

**Closing the Gender Gap in Education: Making a Difference in Math and Science
Classrooms**

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Abstract

This study presents research that was conducted in the Sandhills Region of North Carolina. In particular, the study involves focus group questionnaires that were distributed to two high schools within the Sandhills Region. The purpose of the study is to establish an understanding of the difference between male students' and female students' perceptions of Science, Technology, Engineering, and Mathematics (STEM) courses and career pathways, as this will provide further evidence to suggest how educational leaders, teachers, and university teacher-education programs can work toward closing the gender gap in education. The literature review and results sections will provide substantive evidence to suggest that progress is being made in the way of closing the gender gap, but this process remains ongoing in the twenty-first century.

Introduction

Closing the gender gap in PK-12 education has been a topic of consideration for decades. In fact, Hyde, Lindberg, Linn, Ellis, and Williams (2008) note the following: “Stereotypes that girls and women lack mathematical ability persist and are widely held by parents and teachers” (p. 494). In essence, what this implies is that gender-based stereotypes are, in part, why females have previously not been encouraged to take STEM classes or engage in STEM projects, majors, and career fields. Likewise, consideration must be given to the reasons why males are more likely to pursue the STEM classes, as boys typically need more hands-on activities, which are common in STEM classes. If the schools are limited on STEM courses, the schools may seem to be more geared toward female students because of the structure to sit quietly like sponges, merely absorbing what the teacher delivers. In an effort to determine factors that contribute to the gender gap among males and females within the STEM content areas, the researchers of this study developed focus group questions that prompt the students to provide substantive responses about their perceptions of a variety of topics involving STEM.

Purpose and Objectives

This study examines secondary school students’ perspectives of subjects in high schools, to include Science, Technology, Engineering, and Mathematics (STEM) courses. This study uses focus group questionnaires to gain insight into the courses that high school students deem engaging and appealing. The study also considers the students’ first introduction to STEM courses, as well as the students’ past and present attitudes toward STEM courses.

Review of Related Literature

A cursory search of literature reveals that several previous studies have revealed that males are outperforming females in the math and science classes within the PK-12 setting;

however, more recent literature reveals that females are actually outperforming males in the math and science classes within the PK-12 setting. One particular reason why females are less apt to pursue STEM fields is gender stereotyping. In fact, Hyde et al. (2008) note the following: “Stereotypes that girls and women lack mathematical ability persist and are widely held by parents and teachers” (p. 494). The implication of such a striking fact is that gender-based stereotypes are, in part, why females have previously not been encouraged to take STEM classes or engage in STEM projects, majors, and career fields. Additionally, Hyde et al. (2008) furthers that “Gender differences in mathematics performance and ability remain a concern as scientists seek to address the under-representation of women at the highest levels of mathematics, the physical sciences, and engineering” (p. 494). Thus, experts and educators are concerned about the disparity among males and a female in STEM, as there is a growing concern about how to increase continued interest in the STEM courses as the females matriculate through their academic years.

Whitmire and Bailey (2010) explain that over the past 20 years, “discussions of gender equity have fallen into an either/or paradigm in which one group of students has been singled out as the only group needing attention,” and although females in STEM tends to be one of the trending topics among researchers and educators, continued research on males in English Language Arts courses should also be of concern. Research indicates that “When you examine state tests...you see that girls have pulled even with boys in math and science. In some cases, they outscore boys in those subjects” (Whitmire & Bailey, 2010). However, little evidence suggests that boys have pulled even with girls in the reading and writing, or English Language Arts, courses. Instead, despite the fact that girls are performing alongside the boys in the sciences and mathematics courses, Lichtman (2013) asserts that a report by the American

Association of University Women explains: “Well, among college grads, men outnumber women in nearly every science and engineering major.” Lichtman (2013) questions why there is not an increase of women in the science workforce if more females are taking science in school. The literature questions how encouraged females are to pursue occupations in STEM Robelen (2014) notes that “gender divides are still apparent, especially with participation in the STEM fields of science, technology, engineering, and mathematics.” Robelen (2014) says that “Recent federal data show just one-quarter of people working in those fields are women; one in seven engineers is female.

