### **Population**

The sample consisted of nine public schools in Lebanon, located in the Beirut district and its southern suburb. Nine principals and seventeen teachers were purposively selected after receiving approval from the Ministry of Education. To guarantee anonymity, schools were assigned letters from A to I: three were co-educational (School A, B and G), three were single-sex for girls (School C, D and F), one single-sex for boys (School E), and two initially for boys were converted to co-educational schools (School H and I). These letters were also used to differentiate between school principals. For teachers, we put numbers next to each letter.

### **Instruments**

Three instruments were developed to answer the research questions:

#### **Semi-structured interviews for principals**

Focusing on instructional strategies implemented in class, student performance, and student behavior. The interview consisted of four questions: (1) What obstacles do you anticipate or you are already aware of in grades 9 and 12 in single-sex class/coeducational? (2) Do you think gender is a factor that affects Grade 9 and 12 students' performance in mathematics? (3) To what extent do teachers teach classes differently in single-sex versus coeducational? (4) And In your opinion, what are the goals and benefits of single-sex classrooms versus coeducational ones?

#### **A questionnaire**

A questionnaire completed by teachers that included four sections about the demographic data, student performance in mathematics, student attitude in math class, and the most commonly used teacher instructional strategies. A five point Likert scale was used ranging from "strongly agree" to "strongly disagree" with a neutral point "not applicable". The questions were about:

- Students' attitude based on teachers' gender
- Students' attitude in math in single-sex versus co-educational classrooms



- Level of student misbehavior (such as noise or fighting) interferes with their teaching
- Large class size
- Disrespect in class
- Teachers' instructional strategies in single-sex versus co-educational classrooms
- Use of exam grades to modify lesson plans or teaching methods in areas where students encountered problems
- Teaching how to apply math in real life
- Teachers' need for training in gender-related instructional strategies

### **An observation grid**

A checklist with open space for anecdotal notes was used for classroom observations. The main themes in the observation were: (a) instructional methodologies, (b) students' interactions in class, and (c) level of questioning for critical thinking skills.

### **Data collection and procedure**

After obtaining the Ministry's permission to collect data from public schools, meetings with the principals and then with math teachers were arranged to inform them about the purpose of our study and obtain their consent for interviews, questionnaires, and classroom observations.

The interviews with principals were conducted early in the morning in their respective offices for 20 minutes before he/she began their usual daily routine. The questionnaires were completed by teachers during their break time in the teachers' room. Classroom observations took place between January and April 2018; the average session time allocated was 45 minutes.

The principals' interviews were analyzed qualitatively: they were coded and categorized according to common responses. Three themes emerged: (a) benefits and obstacles of single-sex classrooms versus co-educational classrooms (b) teachers' adjustment of teaching strategies for boys and girls, and (c) effect of teachers' gender on student behavior. Data obtained from the teachers' questionnaires was analyzed using the Statistical Package for the Social Sciences (SPSS). The notes from the observation tool were analyzed regarding the (a) instructional methodologies used, (b) students' interaction in class, and (c) teachers' activities and level of critical thinking questions.

## Findings

### Interviews with Principals

Out of the nine principals interviewed, seven were female and two were male. To understand how they perceived students' mathematic performance, gender-related teaching strategies and students' behavior, thirteen questions with few prompted ones were asked that shed light on many pros and cons related to single versus co-education.

### The pros and cons of single-sex versus co-education classrooms

Principals of the co-educational schools (A, B, H, and I) had common beliefs that boys in grades 9 and 12 usually misbehave in single-sex schools; however, they become shy in front of girls when in co-education settings. Principal A insisted that "it is the principal's and administrators' responsibility to make students in a co-educational school feel and act like brothers and sisters so parents won't need to worry about their children." Conversely, Principal (C) of the single-sex school for girls affirmed that her students were calm, peaceful, and well educated without any of the troubles being faced in many co-educational schools. She added that "nowadays, girls meet boys outside of school normally and they engage via social media"; she believed that being in a single-sex school would not affect the lives of young girls later on, an idea rejected by the Principal of the co-educational school (G) who stated that "it is difficult for students in single-sex schools to merge into real life later on". As for Principal (D) who was heading another single-sex girl's school, she stated that "single-sex schools are good up to grade 6. Then girls become more gossipy and less energetic; they come to school sleepy because they do not have to please anyone. However, students in single-sex schools are always much more disciplined than those in co-educational ones". On the other hand, Principal of the single-sex boys' school (E) stated that single-sex education reduces jealousy between boys especially with respect to girls and romantic issues. As for the Principal of another single-sex girl's school (F), she insisted that "single-sex schools in Lebanon achieve better results in official exams than co-educational schools, and that is one reason other than religion to encourage parents to register their children at our school".

