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Different, Not Deficient: Engaging Women in the 21st Century STEM Workforce

DEVELOPING THE 21ST CENTURY WORKFORCE

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Introduction

Description of the Problem

Despite the increase in female labor force participation, women remain substantially underrepresented in science, technology, engineering, and math (STEM) fields. The small number of women in these fields has been attributed to a variety of reasons, including the erroneous notion that women are deficient in ability (Kenney, McGee, Bahtnagar, 2012).

According to a July 2015 study by the American Association of University Women (AAUW), women make up about 50% of the labor force; however, less than 12% of engineering professionals are female, 35% are scientists and 31% chemists. Women employed in mathematical and computer science industries declined to 26%, down from 35% in 1990. In addition, women in STEM fields are less likely than men to be employed in the industrial sector and far less likely than men to hold management, senior management or corporate officer roles (AAUW, 2015).

The reasons why women have made such a slow entrance into STEM fields remains a sociocultural factor that discourages their participation in the technical and scientific fields.

According to Rosener (1995) "The experience of women, whether they like to admit it or not, is that being viewed as different has meant being viewed as deficient or deviant" (Rosener, 1995, p. 105). Images, symbols and systems of belief have continued to link science, technology, engineering and math with men and masculinity, and separate it from women and femininity. Together these symbols and systems have operated to create a sense that such divisions are natural (Acker, 1999), with men the standard group and women the nonstandard or other group who are different from the norm (Fox, 2006).

A 2010 Reuters poll of more than 24,000 adults in 23 countries released on the eve of International Women's Day 2010, found that one in four adults globally were most likely to agree that a woman's place is in the home (Reuters, 2010). Clearly there is an entrenched sentiment about the role of women in society.

Problem Statement

Women are capable and competent, yet remain underrepresented in STEM related fields. The problem is not about ability or deficiency, it is the sociocultural phenomena of stereotyping—of abilities, societal influences, and workplace environments.

Problem Statement

Recommendations to Solve the Problem

The first step to solve this problem is to recognize that stereotypes are powerful, enduring and play a significant role impacting women's decisions to pursue and remain in STEM career fields. The next step, which is equally paramount to solving the problem, is to engage this underrepresented group through discussions and recommendations targeted toward parents, educators, and industry.

Parents are the first line of defense

Parents are the first line of defense against the "stereotype threat," or the impression that men outperform women in science and technology (Spencer, Steele and Quinn, 1999; Goode, Aronson and Inzlicht, 2003). Arguably one of the first transference of social stereotypes occurs at home. Parents can instill basic values, set expectations, goals, and a culture of celebrating science and discovery in the family. Outdoor fun activities can be more inclusive, where Dad going fishing does not have to be an exclusive father and son event. Getting dirty, playing in the outdoors, collecting bugs and beetles, setting up a home computer, and spending Saturday afternoon in the garage troubleshooting engine problems can be inclusive family events where girls participate and enjoy these events as much as boys (Kenney, McGee, Bahtnagar, 2012).

Likes and dislikes are formed early in life and are often difficult to dislodge in later years. Inculcating a liking for science, technology, engineering and math in early years is a task that can be most effectively carried out by a parent. For example, socializing habits and upbringing can expose girls to videogames, virtual or simulated navigation, as well as physical tinkering with assembling parts, troubleshooting gadgets, or hooking up cables. Following assembly instructions from a technical manual is an elementary lesson in 3-D cognition, where one must

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make sense of instructions and diagrams given in 2-dimensional space to put together a 3-dimensional object. It follows that females engaged in mechanical activities will be exercising their spatial cognition skills more. Greater use leads to greater development, and thereby greater confidence, which in turn promotes more use. Parents can become the critical mediators in encouraging and engaging girls in STEM (Kenney, McGee, Bahtnagar, 2012).

Educators can cement impressions

While parents can create and promote positive perceptions about science and technology subjects, it is fair to argue that school experiences can cement these impressions. The gender gap in self-confidence in math and sciences, and the resulting difference in self-assessment of math and science skills is critical to students selecting higher-level math courses (Correll, 2001; Bhatnagar and Brake, 2010).

Educators can address the issue of self-confidence in a variety of ways. One of the more radical suggestions is to move toward a single-sex education model. Research has supported this model for both attitudinal and achievement variables (LePore and Warren, 1997) for the obvious benefit of being able to foster fewer stereotypical views of courses and occupations. A less aggressive and strongly recommended strategy for engaging more girls in math and science courses is to increase the number of female mentors and female instructors in those subjects (Haag, 1998).

During school lab activities it is often found that boys and men set up the experiment and take readings, while girls and women stand on the sidelines and take notes. A countering strategy suggested by the Institutes for Women in Trades, Technology, and Science (IWITTS) is to announce a "call time" to switch tasks (IWITTS, 2011). This can guarantee equal access to equipment handling for females. The fact that such a simple strategy can be applied to ensure equitable engagement of girls and women is an indication of the underlying stereotypes relevant to female students enrolled in science, technology, math and engineering courses.

