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CRG | PUTTING THE WORLD'S BEST RESEARCH TO WORK FOR GIRLS

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ENGAGING GIRLS IN STEM: **ROLE MODELS**

Research on the gap between men and women in STEM fields points to the paucity of readily available role models for girls as they consider STEM careers. This dearth of STEM role models harms girls in two related ways. First, as girls begin to consider college majors and career trajectories, **the choice of STEM fields is not reinforced by respected role models**; second, **the lack of female role models reinforces some negative stereotypes held by girls and young women about STEM fields**. Specifically, researchers note that the “male geek” stereotype about computer scientists actively dissuades women from considering the field.¹

Once women reach college and enroll in classes, role models and mentors can help them persevere in STEM majors. Research from several disciplines suggests that the presence of female peers,² teaching assistants,³ and faculty members⁴ increases female retention in STEM majors. On the flipside, the absence of female role models and mentors has a clear negative impact. Women cited a lack of role models as a significant reason for leaving the fields of physics, chemistry, electrical engineering, and computer science.⁵

[ENGAGING GIRLS IN STEM: ROLE MODELS]

ROLE MODELS VS. MENTORS

Both role-models and mentors are important to cultivating girls' interest in STEM fields and it is worth noting the difference between the two. Role-models may be thought of as lighthouses: they offer a steady point of reference as we travel through complicated waters. In contrast, mentors forge an on-going close connection with students and offer one-on-one guidance such as academic advice or information about courses and career options.

Young female students are more likely to choose to pursue a STEM career or education with the support of a mentor, especially if the mentor is someone with whom the student has close contact. Researchers at Techbridge, a program connected to the Chabot Space and Science Center in California that emphasizes science and technology for girls, have found that girls consider STEM careers when they are encouraged by "family members who communicate enjoyment for their work, strong encouragement for a career in technology, and opportunities to see, hear, and learn about these careers."⁶ Both role-models and mentors constitute valuable support for girls in STEM fields; in some cases, one person can serve in both roles.

ROLE MODELS AND MENTORS COMBAT NEGATIVE STEREOTYPES ABOUT STEM FIELDS

Having a wide variety of role-models and mentors helps combat the negative stereotypes girls hold about the nature of STEM careers. As the AAUW's 2000 report, *Tech Savvy*, makes clear, the negative stereotype that STEM fields are dominated by "nerdy" men who work in isolation from other people and real-life problems contributes heavily to the continued gender disparity in STEM fields in both higher education and industry.⁷ Further, girls tend to prefer careers in which they have opportunities to help others. When interviewed, girls report that they do not recognize the collaborative, social, or human applications of STEM fields such as engineering and computer science.

The reality of life in STEM fields is, of course, significantly different from these perceptions. Yet, convincing girls that in STEM fields, collaboration is the rule, not the exception, can be difficult to do. Similarly, girls need to be provided with clear examples of how *all* STEM fields have socially relevant applications. Role-models and mentors can prove to be very effective in this vein. By familiarizing girls with women whose daily work experiences include a high degree of connectedness to others and an on-going and meaningful engagement with her society, schools can begin to reshape the conceptions that girls have about STEM fields.

THE IMPORTANCE OF A WIDE VARIETY OF ROLE-MODELS AND MENTORS

Girls should be exposed to a wide variety of role-models and mentors in STEM fields not only to combat negative stereotypes about the nature of STEM work, but to ensure that every girl has the potential to find a role-model or mentor with whom she connects. It is valuable to have role-models whom students can easily admire, perhaps because they represent paragons of achievement in their fields. It is also valuable to have role-models and mentors with whom students can identify. Role-models or mentors with whom students can identify will likely come from a wide variety of backgrounds, racial and cultural groups, and be at various points in their career trajectories.

BRINGING GIRLS INTO CONTACT WITH ROLE-MODELS AND MENTORS

When bringing potential role-models and mentors into contact with girls, it is worth considering how to make the effort as successful as possible. A one-time speaker will only be successful if she happens to be someone who is inspirational and compelling in that role. In many cases, arranging opportunities for role-models and mentors to work with students over time increases the likelihood that a useful relationship will develop and can do more to bring out what that particular role-model or mentor has to offer.

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Below are several ways in which schools might bring girls into contact with role-models and mentors.

- * Look for intra-school opportunities that capitalize on the fact that young students naturally look up to older students. Consider having the older students in your school develop as part of their coursework (in a STEM-related class) a lesson or even a mini-unit to be taught to the younger students. Also, consider having older students serve as STEM tutors to younger girls.
- * Look for local partners from higher education. Carnegie Mellon University increased female undergraduate enrollment in the computer science major from 8% in 1995 to 42% by 2000 by offering extensive environmental supports (mentoring groups, support groups, etc.).⁸ Many colleges have aimed to replicate their success by offering similar programs. As a natural extension of this concept, many universities collaborate with local primary and secondary schools.
- * Look for curricular partners from your community. Schools should invite women in STEM fields from their parent bodies, boards, or other community contacts to engage with students – whether on a one-time speaking basis, or as part of an on-going project.

