Gender Differences in Science

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Perhaps an age old question in all fields of study; who performs better, males or females?
The differences between male and female reasoning, understanding, and perhaps most importantly attitude toward a given subject in their educational course of study has been questioned. In fact, a number of studies have indicated that girls and boys’ educational experiences differ qualitatively especially in the area of mathematics and science. Given the current data findings, it appears that the performances of girls and boys often trade places between elementary school and high school. Because of the differences, the purpose of this paper is to compare and contrast previous studies and their findings to better analyze gender difference and its relationship to science. Data from studies of elementary school aged, middle school aged, high school aged, as well as “gifted” students will be included in an attempt to accurately portray the answer to the question at hand; who performs better in science and what can be done to decrease the existent gender gap?

The first article, “Gender Differences in Attitudes Toward Science,” by Michele Trankina, presents the findings of a nationwide survey taken from 1972 through 1990 indicating that females have less confidence in science than their male counterparts. This study differs from the other articles that will be discussed because the studied age group is 20 to 79 years of age. However, as will be seen momentarily, the findings are relatable in that from the age of a high school student, 18 years, through adulthood, women have different attitudes towards science than men. For this study, “nationwide door-to-door surveys of a median length of one and one-half hours with about 1500 respondents each were conducted annually since 1972 and were representative of the entire English-speaking, no institutionalized population of the conterminous United States” (Trankina, 124). This data is apart of the General Social Surveys (GSS). A series of questions were presented asking about personal attitudes toward science and scientists, and the participants were told to answer either agree or disagree. The responses were used in a mathematical equation to compute the findings. The results were not surprising; spanning the age range of the study, “males were significantly more confident than females in science” (Trankina, 126). The findings from the questions also reveal a more negative attitude toward science in
females; “more females than males believe that science breaks down people’s ideas of right and wrong and that science pries into things“ (Trankina, 127). It appears that this negativity may account for the lower number of women than men in science fields.

Although the second article is a guest editorial piece in the Journal of Research in Science Teaching, not a standard research article, it draws from the National Assessment of Educational Progress’s (NAEP) evaluations of science in schools and reports relevant findings about gender differences in attitudes and performances in science. The findings are significant statistical reports, and thus this article was included in the analysis. Jane Butler Kahle, in her editorial “Will Girls Be Left Behind? Gender Differences and Accountability,” analyzes the findings of multiple NAEP assessments for science achievement. The first part of the title, “Will Girls Be Left Behind,” refers to Kahle’s concern about the place of girls in the No Child Left Behind Legislation. Her intention in writing the article is to bring light to the gender gap in science in an attempt to keep girls afloat in the legislation that could cause them to drown. In the NAEP studies, scores were reported for four age levels: 9, 13, 17, and young adult - age 25-35 years. According to the assessment, “findings in science showed that males outperformed females in all age groups, with the differences increasing with age” (Kahle, 962). The findings for this article are similar to the first article. Although the first article measured confidence levels instead of performance levels, the similarity that exists is male dominance and superiority. Kahle, in her article, questions the validity of the test questions and suggests the possibility of biased tests toward areas where boys, compared to girls, “historically have taken more courses, have had more out-of-school experiences, and have shown more interest” (Kahle, 962). Kahle also reports the results of a 1977 science assessment in which 66% of 9-year old girls reported that science interested them, whereas only 59% of boys the same age felt this way. However, at age 13 the positive feelings that girls felt toward science changed; 34% of girls compared to 40% of boys age 17 liked science. This figure should not be surprising considering the similar pattern that appears; boys enjoy and like science more than their counterparts.
The third article, entitled “Gender and Grade-Level Differences in Science Interest and Participation,” was a studied aimed at assessing students’ attitudes towards science. According to the study, “two to three classes at each grade level from K-12 were surveyed to assess and compare attitudes toward science, extent of prior science-related experiences, and perceptions of science and scientists” (Greenfield, 259). In addition, the study focused on student-teacher interactions compared to gender to see if there was a relationship between gender and attention to questions and concerns in the classroom. The ultimate goal of this research, however, was “to investigate the possible existence of traditional science related gender differences within the context of a nontraditional situation,” (Greenfield, 260) where nontraditional refers to an advanced science classroom dominated by girls. From this study the researchers would be able to determine if girls do better in an environment surrounded by other girls as compared to their performance in a more traditional male dominate classroom. All participating classrooms in the study were observed for at least 30 minutes during one or two science lessons. A survey to assess attitudes and perceptions of science was a second aspect of the study. The grade levels were combined into groups: K-3, 4-6, 7-8, and 9-12. Like the second article, this study found that elementary school girls like science more than the boys of the same age level, however the relationship was reversed in high school; high school aged girls like science less than high school aged boys. Another component to the study was gender based attitudes towards scientists and it was found that “boys more than girls seemed to think that one must be highly intelligent to become a scientist, and boys expressed a stronger male-stereotyped view of science and scientists than girls did” (Greenfield 264). From the classroom observations it was found that boys received more teacher attention than girls, but the girls were as likely as boys to seek it out. This finding does not directly suggest that boys are favored in science classrooms; however, it does seem to indicate that if girls did not initiate questions in class they would not receive the same amount of attention as the boys who were simply called upon. One last point of interest that the study points to is that “girls seem to believe that, whether or not they particularly like the science
courses they take, they nonetheless are capable of *doing* the science required by them” (Greenfield 270). The fact that this study reported this finding is promising because it offers a possibility of determining a way to decrease the gender gap towards the attitudes of science. Given that girls believe they are capable of doing science is a glimmer of light to equality of the sexes. What remains is an educational system which supports science throughout the entire educational career of both males, but more importantly females.

