When Do Female Role Models Benefit Women? The Importance of Differentiating Recruitment From Retention in STEM

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Increasing the participation of women in science, technology, engineering, and mathematics (STEM) involves two distinct challenges. One is increasing the retention of women who are already in STEM fields. The second is increasing the recruitment of women who enter the STEM pipeline. Nilanjana Dasgupta (this issue) suggests that female role models assist in both of these efforts by improving women’s performance and sense of belonging in STEM. In the current article, we conceptually differentiate recruitment from retention and propose that although female role models may be effective in the retention of women in STEM, female and male role models can be equally effective in recruitment efforts. For interventions using role models to be most effective, we must understand when female role models matter and when male role models can be just as effective. Doing so helps to ensure we are “rendering onto the right students the right intervention” (Steele, 1997, p. 624).

Retention: The Power of Female Role Models

Same-gender role models are helpful for women who are already in STEM fields. Women who are in STEM fields contend with negative stereotypes that cast doubt on their abilities to perform well in these fields (Spencer, Steele, & Quinn, 1999). The fear of confirming these negative stereotypes, known as stereotype threat (Steele, 1997; Steele & Aronson, 1995), causes women who are personally identified with the domain to underperform (Schmader, Johns, & Forbes, 2008; Spencer et al., 1999) and disidentify with the field (Davies, Spencer, & Steele, 2005; Murphy, Steele, & Gross, 2007). Interventions designed to prevent harmful effects of stereotype threat can thus protect women by preventing them from underperforming and leaving the field.

One such intervention involves deploying female role models. Female role models inoculate women who are highly identified with STEM against the harmful effects of such negative stereotypes (Marx & Roman, 2002; Stout, Dasgupta, Hunsinger, & McManus, 2011). Women who were highly identified with math performed better on a math test when they encountered a female role model (i.e., a woman who was portrayed as highly competent in math) than when they encountered a male role model (Marx & Roman, 2002). Similarly, taking a calculus course with a female professor enhanced women’s implicit math self-concept and improved their implicit attitudes toward math compared to taking a calculus course with a male professor (Stout et al., 2011). Finally, women who read about a successful graduate of their university who majored in the same field as them rated themselves higher on success-related traits when the role model was female compared to male (Lockwood, 2006). Female role models are thus effective in preventing women who are highly identified with STEM from underperforming and disidentifying from the field.

Recruitment: Male and Female Role Models Are Equally Effective

To our knowledge, all experiments that have shown benefits of female versus male STEM role models have done so in retention contexts with women in the field or otherwise highly identified with STEM. To increase the representation and success of women in STEM, we must not only retain women in the field but also improve the recruitment of women into STEM (de Cohen & Deterding, 2009). Women enter STEM majors at lower rates than would be predicted by their abilities in these fields (Ceci, Williams, & Barnett, 2009; Strenta, Elliott, Adair, Matier, & Scott, 1994). There are no longer gender differences on standardized tests of math abilities (Hyde, Lindberg, Linn, Ellis, & Williams, 2008), and in high schools in the United States, girls now take as many STEM classes as boys and receive higher grades than boys (Ceci

1 One experiment by McIntyre, Paulson, and Lord (2003) found that undergraduate women performed better on a math test after they learned about the achievements of other women compared to when they did not learn about role models. However, because the control condition of this study used no role model instead of a male role model, it is difficult to know whether improved performance was due to the presence of a successful exemplar or if it was specific to female role models.
were no more interested in enrolling in that course
told about an introductory computer science course
press). In another set of experiments, women who were
major were just as interested in majoring in computer
interacted with an upperclassman computer science
course and anticipated being equally successful in
field regardless of whether their interaction partner
was female or male (Cheryan, Drury, & Vichayapai,
2010). Similarly, encountering computer science
role models who embody these stereotypes in appear-
ance (e.g., wearing a T-shirt that says, “I code there-
fore I am”) and preferences (e.g., reads Electronic
Gaming Monthly) decreased women’s sense of belong-

2 Null effects of role model gender were obtained in the context
of an intervention known to successfully recruit women into STEM:
changing stereotypes of the field (discussed further in the upcoming
paragraphs). Because role model gender did not influence recruiting
but another intervention did, we can be more confident that null
effects were due to role model gender and not to a flaw in the
experimental design or the nature of the dependent measures.
success in computer science compared to encountering a computer science role model who did not embody these stereotypes (Cheryan, Drury, et al., 2011; Cheryan et al., in press). This effect was found regardless of whether the role model was male or female. Taken together, these results suggest that changing current stereotypes of STEM may be more effective in recruitment of women than replacing male role models with female role models.

Who Makes a Good Role Model? The Importance of Similarity

The analysis just presented elucidated how effective role models in recruitment might differ from effective role models in retention. However, one aspect of role modeling that may be important in improving both recruitment and retention of women in STEM is: a sense of perceived similarity to the role model. In recruitment, Cheryan et al. (2011) found that women felt more similar to nonstereotypical versus stereotypical role models. This greater sense of similarity mediated the relationship between stereotypicality of role model and anticipated success in computer science. In addition, Diekman, Clark, Johnston, Brown, and Steinberg (in press) found that greater similarity between students’ own communal goals (i.e., to work with and help others) and a STEM role model’s daily activities predicted more positivity toward that role model’s career. In addition, Stout and colleagues (2011) found that female students who related more to female faculty than male faculty had greater feelings of self-efficacy in math domains. Perceiving oneself to be similar to another person leads to an assimilation of self-views to the characteristics displayed by that person (Brown, Novick, Lord, & Richards, 1992; Collins, 1996; Lockwood & Kunda, 1997; Mussweiler, 2003). It is important to note that it is perceptions of this similarity, not an objective similarity, that most strongly influences people’s responses to others (Murray, Holmes, Bellavia, Griffin, & Dolderman, 2002; Selfhout, Denissen, Brande, & Meeus, 2009). In fact, perceived similarity may be even more important than demographic similarity in predicting successful mentoring (Ensher, Grant-Vallone, & Marelich, 2002; Ensher & Murphy, 1997).

