

Women in Math and Science: Examining Psychological Barriers to Learning

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Lawrence Summers, the outgoing president of Harvard University, caused outrage and anger throughout the academic community last year when he suggested that innate differences between men and women might explain why so few women become scientists and engineers. As the debate about the influence of genetic and biological factors on gender difference in male-dominated academic areas continues, the fact remains that women continue to be underrepresented in the areas of science, math, and engineering. Another explanation for gender differences in science and math involves psychological factors that influence and potentially undermine women's motivation and self-confidence to continue in these areas during college and graduate school. With the help of the Center for Teaching and Learning's summer grant, we hope to be able to examine some of these psychological factors so that we can identify barriers Agnes Scott students face in science and math courses. A second goal is to create teaching tools and techniques that might help to break down these barriers.

The first goal of our project is to understand the psychological reasons why students in math and science courses might not perform up to their intellectual potential. Psychological factors such as stereotype threat (i.e., feeling afraid that one might conform to their group's stereotype; Steele, 1997), lower self-esteem (Ryckman & Peckham, 1987), and lower academic self-confidence or efficacy (Eccles, 1983) have all been shown to hinder academic performance in women and girls. In a recent study of college students, women in male-dominated academic majors were more likely to report feeling threatened by negative gender stereotypes and to

perceive greater gender discrimination in the future compared to women in female-dominated majors and men in female-dominated majors (Steele, James, & Barnett, 2002). This same study also found that women in male-dominated majors were more likely to consider changing their major than other students. With our study, we hope to determine whether or not women at Agnes Scott feel threatened by negative stereotypes, perceive gender discrimination, and change their perceptions of math and science during the course of the summer session.

Our second goal is to create teaching tools and strategies that address psychological barriers to students' success in math and science. We want to boost the students' confidence in their math and science abilities in order to reduce their anxiety during exams. One strategy that we have found effective in the past is the use of short quizzes which are based on material from the previous day or week, depending on how often they are administered, and are easy for anyone who has been in class and kept up with the assigned work. From anecdotal experience, we believe that these quizzes help to increase self-confidence and feelings of efficacy in the students who have kept up with regular attendance and assignments. Another strategy is the development of student projects, dealing with the history of the subject, or current applications, or any related topics of interest to the students. The hope is that when students select the topic themselves, they will be more and engaged and confident with the material. This summer grant would allow us to further develop these teaching strategies and create new ones.

For this summer project, we propose to conduct a longitudinal study to examine the relationship between endorsement of stereotypes about women, gender identification, self-esteem, self-perceptions and desire to continue in the field for math and science students at Agnes Scott College. The sample for this study will be students in lower level math and science summer classes. To measure our variables of interest, students will be given a survey including

all measures three times during the summer semester. The survey will be given during the first two weeks of the class, at some point in the middle of the semester, and at the end of the semester. A unique identifier will be used to link the three surveys over the semester. Participation is voluntary and the data are confidential. At the end of the semester, the professor will give the students' final grades to the researcher, using the unique identifier. Approval for this protocol has been granted by the Agnes Scott Human Subjects Committee (January, 2006).

During the Spring 2006 semester we collected pilot data from 47 participants in Dr. Wiseman's math and Dr. Winget's chemistry courses. Data from Time 1 show that 62% of the students reported feeling that math and science were likely or very likely to be a part of their future careers. Students did not endorse traditional gender stereotypes. For example, they reported that women were just as likely to be good in math and science as men. They also had high personal and collective self-esteem. We are currently in the process of collecting Time 2 and Time 3 data from these students and are interested to find out what changes occur during the semester. With the help of the summer grant, we will analyze the data from both the spring and summer sessions to look for similarities and differences between these sessions.

We strongly believe that the goals of this project are consistent with the mission of the Center for Teaching and Learning. First, we want to identify psychological barriers to learning in math and science students. Second, we want to create teaching tools that will effectively address these psychological barriers. We worked on the pilot study together and we share the goal of increasing the representation of women in advanced areas of math and science. Dr. Garcia brings to this project her knowledge of psychological processes and stereotypes. Dr. Wiseman brings to this project the day-to-day experience of working with math students and watching as otherwise bright students succumb to feelings of math anxiety and inferiority. We look forward to learning

more about how we can become better teachers and facilitate student success at Agnes Scott College.

References

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