Methods

A qualitative approach was used to gather the data in an attempt to gain insight and develop generalizations about closing the gender gap in math and sciences education. The researchers used focus group questionnaires to gather the student responses. In order to gather the data, the researchers engaged in a systematic study of the males and females at two rural high schools in North Carolina. The researchers physically went into the schools and met with administrators prior to conducting the study. After meeting with administrators, the researchers distributed the questionnaires to the teachers who, in turn, prompted the students to complete the questionnaires. The only demographic information that students were asked to provide was their self-identified gender. The researchers returned to the schools one week later to collect the data. After all of the data was gathered, the researchers sorted and analyzed the data, focusing on common recurring themes in the students’ responses. The focus group questions that guided this study were as follows:

1. What subject is your favorite? What about this subject do you enjoy?

2. Are you aware of the acronym STEM? What is your attitude toward STEM (Science, Technology, Engineering, and Mathematics) classes?
3. Rank the importance of science, technology, engineering, and math. Do you enjoy English or social studies courses better than math or science, why or why not?
4. What would you suggest teachers do to make STEM courses more engaging and interesting to students?
5. What is your career intention? Have you considered a career in a STEM field? Why or why not?
6. Were you introduced to the STEM fields in elementary, middle, or high school? What is your earliest memory of a STEM content area?
7. Did you once have an interest in the STEM content areas at an early age, such as elementary school, but lost interest as you matriculated, or progressed, through the grade levels?
8. What is your impression of the teachers' attitudes toward boys and girls in STEM courses? Have you been discouraged or encouraged to pursue an interest or career in STEM by your teachers, if so how?
9. Has your family encouraged you to pursue a role in a STEM field? What particular role has been encouraged (e.g. engineering, biology)?
10. Do you think that you will get into a good college and major in an area needed for a career in science, technology, engineering, or math, why or why not?

Participants

839 Students from two rural high schools in North Carolina's Sandhills Region, Region 4, participated in the research study. One high school, coded School A, is in Hoke County, and

this is the only traditional high school in the county. The county also has an Early College High School and alternative high school, but neither of those schools was included in this research study. The other high school, coded School B, is in Cumberland County. From School A, 90 self-identified females and 91 self-identified males participated in the study. From School B, 312 self-identified females and 338 self-identified males participated in the study. Thus, the total number of participants in this study is 182 from School A and 657 from School B. The participants ranged from freshman through senior levels.

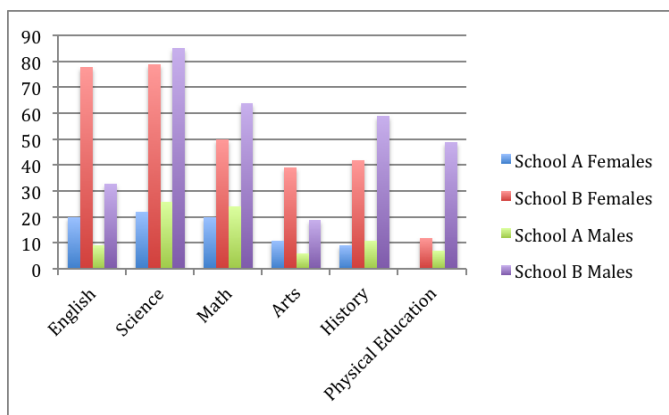
Results

Focus Question 1

Focus Question 1 asks students to identify their favorite subject. To that question, the students' responses are indicated on Figure 1. Although Figure 1 does not depict why the students chose such subjects, the students cited various reasons why the subjects were their favorites: some students contended that the subjects were easy, other students explained that a certain teacher or homework load swayed the student responses, and students appreciated the hands-on aspect of science classes.

Figure 1.

Results to indicate students' favorite subjects.



Focus Question 2

Focus question two asked the students if the students were aware of the acronym STEM and what their particular attitude was toward STEM classes. In response, students at both School A and B seemed confused about the acronym. Some students thought it directly related to an anatomy course about males and females, while other students simply responded “no” in that the students were not aware of the acronym. In the question, next to the acronym STEM, is an explanation of STEM as science, technology, engineering, and mathematics; however, the majority of students explain that they have no concept of such a program. For instance, one student says that he is aware of the STEM classes, but “the STEM classes seem just like any other classes.” In essence, one might consider that educators in the secondary setting are not explaining that science; technology, engineering, and math courses are, in fact, STEM courses.