Teachers may also try to relate subject matter to issues that more females may be interested in. It may seem counter-intuitive at first glance, however, the fundamental principles of physics, math and technology may sometimes be communicated to students in overtly gendered ways. "Teaching principles of kinematics by using football analogies for instance, or momentum and projectile motion by rifle discharge sequence may unwittingly cause alienation and disinterest in an otherwise motivated and smart group of female students" (Bhatnagar, 2010, p.1). Learning, after all, occurs by internalization of examples in a relatable and familiar universe. When girls are presented concepts couched in unfamiliar terms, their dislike of the example may transfer to a dislike of the subject itself (Kenney, McGee, Bahtnagar, 2012).

The most valuable contributions educators can make toward encouraging girls to pursue STEM career fields is to instill greater degrees of self-confidence and self-esteem as it pertains to the related courses (Correll, 2001). Girls and women need reinforcement of self-confidence and a renewed purpose in pursuing science and technology, where their sense of self-efficacy is brought to match their actual scores. Educators can address this issue in a multitude of ways. More female mentors will help create tangible role models for female students. Counselors and teachers can actively engage in disrupting the myth of female ineptitude in science and technology. To that point, it has been reported that the grade point average of women who dropped out of engineering programs was identical to those who were retained (IWITTS, 2011). The issue was not ability, but self-confidence—the single biggest predictor of success for women and girls in technology courses.

The female friendly workplace can be achieved

While the social dynamics of family and education may tend to work outwards, it can be argued that a female friendly workplace is likely created by an inward focus on an inclusive work environment. The two-fold explicit and implicit sociocultural bias against women in the workplace makes for difficult counter measures (Nosek, et al., 2009). Explicit bias in terms of discriminatory policies is most certainly on its way out in the United States. The implicit biases, however, of learned behaviors, attitudes, and assumptions are not only deep-rooted but also less visible. It is these implicit biases that are largely responsible for the chilly climates in many STEM work environments.

Recommendations for workplace enhancement must address the elusive yet all important culture factor. In the absence of any management directive, the culture of a workplace may often become a mixed bag of value systems and beliefs of its employees. Since the underlying beliefs and biases are usually entrenched, the only way these can be countered is by explicit policies and counter conventions spelled out as career-friendly, not pro-women or anti-men policies, and implemented in full force (Kenney, McGee, Bahtnagar, 2012).

A way to reduce the high attrition rate among female STEM professionals is to modify cultural climates where female employees feel empowered and supported

A wide variety of workplaces, both public and private, have instituted family- and career-friendly policies (State of Oregon, 2000; Gerten, 2011). These include flexible work options including job-share and telecommuting opportunities, paid and unpaid leave options, greater transparency in decision making, and flatter organization structures. Options for childcare, and services for seniors and the disabled, can form key aspects of a career-friendly workplace. Support groups for parents, an accepted tradition of working at home, and sensitivity of employers, co-workers, and supervisors to parental responsibilities, are all key to creating more career-friendly workplaces (Kenney, McGee, Bahtnagar, 2012).

Although such policies help women navigate family and work, they may not lead to advancement or promotion or address other issues like icy departmental climates and feelings of isolation. A way to reduce the high attrition rate among female STEM professionals is to modify cultural climates where female employees feel empowered and supported (AAUW, 2010). A template for successful creation of a supportive climate can be found in the private sector, especially among high-tech companies. Hill, et al. (2003) reported that 35% of fathers and 49% of mothers at IBM have had flexible work schedules, while 82% of fathers and 89% of mothers intend to do so in the future. Other key policies that can be put in place to make workplace more welcoming for women are intra-office social networking tools to encourage women to become more involved, rather than the "good old boys" water cooler networks. A well-instituted buddy system can go a long way in providing support, as well as mentoring through informal networks for newcomers (Kenney, McGee, Bahtnagar, 2012).

Creating a strong work culture of inclusiveness by encouraging differences, new ideas, independent opinions, and risk-taking, are all strategies to inculcate a climate that not only welcomes women, but also is great for innovation and the bottom line. The goal is to transform deep-seated beliefs, values, and cultures put in place over centuries of male hegemony. Often these assumptions and stereotypes are so much a part of the workplace that they become invisible. The problem of gender gap in STEM career fields must address and cut away at these unspoken assumptions, which paralyze our minds and blind us to opportunities as well as the sheer joy of discovery (Kenney, McGee, Bahtnagar, 2012).

Conclusion

STEM fields are considered crucial to the United States' economic growth and are expanding rapidly (Fassinger and Asay, 2006). Science and technology form the frontier outposts of our civilization. In fact, the National Science Foundation (2010) identified addressing the adequacy of the supply of scientists, engineers, and science teachers as one of the top 10 priorities of the 21st century.

Conclusion

It does matter if more women enter the STEM fields, and the reasons are fundamental. From an economical perspective, *STEM is good for women*, in terms of more and higher paying jobs and advancement opportunities. However, w*omen are also good for STEM*. Women bring a rich diversity of experience and perspectives that are invaluable. Finally, women represent the family and children in all societies. Thus, educating women goes beyond the individual—it becomes a strategy to lift up entire families in terms of economic and sociocultural gain. Women represent a key sector of the workforce and a viable market to help close the gap in the STEM work force labor shortage.

In order to increase the number of females in STEM, it is critical to recognize that the problem is not about female ability or deficiency, it is the sociocultural phenomena of stereotyping—of abilities, societal influences, and workplace environments. To solve the problem and change the future, we must engage girls and women through discussions and recommendations targeted toward parents, educators, and industry.

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