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Advancing Women In Leadership

Crossing the Great Divide: Changing the Culture of Women Through Gender Equity in Mathematics Teaching and Learning

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Introduction

“Crossing the great divide” (of mathematics) involves a journey not unlike many arduous journeys. In order to reach your destination, the traveler must prepare for difficult road conditions and allow for alternate routes. In this presentation, consider gender equity as the destination and imagine there are a number of routes that we could take while making our journey. Recognizing that there may be different definitions for *gender equity* and the route you take depends on your definition. In their definition of *gender equity*, Grossman and Grossman (1994) state that “gender equity can be viewed in terms of treatment of students, gender differences in roles for which schools prepare students and gender disparities in educational outcomes” (p. 119). Koch and Irby (2002) describe gender equity as “to be fair and just toward both men and women, to show preference to neither, and concern for both” (p. 4). Walker and Foote (2001) define *gender equity* within a culture to mean “all individuals having freedom from limits imposed by self or society that would prohibit both males and females from pursuing the fields of knowledge and skills suited for them” (p. 101). Others describe gender equity in terms of the educational environment, one in which individuals have not only opportunities, but real efforts are made to equalize, reform, and improve (Nash & Dougherty, 1991). Using these definitions, gender equity can be viewed as a subset of a larger set identified as *educational equity*.

First Step

Educators who are going to make the journey in the same vehicle to achieve gender equity must agree on what route to take. That is, faculty and staff involved in the same school improvement initiatives or

campus staff development activities must agree on what they are calling *gender equity* if they intend to achieve it. A first step towards gender equity, then, is to allocate time for the staff to read background information and then create their own collective definition of what is meant by gender equity based on their own needs and goals for the school.

I was reminded of the importance of this step as I worked long distance with a partner to prepare for a presentation on this paper at the Research on Women in Education Conference in New Orleans this year. While pulling our thoughts together, we each realized how important it was to first agree on where gender equity and mathematics achievement came together. In this paper, I concentrate on the “treatment” perspective of gender equity, analyzing behaviors, and teacher interactions most identified with successful problem solvers and compared those to the classroom opportunities and interactions documented to occur less often with girls than boys. Included in this paper is a summary of findings from this inquiry.

Needs Addressed Through the Inquiry

One of the most significant trends in the United States labor force over the past three decades is the growth of working mothers, especially single working mothers (Nash & Dougherty, 1991; Sadker & Sadker, 1994). Many of the children in our school systems are dependent on the incomes and well-being of these mothers. Non-traditional jobs often afford the opportunity for better pay for women, because jobs traditionally held by men pay better wages. Data indicate that girls participate less in higher level mathematics courses than boys do in high school (American Association of University Women Educational Foundation [AAUWEF], 1992). Courses such as calculus and statistics often serve as “gatekeepers” for those fields and professions that are traditionally male-dominated: mathematics, chemistry, engineering, business, advanced medicine, and technology. Girls who do not take these courses are often less prepared to score well on mathematics portions of college entrance exams and less likely to get into major prestigious universities (Goodlad & Keating, 1990). This track record of missed opportunities and experiences results in a limited number of girls (when compared to boys) who have access to higher paying and often personally satisfying jobs (Brody, Fuller, Gosetti, Moscato, Nagel, Pace, & Schmuck, 2000). Therefore, one critical need is that of educating girls to know that “unless they prepare for paid work by selecting and obtaining the necessary education and training for an occupation that interests them, they are more likely than males to be limited to low-paying, uninteresting jobs that provide little opportunity for economic self-sufficiency or advancement” (Bitters & Foxwell, 1993, p. 8). Mathematics, then becomes "the great divide" that must be crossed in order to achieve and succeed in financially-enhanced and challenging jobs.

Another area of need is in the mathematics classroom itself. One of the best ways to achieve gender equity is to improve classroom learning in general. The culture of the mathematics classroom as well as the curriculum often fall short of meeting the needs of today’s girls and underrepresented populations. (AAUWEF, 1998). Girls and minorities are in need of teachers who increase the chances of their succeeding, not diminish them, and they are in need of a culture that encourages and supports the idea of mathematics for all. “Administrators should assist teachers in creating better learning environments where equity can be achieved” (Lunenburg & Irby, 1999, p. 145). If girls are not developing the skills and dispositions for problem solving and if they are not enrolling and completing higher level mathematics courses in high school and college, then no matter what definition for gender equity we use, the chances for women to develop their abilities, talents and interests, and aptitudes to their fullest potential are limited as they compete with men in the job market (Goodlad & Keating, 1990).