When asked about the obstacles faced in single versus coeducational schools, all principals said that they were confronted to the same problems at all levels, not only in grades 9 and 12. These included (a) parents carelessness, (b) activities that could require both genders to socialize in single-sex schools, and (c) students number in class. All principals insisted on the latter point. One of them said clearly that "more than 15 students per class should not be permitted, because it makes it too difficult for teachers to manage their classroom and hence, more misbehavior occurs which leads to lower academic achievement". An interesting aspect related to gender was raised by the Principal of the single-sex boys' school (E) who tried to convince the single-sex girls' school Principal (D) to allow girls to participate in a theater play with boys in his

school. Being “very conservative and protective of her students” as he said, Principal (D) refused the idea completely. When we approached Principal (D) about this issue during the interview, she stated that “parents insist on their girls not mixing with boys so why take the risk?” adding that she was particularly facing a problem with respect to physical education since girls did not take any sport lesson in the past two years because she could not find a female sports teacher.

### **Teaching strategies**

Seven out of nine principals stated that the Lebanese curriculum was the same for all public schools and that they had to implement it as required, which called for teachers to use the same strategies for teaching both genders, especially that many teachers were teaching in both single-sex and co-educational schools and they had the same lesson plans for both types of schools. Principal (E) of single-sex school was the only principal who thought that it might be helpful if the Ministry of Education prepared some workshops to introduce teachers to new instructional strategies to use in single-sex classes. Mostly, all the principals complained about the fact that none of their schools received the new equipment needed to embed new technology into teaching, which made it difficult for teachers. Principal (H) added that “the school was newly renovated by a foreign organization and that was the only projector provided!” (Showing us the material in her office). She added, irritated, that “the Ministry of Education rarely cares about the importance of new technologies in public schools”.

### **Student performance**

Principals of the co-educational schools (A) and (B) explained that girls were more on task in math and science classes than boys, and that they outperformed boys in robotics. Heading the school (I) that moved from single to co-educational the Principal stated that “students used to concentrate more in scientific classes and get better grades when the school was only for boys, but the overall average in the official exams is better after the school shifted to co-educational”. However, he pointed out to a cultural issue related to girls at the intermediate level saying that “many of the girls in grade 9 get engaged to be married due to their low socioeconomic background so their focus is no longer on their studies; this makes boys achieve better in the last four years of school”; he added that this issue was one of the reasons for girls’ dropping out of school but then trying to sit for the official exams. Reasoning differently, principals of schools (C), (D), (E), and (H) insisted that their students’ performance was “very good” regardless of whether the school was single or co-educational because their teachers were teaching in both types of schools. As for the girls’ single-sex school (F), the Principal criticized co-education believing that “boys tend to be more agitated and this makes them concentrate less in class while girls are calmer and more obedient which helps them achieve better not only in mathematics but mostly in all subject areas”. On the other hand, Principal (G) of a co-educational school insisted that “students’ performance depends on the teacher’s gender.” She believed that boys needed to have a female teacher because she

could understand them more and could “act like a mother to them so they obey and respect her which leads to better concentration and better achievement.” In the same line of thought, Principal (D) of the single-sex girl’s school insisted that “even male teachers can’t handle teaching boys all the time and they find it easier to teach girls because they are more sensitive, calmer, they focus more, and achieve better”.

### **Teachers’ questionnaire**

The questionnaire had five sections: demographic data, student attitude in math classes, teaching strategies, teachers’ opinion about single sex versus co-education, and open-ended comments. To analyze our results, participants’ responses on the Likert scale for the two points related to “strongly agree” and “agree” were merged under affirmative responses.

