THE FEMALE SCIENTIST IN THE 21ST CENTURY
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INTRODUCTION

Much debate exists regarding the significance of gender roles in society. Linda Jean Shepherd, Ph.D., suggests that traditional concepts of masculine and feminine are not universal and are merely dependent on the mores of society. Shepherd referred to anthropologist Margaret Mead who “reported on cultures that defied the sex roles imposed on Western culture”.⁹

A very specific example of Mead’s research described the Tchambuli tribe in New Guinea where the usual patterns of behavior of men and women were reversed. Here women managed the business affairs, earned the money, fished, gardened, traded, and cooperated well with each other, while the men carved and painted, adorned themselves, gossiped, were moody, and engaged in ceaseless petty jealousies and rivalries with other men.⁹

These observations suggest that stereotypical masculine and feminine traits are not innate but result from cultural conditioning. A child’s disposition and personality seem to stem from the way he or she is reared, the certain kinds of behavior which are encouraged or discouraged, and the role models to which he or she is exposed.

This leads me to believe that there are no genetically predetermined roles for men and women in our society. Other societies may accept things the way they are, but here in the United States, as well as in other countries, some people want to change the status quo. A change in society is not a simple task, and this is complicated by the many different views held by members of a democratic society. One particular problem in the United States is the gap in educational achievement scores between boys and girls.

In my opinion, men and women should not have ‘assigned’ careers which they are supposed to pursue and should be able to follow a career to which each individual is best suited. If women have less true aptitude for math and science, then there should always be fewer females than males in science and engineering careers. However, the situation is more complicated than this conclusion might indicate and women who would enjoy and succeed at careers in math and science are discouraged from doing so in several ways. Some of these forces are apparent when we look at the environment in which children develop, including subtle ideas and suggestions to which they are exposed. For the greatest advancement in scientific thought, every student who has an aptitude for science should be encouraged to pursue that interest. Mentoring is a powerful tool in overcoming negative forces and fostering equality of the sexes in the scientific and technical fields.

SECOND STAGE TRANSFORMATION: CREATING A NEW VISION IN THE 21ST CENTURY
2000 WEPAN National Conference
Some people may argue that students who cannot survive the rigors of scientific study on their own will not be of any benefit to the scientific community anyway. I argue that female students who may be discouraged by various factors throughout their scientific careers could benefit society and these students may indeed contribute significantly with the help of mentors. We should not prejudge the potential quality of an individual’s contributions. By discouraging a student in one of his or her early stages of learning, no one knows what was lost had the student been encouraged instead. We are not at a point where all questions have been answered and no one can predict that of which a child is ultimately capable. We should give every individual the opportunity to achieve according to his or her abilities and encourage each to follow their dreams.

TEST RESULTS

In the United States, the gap between the number of high achieving men and women in mathematical areas exists in children as well as in adults. According to David Deming:

Among seventh- and eighth-grade youth identified as mathematically talented, the male to female ratio in the mathematical section of the SAT test was 2:1 for scores in the range 500-600 but increased to 17:1 for scores greater than 700.²

In 1999, the mean SAT scores on the math section for college-bound high school seniors were as follows:

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
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<tbody>
<tr>
<td>531</td>
<td>495</td>
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This shows a tremendous decrease in the difference between the male/female scores for the math section of the SAT as compared to the scores reported taken from seventh and eight grade students. When surveyed about their intended college major, 8% of these seniors answered engineering and of this 8%, 81% were males and 19% females.⁸ It seems that these decisions were made without taking into consideration how well the students scored on these standardized tests. The females and males exhibited similar aptitudes for math, but many more males than females chose to pursue this course of study.

One possible explanation is that the girls looked at their early results and felt inadequate. It is general human nature to be more interested in pursuing something at which one excels. These girls may have matured biologically in the intervening years between middle school and high school and improved their skills. However, they also may have already formed ideas that they were less inclined towards mathematical areas of study.

In addition to this significant difference in the performance of males and females as children, David Deming also claims that “there is virtual unanimity in the psychological sciences that ... differences exist” between the academic abilities of females and males.² He claims that “females have better verbal abilities than males” and males “tend to be
superior in visual – spatial skills and mathematics”. Consider the lack of a female presence in the sciences, particularly engineering. Continuing on to the professional level, these differences are still apparent. According to Mairin Brennan, in 1985 “white males made up 47% of the work force [and] among all scientists and engineers women made up only 16%”.

MENTORING

When teenage female students see that generally boys achieve higher scores than girls on math exams, they often lose self-confidence and draw inaccurate conclusions about their innate abilities. This is a critical juncture when mentoring could make a difference. They need to see women who have gone through very similar situations and can encourage them; they need to see what they can do without comparing themselves to the other students in the class. Mentoring is extremely powerful and is beneficial to students in varied disciplines.