Focus Question 3

Focus question three asked the students to rank the importance of science, technology, engineering, and math. It also asked students if the students enjoyed English or social studies courses better than math or science. At School B, the majority of females responded with surprising remarks that science classes were the most important, but instead of following science with technology, engineering, or math, the females actually stated English was a close second to science courses. About one quarter of the female students at School B remarked that all of the courses are essential to learning and growth, but, once again, science and English were the predominant responses. Of the males at School B, math ranked highest, with engineering and technology as the second most common in terms of level of importance. Overall, science was ranked fourth for the majority of males, but some males ranked science as the most important. Of the males, only seven remarked that English was the most important or of equal importance to

the STEM courses. At School A, males ranked math as the highest, as well, but science was the most prevalent response for second highest in importance. Following math and science were engineering and technology. Once again, about one quarter of the students claimed that English was more important than at least one of the STEM content areas. In fact, many males contended that English was more important than science; therefore, if science was ranked second, it is noteworthy to mention that many male students at School A believe math and English are the two most important content areas, followed by science, engineering, and technology.

Focus Question 4

The fourth focus question prompted students to respond about what the students would suggest that teachers do to make STEM courses more engaging and interesting to students. The purpose of this question is to consider the varying perspectives of males' and females' attitudes toward the courses that are offered in science, technology, engineering, and mathematics. The students are the individuals who make the decision to take STEM courses and pursue the STEM-based path in academia, thus educators must develop an understanding of how to develop attitudes and curriculums that promote more engaging and interesting STEM courses to both males and females. To this question, numerous male and female students, alike, discussed that being "more active"; "more interactive activities"; and, "having hands on activities" would provide for a more engaging and interesting STEM course. In fact, having hands-on activities was a primary response because the students clearly want to be a part of the learning experience. To that, one female student discussed that the teachers should find more interesting ways to teach the material so that the students can remember the information. Retention, thus, is a factor in female students' decisions to take or not to take STEM courses; however, one might suggest that

in order for the students to retain the information, the students need to be actively participating in the learning experience.

Focus Question 5

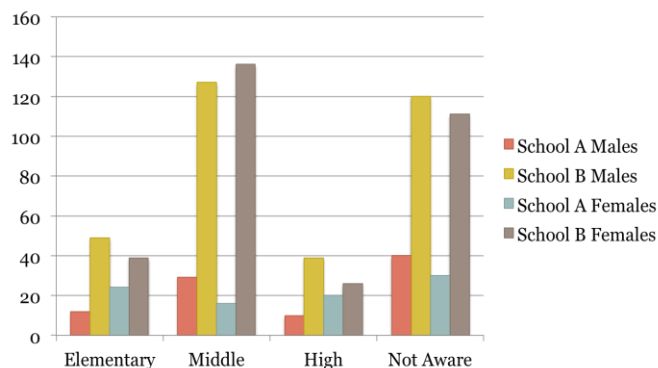
Focus question five asks what the students' career intentions include and whether or not the students have considered a career in a STEM field. One student acknowledged that he wanted to become a dentist but had no intention of going into a STEM field. Two male students discussed becoming doctors without entering into a STEM field. In consideration of female students, one female said "I want to be a psychologist so it is in the STEM." Another female stated: "All jobs require at least a little STEM knowledge." Still yet, another female said, "Yes, I want to be a veterinarian." Very few females, even those who were not interested in STEM fields, had difficulty making the connection between certain careers and STEM fields; whereas, the males seemed to be interested in STEM fields but had little knowledge that the fields provided were, indeed, STEM-related.

Focus Question 6

This particular research question asked students if they were introduced to the STEM fields in elementary, middle, or high school. Figure 2 indicates the results of this focus question.

Figure 2.

Results to indicate student's earliest memory of STEM coursework in school.



Focus Question 7

Focus question seven asks: “Did you once have an interest in the STEM content areas at an early age, such as elementary school, but lost interest as you matriculated, or progressed, though the grade levels?”; almost half of the female participants at School A simply said that they did not lose interest. Meanwhile, the remaining half stated that they did lose interest because the courses relating to science and math became too difficult. One student even replied: “I wanted to be a doctor, but someone told me it was too hard to do because of the math and science.” In other words, this particular female lost interest in STEM simply because someone taught her that she would not succeed in a STEM field. Once again, this directly relates to the stereotype of females in STEM. As for the male respondents, over half of the males at School A and three-quarters of the males at School B said that they once had an interest in STEM, but of that portion of respondents, only seven males said they lost interest over the course of time. Perhaps this striking fact lends one to grasp the ways in which male students are mentored in the areas of STEM, as opposed to how female students are not mentored in the areas of STEM.