### **Demographic data**

Out of the 17 teachers who completed the questionnaires, seven were female and 10 were male teachers; out of these, 11 were full timers while six were part-timers. Regarding their highest degree, three had a bachelor degree, seven had a Master’s degree, six a teaching diploma, and one was working on a doctoral degree.

### **Student attitude in math in single-sex versus co-educational classrooms**

This section was subdivided into two parts. In part 1, we had four items asking teachers’ opinion about students’ attitude (Table 1), and in part 2, we studied the correlation between teachers’ gender and students’ attitude in single versus co-educational schools.

#### **Part1: Teachers’ opinion about students’ attitude**

25 % of teachers in single-sex schools and 44.4% in co-educational schools stated that students’ misbehavior such as noise and fighting affects their teaching, while 75% of those in single-sex schools and 66.6% of those in co-educational believed that this is due to large class sizes. Moreover, teachers seemed to complain about students who do not raise their hands to ask questions (50% in single sex and 77.8% in co-education), giving therefore a feeling of disrespectful attitude (75% in single-sex versus 50% in co-educational settings) (Table 1).

**Table 1. Students’ attitude in math in single-sex versus co-educational classrooms.**

Affirmative answers		
Schools Students attitude	Single-sex schools	Coeducational Schools
1. Level of student misbehavior (such as noise or fighting) interferes with teacher’s teaching	25%	44.4%
2. Large class size as a factor of misbehavior	75%	66.6%
3. Students in class do not raise their hand to ask questions	50%	77.8%
4. Students show disrespect with side talking, disobedience, and not listening to teachers’ explanation	75%	50%

On the other hand, almost the same percentage of teachers in both systems (single versus co-education) seemed to advocate for the settings they belonged to since 57.2% said that single-sex education reduced negative behaviors during math classes versus 55.5% in co-education schooling.

**Part 2: Correlation between teachers’ gender and students’ attitude in single versus co-educational schools**

When data was analyzed using the two-way ANOVA Mixed test to check the effect of teachers’ gender on students’ attitude, results showed that there is a statistical significant interaction between the effects of teachers’ gender in both single-sex and co-educational classes on students’ attitude (Sig. <0.05) (Table 2).

**Table 2. Tests of Between-Subjects Effects.**

Dependent Variable					
Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	273.971 <sup>a</sup>	3	91.324	4.488	0.023
Intercept	11520.444	1	11520.444	566.222	0.000
Gender	100.000	1	100.000	4.915	0.045
Group	2.778	1	2.778	0.137	0.718
Gender * Group	169.000	1	169.000	8.306	0.013
Error	264.500	13	20.346		
Total	13699.000	17			

Corrected Total	538.471	16			
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a. R Squared = .509 (Adjusted R Squared = .395)

In order to determine if there is a significant mean difference for the variable "student attitude" based on teachers' gender, we did an independent sample T-test. Results showed that the average for male teachers was 29.95, and for female teachers 24.86. As for the normality of the student attitude variable, it was verified using the Shapiro-Wilk Test of normality according to the gender ( $p > 0.05$ ). The t-test results were  $t(15) = -1.904$ ;  $p < 0.05$  (Table 3).

**Table 3. Students' attitude based on teachers' gender.**

Students' attitude				
Gender	N	Mean	Std. Deviation	Std. Error Mean
Female	7	24.86	5.699	2.154
Male	10	29.90	5.152	1.629

Therefore, we observed a significant mean difference of the variable "student attitude" according to teacher gender, which means that female teachers seemed to be more tolerant to disruptive behavior than male teachers. Accordingly, the hypothesis "female teachers were more tolerant of disruptive behavior than male teachers in math classes" was verified.

**Teaching strategies**

50 % of teachers in single-sex schools and 40% in co-educational schools stated that they consider the exam grades to modify lesson plans or teaching methods in areas where students encountered problems. Nevertheless, 62.5% of those in single-sex schools and 55.5% of those in co-educational said that they teach students how to apply math in real life. Regarding the item "training in gender-related instructional strategies", 25% of teachers in single-sex vs. 11.1% in co-education expressed their need for such programs (Table 4).