Guiding Questions

The following questions served to guide this inquiry into gender equity in mathematics to advance the achievement of women in a world where success is often dependent on economic prosperity and intellectual power:

1. Why are girls underrepresented in higher level mathematics courses in high school?
2. Why do girls consistently underperform their gender counterparts on college entrance and graduate entrance exams?
3. Why are girls less likely to take higher level mathematics course work in college?
4. Why are less girls pursuing careers in mathematics and mathematics-related fields than boys?

Results Form the Inquiry

Performance of Girls in Mathematics and Science

Myra and David Sadker in their book *Failing at Fairness: How America's Schools Cheat Girls* (1994), synthesized a number of behaviors from studies on gender performance in mathematics and science. Of their findings, the following were found to be particularly relevant to this inquiry. When compared to boys, girls:

1. are less comfortable taking risks in the secondary mathematics and science classrooms;
2. are less persistent when seeking solutions to problems;
3. have less confidence in their own innate abilities to solve problems;
4. believe that others hold lower expectations for them to succeed and/or advance in mathematics studies; and,
5. are less likely to find alternative strategies for solving mathematics problems when their first attempts to solve a problem fail.

Characteristics of Good Problem Solvers

The level of success in higher level mathematics courses in high school and college is dependent on how well students are able to solve problems. According to the National Council of Teachers of Mathematics (NCTM, 1989), good problem solvers demonstrate the following characteristics:

1. Risk-taking,
2. Persistence,
3. Confidence in their own abilities,
4. High expectations for success, and
5. Resourcefulness.

Teaching Strategies that Promote and Develop Problem Solving Characteristics

The following teaching strategies have been linked with achievement in problem solving (NCTM, 1991).

1. Incorporate active participation.
2. Support risk-taking.
3. Technology-enhanced and supported.
4. Multiple opportunities to respond to higher level questions.
5. High level of expectations.
6. Content which is relevant and meaningful to students and taught within the context of real-world situations.
7. Lessons, which are integrated across strands.
8. Incorporate multiple opportunities for collaborative problem solving.

Girls Less than Boys

Sadker and Sadker (1994) relate a story in which the television news show Dateline conducted an investigative story following a report they did on girls not receiving their “fair share” of education. In this story, hidden lessons of unconscious bias were uncovered after training the news team on how to look for gender bias. Clearly the teacher who was purposely trying to demonstrate a non-biased classroom, segregated the math group into boys and girls, focused on the boys, teaching them actively and directly. When the teacher did call on the girls, it was for them to perform in a passive way, for example, holding the math book up (p. 3). Other studies have received similar results where boys initiate more contact and receive a greater share of the teacher’s time (AAUWEF, 1998). Subsequently, reinforcement of these passive behaviors in school can negatively impact the ability of students as indicated by declining IQ scores where passive approaches to learning are reinforced (Goodlad & Keating, 1990; AAUWEF, 1989). Of the above teaching strategies that are shown to promote better problem solvers, girls are less likely than boys to:

- a. actively participate;
- b. take risks;
- c. receive specific feedback on performance;
- d. experience, work with technology;
- e. be asked higher level questions; and,
- f. held to higher expectations.

Perhaps not so surprising, the correlation between the characteristics of good problem solvers and the characteristics identified as being less encouraged in girls than boys in both classroom and home environments is close to a perfect 1.0.

Recommendations From the Inquiry

Provide teachers with training and follow-up support for implementation of strategies which both are correlated with increased achievement in problem solving and the learning styles of girls and other underrepresented populations. For example, strategies could include:

- a. Teaching content that is relevant and meaningful to students.
- b. Teaching skills that are taught within the context of real-world situations.
- c. Developing lessons that are integrated across strands.
- d. Providing multiple opportunities for cooperative problem solving.
- e. Finding role models and mentors who encourage and support participation of girls in higher level mathematics.

Provide teachers and administrators training in to analyze both overt and subtle messages delivered through methodologies and materials in mathematics instruction and then require that these analyses be used to evaluate teacher and administrator performance and to set professional development goals.

Provide teachers with training in how to provide equitable opportunities in the classroom as they relate to high performance in mathematics for girls.

District leaders and staff need to establish policies and procedures that support equity in student performance by way of the following:

- a. Communicate with conviction that diversity is a strength.
- b. Establish policies and procedures that require ongoing improvement efforts in equity of student performance or outcomes.

c. Use the knowledge gained from research to guide policy development and school improvement and to discontinue in effective practices.

Provide teachers, school administrators, universities and state departments with training in subtle and subconscious bias found in career awareness and guidance practices, counseling practices, curriculum design, school improvement initiatives, instructional practices and personnel evaluations.

In conclusion, clearly there are specific actions that can be taken to reach a destination of gender equity in mathematics. How seriously universities, schools, and school leaders are about increasing the representation of girls in higher mathematics courses, as well as the employment of women in mathematics-related, higher paying careers, will depend ultimately on how we feel about the fact that we have not done so thus far.

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