Unlike the previous two articles, this third article provides the aspect of classroom observation in addition to the typical surveys aimed at gathering the feelings and attitudes of girls and boys towards science. The interaction of teachers with their students could be a link the ties students attitudes to the science curriculum. It could be possible that the attitudes towards science of high school girls and boys stems from a teacher in the elementary levels of their education. This article even made mention of a girl’s positive attitude toward science as a result of a woman elementary school teacher. The reports of the first two articles are important because they highlight the gender gap in science; however they do little to suggest possible solutions in terms of findings from other components of their study. This third article effectively incorporates both.

The forth article, “Science Enrichment Programs for Gifted High School Girls and Boys: Predictors of Program Impact on Science Confidence and Motivation,” by Jayne Stake, and Kenneth Mares investigates the impact of two science enrichment programs on the science attitudes of gifted high school students. In an attempt to conduct a more cohesive evaluation the following items were indicators of change: “(a) student subjective ratings of program-related change, (b) student written descriptions of change, (c) parent ratings of student change, (d) parent written descriptions of change, and (e) a third administration of the repeated measures at a 6-month follow-up” (Stake & Mares, 1068). These indicators were combined with the traditional pre- and post questions, which target the overall success or failure of the program. Two science enrichment programs were administered. Program I “was designed as an initial science enrichment experience” (Stake & Mares, 1069) in which the students attended a full-time, 4-week
summer program in science, which provided the following: instruction on the elements of the scientific process, close mentoring from teachers, information on careers in science, and social activities to develop interpersonal ties to other students in the program. The second program, Program II, “was a 6-week intensive, full-time summer program that contained all the elements of Program I plus provided time for students to carry out their research proposals and present their findings.

One interesting finding is that the research suggests no significant positive change in attitude were found when comparing pre- and post test measures. This would indicate that the program was ineffective; however, the researchers suggest that the original pre-test scores were inflated because of the caliber of students. These were gifted students and thus they might have more positive attitudes towards science in the first place because they might excel in it more so than average high school students. Another aspect of the study was to inform students about the possibilities of careers in science. The findings suggest that “when students are exposed to extensive information about science careers, they may reevaluate their goals and possibly entertain alternative directions in science without losing interest in pursuing a science career” (Stake & Mares, 1080). Differences found between Program I and II provide evidence of the importance of providing sequential science enrichment experiences as a means to foster a positive outlook on science. Students who were returning for a second experience to work on a research proposal in Program II “reported more positive changes than first-time students in either program” (Stake & Mares, 1081). Out of the four articles, this is the first to suggest the importance, as well as, the impact of continual programs in science. In addition to the findings already stated, family encouragement and influence from a science teacher were strong predictors of the impact of the program. The more support the students had, the better their experience was. Speaking directly toward gender, it was found that girls who had less science advantages or experiences than boys reported more program gains. Knowing this information is important.

In the first three articles reports of lower interest and performance in science were noted
for girls. Unlike the other articles, this forth article not only states that fact, but provides evidence for a possible solution to the gender gap; the solution is more science enrichment programs. Further, because the programs avoided male-dominated experiences, the atmosphere was a positive one aimed at better appreciation for science. This allowed for the girls to thrive and not feel threatened or inferior to their male counterparts. Despite the fact that this article is an enrichment based study for gifted students, the finding can be applied to all levels of high school students. A more positive environment, stronger student-teacher relationships, and stronger parental and social support create a greater likelihood of success in science.

Finally, the last article is the most recent study of gender effects and attitudes towards science. Jayne Stake, and Shannon Nickens, in their article entitled “Adolescent Girls’ and Boys’ Science Peer Relationships and Perceptions of the Possible Self as Scientist,” analyzed the effect of science peer relationships. The participants for the study were chosen for a summer science enrichment program on the basis of “ability, science interest, and teacher recommendations” (Stake & Nickens, 4). The study was 4-6 weeks in length and the program was structured to “foster cooperative working relationships among participants” (Stake & Nickens, 4). Pre- and post tests, as in all the studies discussed, were administered to determine the importance of science peer relationships and how the participant view the possibility of themselves as a scientist. It was found that having peers to share science interests with would enhance both girls’ and boys’ imagined future as a scientist. It was also found that girls reported a stronger “niche” among peers for science support than the boys and these findings “provide evidence that science enrichment programs that encourage a high level of peer interaction may be particularly effective in establishing supportive peer networks among adolescent girls” (Stake & Nickens, 9). This article, like the previous one, focuses on enrichment programs outside of the normal science curriculum in schools, and both report evidence for the positive effect of these programs on high school aged boys, but more positively and perhaps importantly for girls. Some gender differences are discussed, but unlike the first three articles, the study focuses more on the success of
enrichment programs for all students. In that, this article is most comparable to the forth article in its approach and also its findings.

Despite the differences in the five articles discussed, there is a great message that exists when all are combined and meshed together. It appears that the best combination for science success is first continued support throughout the elementary years when interests are higher for girls, and in addition more focus on extra enrichment programs with social relationships and hands on approaches for the ultimate science experience. Given the right environment, the science skills and attitudes towards science can thrive for both girls and boys.

Works Cited


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