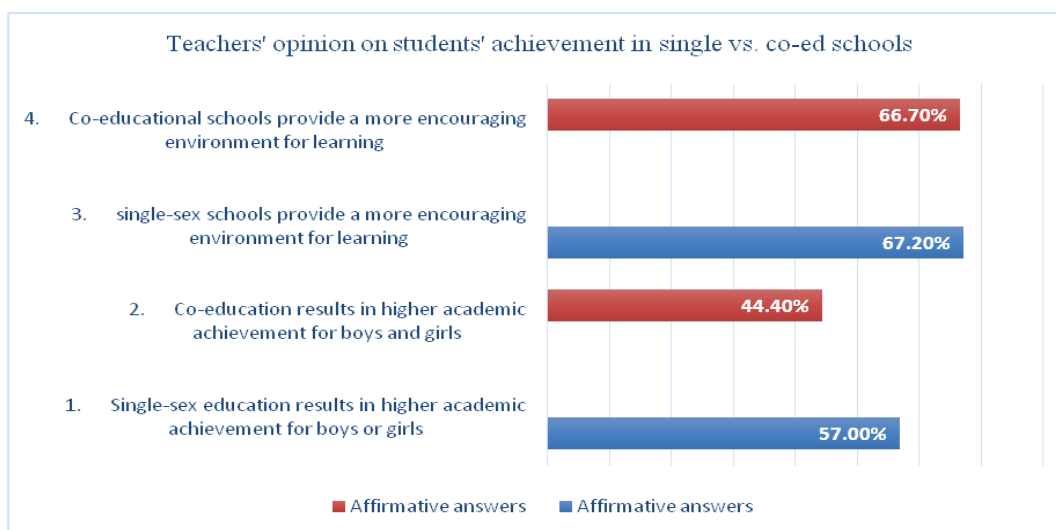
**Table 4. Teachers’ instructional strategies in single-sex versus co-educational classrooms.**

Affirmative answers		
Schools Instructional strategies	Single-sex schools	Co-educational Schools
1. Use of exam grades to modify lesson plans or teaching methods in areas where students encountered problems	50.0%	40.0%
2. Teaching how to apply math in real life	62.5%	55.5%
3. Teachers’ need for training in gender-related instructional strategies	25.0%	11.1%

**Teachers’ opinion about single-sex versus co-education**

This section inquired about teachers’ perceptions regarding students’ achievement and the learning environment.

57.0% of single-sex math teachers said that students in single-sex classes performed better than those in co-education settings. This opinion was somehow ascertained by 44.4 % of teachers in co-educational settings who said that “education in co-educational schools results in higher academic achievement for boys and girls”. On the other hand, the result for whether single-sex or co-educational schools provided a more encouraging environment for learning came approximately similar (respectively 67.2% versus 66.7%) (Figure 1).



**Figure 1. Teachers' opinion on students' achievement in single vs. co-ed schools.**

## **Open-ended part**

In the open-ended part of the questionnaire, teachers were asked to add comments they could find interesting regarding gender and schooling. Data was coded and categorized into themes. The recurrent responses came as follows for both the single-sex and co-educational settings: parents' "carelessness" about their children involvement in schoolwork and students neglecting their homework, which constituted an added burden on teachers in the classroom. Moreover, teachers raised the need for modifications to be brought to the curriculum according (a) to the type of classes, single-sex or co-educational because teachers use nowadays the same lesson plan in both systems, and (b) to official low exams results (Brevet and Baccalaureate) so that teachers may change instructional strategies because "the school and parents wait for the grades in order to blame the teachers, forgetting all the hard work they've done throughout the year". Furthermore, teachers raised the importance of group work to increase motivation, and mostly, they requested embedding more technology and real life problems in math classes taking into consideration students' gender.

## **Class Observations**

Class observations were done in seventeen Mathematics classes during a whole session that lasted 45 minutes each. Teachers and students were welcoming as chairs were prepared in the back of the classroom. Based on the class observation grid, we looked at the premises, instruction and students' attitude.

### **Premises**

Classes observed in the nine schools were simple, orderly, and clean but had no educational displays or visual aids set up on any wall. Only one class had some poetry and comprehension papers written by students who got the highest grades in the Arabic class displayed on the billboard, and one class exposed a sports and football schedule.

