Research-Informed Guidelines for Inclusive STEM Classrooms: Strategies for Educators to Close the Gender Gap

The Problem

The underrepresentation and attrition of females and underrepresented minority students in science, technology, engineering, and math (STEM) fields is a widely acknowledged, complex problem for which solutions will be multi-faceted. However, while a wide body of research examines factors that influence women’s experiences in these fields, many STEM educators at the high school and undergraduate levels are unfamiliar with the most recent research on gender’s relation to STEM classes. This paper aims to bridge the research with practical strategies for educators as they work to both capture students’ initial interest in STEM and retain students who are already interested.

Methods

As an engineer, the new experience of writing a literature review forced growth in my statistics skills and knowledge of psychology, sociology, and education. I used widely known and established sources to start my research but subsequently sought out more specific and recent papers. I focused on papers about gender in math, physics, chemistry, and (pre-)engineering courses at the primary, secondary, and post-secondary levels. Within the primary focus on gender I also had a sub-focus on under-represented minority status. A few key constructs that arose were self-efficacy, identity, and self-concept. Once several clear themes emerged I tailored my research to those areas. I found the Journal of Engineering Education and the Journal of Research in Science Teaching to be particularly relevant, however I drew from many other journals as well. In total I read over 50 journal articles and books. I used Zotero to organize my notes and citations.

ASEE Paper Abstract

This is an excerpt of the draft abstract that I will submit to the American Society for Engineering Education’s 2012 conference. The selected research presents not only how students’ educational experiences vary by gender, but also how women and men’s interpretations of the same educational experiences differ. This knowledge of the conditional effects of gender is vital to improving STEM classes at the middle school, high school, and undergraduate levels.

For example, regarding emphasizing communication in engineering, most educators probably do not realize that performing well on English tests can decrease a student’s perception of his or her own math skills. Moreover, the negative effect of good English grades on mathematical self-assessments is larger for females than for males (Correll, 2001). This knowledge provides compelling evidence to emphasize the importance of communication skills in engineering and to reshape the society’s false cred that math and language skills are mutually exclusive.

Following the presentation and discussion of the supporting research for each takeaway, implications for practice and suggested directions for future research will be addressed. While some practices discussed are specifically constructive for women, others are beneficial for all students. In fact, Amelink & Creamer found that for both females and males, “exposure to effective female role models within the department” is significantly related to the intent to remain in the major and likelihood of working in an engineering related field ten years from now (2010). By keeping more female students and under represented minority students interested in STEM, STEM classrooms will become more supportive, engaging and challenging for all.

The Gender Gap: Bachelor’s Degrees Earned in Selected Science and Engineering Fields, by Gender, 2007

Do You Know the Difference?

Sex vs. Gender

- Sex refers to biological and physiological characteristics
- Gender refers to socially constructed roles, norms, and attributes
- Male/female
- Masculine/feminine

Potential Solutions

- Mindsets
- Re-evaluate Group Work Practices
- Be Conscious of Differential Treatment
- Active Expert Roles
- Scaffolding
- Clarity in Grading Policies
- Do the Math
- Vital Skills
- Develop Spatial Skills
- Emphasize Communication

August 2012. Special thanks to:
Samantha Brunhaier & Shannon Gilmartin

Helena Scutt
Designing Education Lab
Dr. Sheri Sheppard


Research-Informed Guidelines for Inclusive STEM Classrooms: Strategies for Educators to Close the Gender Gap

The Problem

The under representation and attrition of female and under-represented minority students in science, technology, engineering, and math (STEM) fields is a widely acknowledged, complex problem for which solutions will be multi-faceted. However, while a wide body of research examines factors that influence women’s experiences in these fields, many STEM educators at the high school and undergraduate levels are unfamiliar with the most recent research on gender’s relation to STEM classes. This paper aims to bridge the research with practical strategies for educators as they work to both capture students’ initial interest in STEM and retain students who are already interested.

Methods

As an engineer, the new experience of writing a literature review forced growth in my statistics skills and knowledge of psychology, sociology, and education. I used widely known and established sources to start my research, but subsequently sought out more specific and recent papers. I focused on papers about gender in math, physics, chemistry, and (pre-)engineering courses at the primary, secondary, and post-secondary levels. Within the primary focus on gender I also had a sub-focus on under-represented minority status. A few key constructs that arose were self-efficacy, identity, and self-concept. Once several clear themes emerged I tailored my research to those areas. I found the Journal of Engineering Education and the Journal of Research in Science Teaching to be particularly relevant, however I drew from many other journals as well. In total I read over 30 journal articles and books. I used Zotero to organize my notes and citations.

Conclusion

The underrepresented minority and female students in science, technology, engineering, and math (STEM) fields is a widely acknowledged, complex problem for which solutions will be multi-faceted. However, while a wide body of research examines factors that influence women’s experiences in these fields, many STEM educators at the high school and undergraduate levels are unfamiliar with the most recent research on gender’s relation to STEM classes. This paper aims to bridge the research with practical strategies for educators as they work to both capture students’ initial interest in STEM and retain students who are already interested.