The factors that are salient for women in determining this perceived similarity may differ based on whether they are being recruited or retained. For women in STEM, negative stereotypes of women’s abilities are salient, and women may feel a particular identification with female role models who help to demonstrate that negative stereotypes are unwarranted and that women can succeed in STEM (Lockwood, 2006). However, for women not yet identified with STEM, concerns about negative gender stereotypes are less of a barrier to participation than concerns about dissimilarity from people in the field (Cheryan & Plaut, 2010; Cheryan et al., 2009). Seeing an exemplar, whether male or female, who embodies traits compatible with how women see themselves may engender the sense of belonging that women need to become interested in STEM (Cheryan, Drury, et al., 2011).

Implications for Interventions

Female role models are currently being deployed both to help recruit more women into STEM and to retain them once they are there. However, our analysis suggests that female role models may be best saved for retention efforts, whereas male role models can be further encouraged to help with recruitment. Due to women’s underrepresentation in the field, there is currently a dearth of women available to serve as STEM role models. As such, knowledge about where women’s participation may have the biggest impact will help avoid overburdening women who are currently available to serve as STEM role models and further incorporate male role models into diversification efforts. Identifying the contexts in which female role models are most beneficial will allow for the design of interventions that effectively match the needs of the women they target.

This analysis also suggests that maximizing a sense of perceived similarity to role models is key in both recruiting and retaining women in STEM fields. Finding additional ways to connect with a role model is particularly important for recruiting efforts, as our analysis suggests that sharing the same gender might not be a sufficient source of similarity for female recruits. Moreover, because recruiting efforts necessarily entail role models being in a different field from the potential recruit, relying on a sense of similarity afforded by being in the same field (Lockwood & Kunda, 1997) is less available in recruiting than in retention efforts. As such, to increase their effectiveness, role models should be selected who are highly similar to students in other ways (e.g., attitudes, values: see Brown et al., 1992). This strategy may help to increase the number of role models available for both STEM recruitment and retention efforts.

Does This Analysis Undermine Diversity Efforts?

Our argument that male and female role models are equally effective in bringing more women into STEM may, at first glance, seem at odds with diversification efforts in STEM fields. After all, the efficacy of female role models is sometimes used as a justification for why we need more women in STEM (e.g., Anderson, 2011). However, acknowledging the effectiveness of
both male and female role models in recruitment should not be seen as antithetical to diversity efforts for two reasons. First, as previously noted, female role models are key to the retention of women in STEM fields. Thus, bringing more women into STEM fields should help prevent other women from dropping out of these fields, thereby increasing women’s participation over time.

Second, using both male and female role models can in some ways be seen as a more inclusive approach to alleviating gender disparities in STEM, as it broadens the role model pool to employ men. When all of the pressure to be a role model is placed on women in STEM, diversification may come to be seen as a female issue rather than a societal issue. By relocating some of the responsibility for recruitment onto men, we can ease the pressure on women in the field to assure that their gender is well represented in STEM. Such strategies have been effective in educational settings. For instance, enrollment of women in Harvard’s notoriously difficult introductory computer science course has dramatically increased recently to its highest proportion. This change has been attributed to a male computer science professor who defies computer science stereotypes (e.g., he is also an emergency medical technician who volunteers each year at the Boston Marathon) and values pedagogical approaches that may appeal to women (“Harvard Portrait,” 2009). This strategy will also help free women in STEM to participate in efforts where their presence may be most beneficial, such as retention.

One question that remains is whether our analysis applies when the goal is to diversify STEM along other demographic lines, such as race. Although much of the work on role models has focused on issues of gender, there is other work that has investigated the effects of role models matched for race. For Blacks who are highly identified with a domain, some studies have found that Black role models protect test performance (Marx & Goff, 2005), whereas other studies suggest they have no effect on test performance relative to White role models (Aronson, Jannone, McGlone, & Johnson-Campbell, 2009). To our knowledge, experimental work has yet to examine how same-race role models affect recruitment of minorities into academic domains. Future research should continue to investigate under what conditions role models representing other identities are effective in diversifying academic domains.

Conclusion

Women who have yet to identify with STEM experience a different set of concerns than those who are already identified (Kawakami, Steele, Cifa, Phillips, & Dovidio, 2008; Schmader et al., 2008; Steele, 1997). For women who have already chosen the field, exposure to female role models protects performance (Marx & Roman, 2002) and improves their implicit STEM self-concepts (Stout et al., 2011). However, interventions designed to address stereotype threat, such as deploying female role models, may not most effectively address the concerns of women not yet in STEM (i.e., those we hope to recruit into this domain). Given the limited number of women in these fields, it may be most useful to concentrate their efforts on the retention of other women while encouraging more men in STEM to serve as role models for potential female recruits.

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