Moreover, classes were not equipped with the basic supplies needed for math classes; these were brought from the administration office either by the teachers or one of the students who had to bring them back at the end of the session. Students' desks and chairs were arranged in rows. Classes had an average of 28 students, except for one general sciences class in a single-sex school where there was only four female students. In all co-educational classrooms, alike genders sat next to each other on the same desk, with the exception of school A where both genders were allowed to sit next to each other on the same desk.

### **Instruction**

All teachers used the math textbook requesting students to solve problems from the book. Eight out of the 17 teachers began the lesson without any icebreakers while



the others asked the students to summarize the last session or checked their homework. 12 teachers engaged the students equally, giving each one a chance to do an exercise on the white board or answer a question orally. However, when asking questions, teachers did not wait students to raise their hands, they made sure to engage almost everyone in the class by addressing questions directly to them; students seemed used to this type of interaction since they were also answering directly without raising their hands. As students were solving math problems, nine out of the 17 teachers corrected the exercises right away on the white board, while six others interacted with students differently, asking their peers to come over to the board to correct the mistakes and bring up the right explanations. However, in a more traditional way, one of the teachers in a co-educational class in school (B) answered most of the students' questions and went around checking homework; however, her main concern was getting through the material before beginning a new lesson in the next session, and this made her overlook many students' questions.

In most of the classes, students seemed comfortable with the instruction, except in school (F) where some students looked as if they disconnected for some time. As such, in one of the girl's single-sex classes, a 60-year-old male teacher was solving exercises alone without any interaction with or feedback to students. On the other hand, most of the teachers used the textbook as a reference in teaching and solving problems while only teacher A1 used real life problems with two different examples: one for boys with a sports game scores and another one for girls related to shopping and sales in a mall.

### **Students' attitude**

Three out of seven female teachers (A2, B1, and H2) in co-educational schools, two in grade 9 and one in grade 12, had to deal with many situations of misbehavior in class: students would not stop talking or moving around in class without permission. These teachers were patiently repeating: "please *sabaya* (girls) and *shabeb* (young men) calm down, you need to understand this well for the official exam" or "Bravo, although the class is being disruptive, X understood this idea well but needs to change his place and sit on this desk alone in front of me". Disruption came as well from an external factor in school A as a supervisor entered the classroom and asked 12 out of the 17 students "not to come to school the next day without their parents" because there was a need to discuss grades and behavioral problems. This interruption resulted in class chaos and it was difficult for Teacher A2 to proceed with explanations. On the other hand, three out of the 10 grade 12 male teachers, two in co-educational schools (G1 and I2) and one in single-sex (E1), had difficult classes, and had to raise their voice many times threatening students that they would stop teaching before the official exams in order to get their attention.

## DISCUSSION AND CONCLUSION

The aim of the present study was to investigate school principals and teachers' perceptions about (a) students' performance in mathematics in single-sex versus co-educational schools in Lebanon, (b) instructional methods used according to student gender, and (c) the effect of teachers' gender on students' attitude.

### **Public school principals' and teachers' perceptions about students' performances in single-sex versus co-educational schools.**

Our findings showed that the type of schooling was not a major factor affecting students' performance. This opinion was somehow ascertained by 44.4% of teachers and 33.3% of principals in both single-sex and co-educational settings one of whom said that "education in co-educational schools results in higher academic achievement for boys and girls". This result supports other research that showed negligible differences in boys' and girls' performance in math classes in private and public schools in UAE, Cyprus and Lebanon (Alkhateeb, 2001; Georgiou et al., 2007; Sarouphim and Chartouny, 2016) but contradicted what Demartino (2008) ascertained about the benefits of single-sex education regarding class interactions and achievements. Data from Principals' interviews and teachers' questionnaire indicated that the same lesson plan was implemented in both types of schooling, which yielded, according to them, to the same results at official exams. This shows that there is no difference between boys and girls, and hence contradicts how society labels boys versus girls' learning as pointed out by Resnick (1987). However, principals and teachers stressed out a number of factors that they believed were negatively influencing students' performance: (a) class size : while they had around 23 students per class, teachers complained that this number should be reduced to 15 students, which would be unrealistic; (b) parents' lack of involvement in their children education, which seemed to be a major concern that was also noticed during one of our class observations with a supervisor's intervention who entered the classroom and asked 12 out of the 17 students "not to come to school the next day without their parents" because there was a need to discuss grades and behavioral problems; (c) gender-related concentration, as explained by Thomas (2006), whereby boys were more agitated in class while girls focused more on instruction, which in return yielded to achieving better results in mathematics, ascertaining again Demartino's (2008) and Fabes' (2015) findings about single-sex school principals' views, and finally (d) girls' socio and cultural economic background.