Focus Question 8

Focus question eight focuses on the students’ impression of the teachers’ attitudes toward boys and girls in STEM courses. The question also asks if the student has ever been discouraged or encouraged to pursue an interest or career in STEM. In response to this question, the females at both schools had distinctive responses as compared to the male students. The majority of responses allude to the notion of being discouraged; however, the male respondents typically included the caveat that despite being discouraged, they would continue to pursue the STEM field. The females who further elaborated on being discouraged, on the other hand, explained that as a result of being discouraged, they stopped pursuing the STEM courses. One female from

School A stated that “I have been discouraged [because] of the attitude of the teacher.” Another female said that males and females were treated the same in her classes and also boldly stated the following of encouragement: “I have been encouraged by one of my teachers because he showed me a few jobs I thought were cool that used STEM.” A female student at School B claims: “All of my teachers treat everybody equal, but no it wasn’t them [the teachers] who encouraged me. It was my mom.” Once again, the student is neither receiving encouragement nor discouragement from the educators; instead, the female has a mother who is urging her daughter to take STEM courses and pursue a career in STEM.

Some females noted that they had not been discouraged or encouraged, but no further evidence was provided on what the teachers could do to encourage the females. One female from School A did note that “Guys are more dilatory, and girls aren’t.” Though the student did not further this response, it is noteworthy to consider that if this is the female student’s perception of males in STEM classes, females, thus, are more active and engaged in the STEM classrooms. To that, one female from School B notes that she has been encouraged but prefers not to pursue a career in a STEM field. In one of her previous responses, she notes that English, specifically reading and writing, are her favorite aspects of her high school education.

Focus Question 9

Though some students discussed their familial influences when asked previous focus questions, focus question nine asks, “Has your family encouraged you to pursue a role in a STEM field? What particular role has been encouraged (e.g. engineering, biology)?” 36 females at School A and 122 females at School B stated their families did encourage a STEM field. Of the responses, many females said a medical field, namely doctor, nurse, or pharmacology. The majority of males at both School A and School B simply said they were not encouraged, and

many noted that their families encouraged law enforcement or the military. As this school is in the Sandhills Region of North Carolina, which is directly outside of the Fort Bragg Military Installation, such a response seems logical and appropriate, especially if the parents are not sure of other known career fields in this region. A small portion noted engineering; math was not mentioned.

Focus Question 10

Focus question ten asks: “Do you think that you will get into a good college and major in an area needed for a career in science, technology, engineering, or math, why or why not?” 76.9% of females indicated yes they will get into a good college and major in an area needed for a career in science, technology, engineering, or math; 11.8% of females said no; and, 11.3% said they were not sure or were undecided. Meanwhile, only 54% of males said yes they will get into a good college and major in an area needed for a career in science, technology, engineering, or math; 27% of males said no; and, 19% said they were not sure or were undecided. These percentages indicate the totals for both School A and B. What is telling of these figures is that females appear to be more aware of the direction in which their academic careers will go. Educators must capitalize on that fact and encourage females to pursue STEM courses and careers in STEM fields.

Discussion

Several commonalities persisted among the students’ responses to the focus group questions. Perhaps of most importance is the need to be cognizant of the fact that if students are not being told about the acronym STEM and what it means, students will not be aware of their own personal interests in STEM fields. Another point of consideration is that females are as likely to be interested in STEM content areas throughout the secondary academic years;

however, in order to debunk the misconceptions and stereotypes of women in STEM fields, K-12 institutions must continue to reinforce the value of females taking science, technology, engineering, and math courses throughout the high school years.

Limitations and Suggestions for Future Research

Several limitations of this study should be considered. In particular, this study is only qualitative in nature and does not include the specific quantitative data to determine how males and females at these two schools are performing in STEM courses. Another limitation of the study is that the teachers provided the questionnaires to the students, thus the researchers were not able to encourage the students to provide substantive responses. For future research studies, the researchers recommend that the researcher sit down with the focus groups and verbally discuss the focus group questions with the students. Most importantly, the researchers suggest drawing data-based correlations between the students' responses and the students' actual performance in the STEM content areas.

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