ENGAGING GIRLS IN STEM: ROLE MODELS [ENDNOTES]

- ¹ Margolis, J., & Fisher, A. (1997). Geek mythology and attracting undergraduate women to computer science. *Impacting Change Through Collaboration*. Carnegie Mellon University, School of Computer Science, Pittsburgh: Joint National Conference of the Women in Engineering Program Advocates Network and the National Association of Minority Engineering Program Administrators.
- ² Craig, A. (1998). Peer mentoring female computing students: Does it make a difference? In *Proceedings of the 3rd Australasian Conference on Computer Science Education* (ACSE '98). ACM, New York, 41-47.
- ³ Butler, D. M., & Christensen, R. (2003). Mixing and matching: The effect on student performance of teaching assistants of the same gender. *Political Science and Politics*, 36(4), 781-786.
- ⁴ Robst, J., Keil, J., & Russo, D. (1998). The effect of gender composition of faculty on student retention. *Economics of Education Review*, 29(4), 429-439.
- ⁵ Etzkowitz, H., Kemelgor, C., Neuschatz, M., & Uzzi, B. (1994). Barriers to women's participation in academic science and engineering. In E. W. Fechter, *Who Will Do In Science? Educating the Next Generation* (pp. 43-67). Baltimore, MS: Johns Hopkins University.

Cohoon, M., & Aspray, W. (2006). A critical review of research on women's participation in postsecondary computing education. In M. Cohoon, & W. Aspray (Eds.), *Women and Information Technology: Research on Underrepresentation* (pp. 139-182). Cambridge, MA: The MIT Press.
- ⁶ Kekelis, L., Ancheta, R. W., & Heber, A. E. (2005). Hurdles in the pipeline: Girls and technology careers. *Frontiers: A Journal of Women Studies*, 26(1), 106-107.
- ⁷ AAUW. (2000). *Tech-Savvy: Educating Girls in the New Computer Age*. Washington, DC: American Association of University Women.
- ⁸ Fisher, A., & Margolis, J. (2011, July 10). Women in computer sciences: Closing the gender gap in higher education. *Carnegie Mellon Project on Gender and Computer Science*. Retrieved from cs.cmu.edu/afs/cs/project/gendergap/www/index.html.
- ⁹ Rayburn, C., Denmark, F., Reuder, M., & Austria, A. (2010). *A Handbook for Women Mentors: Transcending barriers of Stereotype, Race and Ethnicity*. Santa Barbara: ABC-CLIO, LLC.
- ¹⁰ Hixson, B. K. (1999). *Women in Science Rule!* Nashua: Delta Education.
- ¹¹ Sullivan, O. R. (2002). *Black Stars: African American Women Scientists and Inventors*. Hoboken: John Wiley & Sons.
- ¹² Dean, D. (2009). *Getting the Most out of your Mentoring Relationships: A Handbook for Women in STEM*. New York: Springer Science + Business Media, LLC.

RESOURCES FOR TEACHERS



ONLINE RESOURCES

NEW FORMULAS FOR AMERICA'S WORKFORCE 2: GIRLS IN SCIENCE AND ENGINEERING

This 2006 publication from the National Science Foundation details the projects that have been funded by the NSF to promote gender equity in STEM fields over a period of ten years. This report describes several initiatives designed to introduce girls to female role-models and mentors.

www.nsf.gov/pubs/2006/nsf0660/nsf0660.pdf

CARNEGIE MELLON PROJECT ON GENDER AND COMPUTER SCIENCE

This website includes a variety of publications and working papers based on Carnegie Mellon's efforts to recruit and keep women in its computer science program. Several of the publications featured on this website address the importance of keeping female undergraduates from feeling out of place in the overwhelmingly male culture of computer science.

<http://www.cs.cmu.edu/afs/cs/project/gendergap/www/index.html>

IGNITE-US.ORG

Based in Seattle, Washington, Ignite is a non-profit organization dedicated to connecting young women with female professionals in STEM fields. Their website helps educators locate or start a local chapter.



BOOKS

A HANDBOOK FOR WOMEN MENTORS: TRANSCENDING BARRIERS OF STEREOTYPE, RACE, AND ETHNICITY

Aimed at women who mentor other women, this book discusses the challenges and pitfalls of mentoring and places a special emphasis on the mentorship for minority women or women in non-traditional careers. An entire chapter is devoted to the mentorship of women in STEM fields.⁹



BOOKS

WOMEN IN SCIENCE RULE!

This book includes biographies of 35 famous female scientists and hands-on activities related to each woman's STEM field.¹⁰

BLACK STARS: AFRICAN-AMERICAN WOMEN SCIENTISTS AND INVENTORS

This book profiles the careers or discoveries of 26 African-American women, some well known, and some neglected by history.¹¹

GETTING THE MOST OUT OF YOUR MENTORING RELATIONSHIPS:

A HANDBOOK FOR WOMEN IN STEM

Full of advice for young women in STEM fields, *Getting the Most Out of Your Mentoring Relationships* addresses topics such as selecting a mentor and cultivating a mentoring relationship. This book also includes a great deal of advice about the pursuit of academic and professional goals in STEM fields.¹²

RESOURCES FOR PARENTS



ONLINE RESOURCES

WOMEN.NASA.GOV

This highly engaging website profiles women who work at NASA, describes the various roles they play in the organization, and tells the stories of the educational and career paths that led them to the work they do today.

GIRLGEKS.ORG

This website catalogs a variety of resources to encourage girls' interest in technological fields. In addition to featuring "inspiring women," this site connects girls with online and local community support for their technological interests.



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Enjoy all of your favorite card games while learning important facts about STEM role-models with CRG's **Famous Women of STEM** playing cards.

<http://www.laurelschool.org/about/CRGStore.cfm>