Interestingly, single-sex schools principals went beyond our concern related to math teaching and raised the issue of gender in class activities for two main points: sports and extra-curricular such as theater. Though they did not have solutions, they refused the idea of mingling with the other gender bringing one principal of a boys' school to critic this situation, hence ascertaining Kirner's (2013) point of view, and Rex and Chadwell's (2009) who believed that single-sex schools deprive children of a real

co-educational experience of work and family while in real life, students are connected to each other through social media.

### **Teaching strategies**

Principals and teachers noted that there was no difference in teaching strategies for boys and girls, and that lesson plans were the same for both types of classes since most of the teachers teach in both single-sex and co-educational schools. According to Schensul, J. and LeCompte M.D. (2013), "mixed-methods ethnographic research has been the norm for many years, and has become increasingly popular." (p. 80). Furthermore, we based ourselves on essentials required for data collection in an ethnography study, as shown above: "relating, communicating-listening, questioning, explaining, discussing, observing, recording revising/reframing" (Schensul, J. and LeCompte M.D., 2013; p. 8). As non-participant-observers, we went through the three different approaches to observational processes, developed by (Werner and Schoepfle 1987, 262-64) : the "descriptive observation" at the beginning of the process to record details of the single and co-educational schools' settings, the "focused observation" where we found out significant factors during our interviews and contact with teachers, and "selective observation" where we focused on class interactions (Werner and Schoepfle 1987, 262-64). This was also ascertained through class observations whereby explanations and exercises were literally based on the textbook without any type of group work and student-to-student collaboration. Through class observations, we could see the type of communication and explanation that happened in class as recommended by Schensul, J. and LeCompte M.D. (2013; p. 8), focusing on class interactions as a factor of engagement in the teaching-learning process (Werner and Schoepfle 1987, 262-64). The traditional way of teaching revealed the importance of training raised by teachers in the questionnaire. It meets what Demartino, 2008 and Hameline (1998) stressed out as to the importance of lesson planning that should trigger students' cognitive skills and Guarisco (2010) who elaborated on the difference in boys' and girls' interest, and the need to adapt adequate instructional strategies that can motivate each gender to achieve better. The latter was observed in fact in one of the co-education schools where the teacher used different exercises related to students' interest (football for boys *versus* shopping for girls) to stimulate their interest and capture their attention. Thus, the first hypothesis "there was a significant difference in instructional methods used in math class based on gender in single-sex classes versus co-educational classes" could not be confirmed.

### **Student attitude in math in single-sex versus co-educational classrooms**

Principals in all schools were more inclined to favor female teachers who seemed to be more appreciated, which was also observed in most classes as female teachers were more patient and more tolerant with disruptive behavior than male teachers who threatened students to stop teaching in such cases. Moreover, two principals noted that female teachers usually "act like mothers" for their students,

bringing male students for more respect and better behavior while acting as role models for female students. This contradicted somehow Thomas (2006) who stated that the teacher's gender shapes communication between the teacher and students and appears as a gender-specific role model to them.

Our findings also showed that single-sex school principals favored the type of education they were leading more than their counterparts in co-education settings who seemed less concerned by the gender issue. Even in teachers' responses only those in single-sex schools insisted that single-sex education reduced negative behaviors, which supported the South Carolina Department of Education (2008a) findings.

Accordingly, the second hypothesis "female teachers were more tolerant of disruptive behavior than male teachers in math classes" could be confirmed.

### **Limitations and Future Studies**

As an exploratory mixed study, the sample size was limited to nine schools and seventeen teachers, which cannot yield to generalize the results. To build on our findings, further studies could (a) investigate student's perception and attitude about learning Mathematics in single *versus* co-educational public schools in Lebanon, and (b) examine the achievement in mathematics.

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