Over the summer of 1999, I participated in AWE (Attracting Women into Engineering), a two-week workshop, as a student mentor. The workshop, sponsored by the EIF and Rowan University, incorporated four faculty members from Rowan University College of Engineering, four student mentors from the college, and eighteen seventh and eighth grade girls from neighboring counties of the college. As an engineering student, this experience “encouraged [me] to recognize the importance of mentoring throughout my life”.

Students enrolled in this program acknowledged how much it had helped them and wanted to continue to help others by becoming mentors themselves. The goal of the workshop was that by “[improving] the girls’ understanding and appreciation of engineering, …their performance in science and mathematics in middle and high school [will improve which will in turn] increase the participation of these girls in future engineering careers”.

Programs like this one can encourage women to participate in activities which may have intimidated them before the program. This workshop gave the participants more self-confidence in their work and sparked interest for them in areas of study with which they were unfamiliar. Coming into the workshop, none of the girls knew what an engineer actually did. Not only did they learn, but also they became excited about pursuing engineering careers. This occurred due to effective mentoring on the part of the faculty, mentors, and other guests and speakers to which the girls were exposed. We did not tell the girls to be engineers. We told them what engineers do, conducted science experiments with them, and introduced some basic engineering concepts to them. After convincing them that they could do whatever it is that they chose, many of them responded on an anonymous survey that they wanted to become engineers.
CAREER/FAMILY BALANCE

Commonly, women who possess sufficient motivation to become engineers and scientists do so only to encounter additional setbacks which they need to overcome if they want to successfully practice in their respective fields. These women’s careers will be developing at the same time that they might otherwise be spending their time raising families. Not unlike other professions, the sciences are highly competitive and demanding. David Deming recognized this female dilemma by saying:

...professionals who lose several years from their careers in full-time child rearing may be seriously handicapped in their ability to achieve professional status on a par with those who devote full time to their work without interruption.2

The balancing act of how much time to devote to career as opposed to family is often a deterrent for women remaining in science and engineering careers. This conflict is a possible explanation for the fewer number of women choosing careers in the physical sciences and why those who do choose such careers do not rise to the same levels as their male colleagues.

According to Professor B:

Women can get through engineering school. That’s not the problem… the problem is whether or not they can make a life after engineering school, in terms of having a family and a career.5

Dr. B continues to explain that unless some major changes occur in the engineering profession, we will continue to have a difficult time bringing women into it. These changes, of course, may be more likely to occur if more women are in the workplace and instigate them.5 Somewhat like a Catch-22, changes in scheduling or travel time for female scientists which could draw more women into these professions will not come about without greater numbers of women lobbying for it.

When speaking about family responsibilities, Dr. D commented:

Now when I had my baby I realized it’s very tiring. Nobody… seems to think of the fact that when you go home, you have a full-time job at home too… You should be performing as well as anybody else… It is discouraging… You are not able to do a hundred percent either here or at home.7

One strategy for maintaining a successful career would be to not compare one’s work to that of one’s co-workers who may have different lifestyles than their own. Unfortunately, in a male-dominated field, it may be inevitable for a woman with a family at home to be compared to a man who has a traditional wife taking care of his family.
REMEDIY TO LOW REPRESENTATION OF FEMALES IN SCIENTIFIC FIELDS

Affirmative action may be the key to building up the numbers of women in scientific fields. Dr. C has suggested that affirmative action could positively encourage students to pursue their scientific interests, which would help the scientific community as a whole, but "the qualifications have to be absolutely there." Affirmative action is not needed to merely increase the numbers of poorly represented groups but to encourage those students who may be discouraged by the overpowering presence of another group. When I asked Dr. A her opinion, she commented that maybe some women are intimidated by the fact that it is kind of a male dominated field. They find it discouraging ... so they end up not pursuing it and those people could be making a valuable contribution. So probably in the end, science is suffering for that. So I just think that we should be encouraging Everybody. In this sense, affirmative action may do the job of recruiting qualified students to the sciences who otherwise would have been discouraged from pursuing those interests.

CONCLUSION

Although this paper focused on the situation of females in the predominantly male fields of science and engineering, I extend my argument to claim that all students, male or female, should be encouraged to pursue their interests regardless of whether these interests conform to the traditional roles existing in society. When most people get sick, they want a qualified nurse to care for them. Would you rather have a less qualified nurse take care of you because males who are interested in becoming nurses have been discouraged from pursuing this career? There will not be an overabundance of nurses, nor will there be an overabundance of scientists or engineers. Our current society is focused on both health care and the sciences and the more people we have working in both of these fields, the more our society will benefit.

Early test results may discourage female students in their schooling from pursuing interests in science; however, this can be overcome through mentoring. Many female students who are not encouraged or led by mentors are discouraged from continuing careers in science when they encounter the struggle of balancing a very competitive career with a family. When all is said and done, science and more generally society, suffer from lack of representation of women in science or engineering. This inequity can be minimized through successful mentoring of students.


6. Professor C, Ph.D., P.E. Professor. Rowan University. Personal interview. 23 November 1999.

7. Professor D, Ph.D. Professor. Rowan University. Personal interview. 23 November 1999.
