Female Science Students' Perspectives on Stereotypes of Women's Pursuit of Science

Carlie D. Trott, M.S., Silvia Sara Canetto, Ph.D., & Amber Anthenian, B.S., Colorado State University

Introduction

Despite considerable growth in U.S. women's representation in science and engineering (SE) higher education and careers (NSF, 2013), negative stereotypes purporting women's "natural" aversion toward, and ineptitude in science persist. Studies show that such stereotypes—expressed explicitly (e.g., in interpersonal interactions) or operating implicitly (e.g., biasing self-assessment) negatively impact women's self-confidence and academic/professional disengagement (Hill, Corbett, & St. Rose, 2010). Studies also indicate that to cope with such stereotypes, women tend to hold themselves to a higher performance standard in comparison to men (Correll, 2004). Finally, such stereotypes may ultimately cause some women to leave their chosen scientific field (Sandler, 1991). A limitation of past studies is a disproportionate focus on how these stereotypes interfere with women's *choice* of an SE education/career over how these stereotypes may interfere with persistence in SE education and careers. Another limitation is that most studies so far have focused on undergraduates or professional science women, rather than graduate students. Attention to graduate students is important because the proportion of women in SE careers lags behind the number of women earning graduate SE degrees, indicating attrition during this transition period (Hill, Corbett, & St. Rose, 2010). This study examined female science graduate students' perspectives on how they are impacted as well as how they cope with negative stereotypes of women in science.

Study' s Objective and Questions

The goal of this study is to examine female science graduate students' perspectives on negative stereotypes of women in science. This study's questions are: (1) *how* women perceive they have been impacted by the stereotypes, and (2) *how* they have coped with such stereotypes.

Method

Participants: Twenty-five female graduate (14 masters and 11 doctoral-level) students in atmospheric science (ATS) between the ages of 22 and 30 (M_{age} = 25.13) participated in this study. Seven were married, 12 were in a committed relationship, and 6 were not in a couple relationship. None had children.

Procedures: Participants were recruited via email invitation and via student and faculty referrals. In-depth, semi-structured interviews were conducted. Each interview was audio-recorded, transcribed verbatim, and edited for accuracy.

Data Analysis: The interviews were analyzed based on grounded theory. Coding was completed by a four-member female team and consisted of a multi-phase process whereby all team members, (1) identified textual segments of interest; (2) organized emergent themes into hierarchical categories; and (3) described categories based on properties and dimensions. Finally, narrative descriptions were created to further elaborate on key themes (Strauss & Corbin, 1998).

Data Trustworthiness: All interviews were independently coded by at least three researchers. Individual codes were discussed/revised in coding meetings, with final codes being achieved via consensus.

Findings

How have you been impacted by negative stereotypes of women in science?

Peers and professors have questioned my capabilities:

"I do think I'm treated differently….I think it's impossible to see me as an equal. . . . [For example], people who see me as a pretty face and not a scientist."

"[The biggest challenge for me] has been getting the respect that I deserve."

"Be[ing] taken seriously…I guess, has been a challenge."

"I had one professor who told me that I would learn differently than men would, and that women just didn't understand science as well."

"[There have been] people who felt like the only reason [I was in my department] was because I am a female. . . . That the entrance exam requirements for girls were lower . . . and that was actually voiced to me several times."

"There's a couple of guys that . . . were used to being top dog, and they were used to not having women on their level. . . . [They would call my scientific work] "stupid." And, I'm not accustomed to being disrespected actually."

Family and friends have questioned my choice of a science career:

"I think people outside the field just in my life are really surprised to hear a woman is in atmospheric science, like it just sounds like something a woman wouldn't do."

"I definitely had that from [one] side of my family . . . a view that science is more of a male's career path. And it's like, you should, like teach or something. . . . you know? I've never felt like they didn't support me. It was just, like I know deep down they're like, "What is she doing?"

I have questioned my choice of a science career:

"[In] high school and the beginning of college, I actually thought about trying to do something more humanities-based or [in the arts] even. . . .Kinda going away from and coming back to the science could have been, kinda subconsciously . . . something to do with the whole culture, you know, that women shouldn't be scientists or can't do math."

Findings (continued)

How do you cope with negative stereotypes of women in science?

I have never felt deterred by the stereotypes:

"I never felt discouraged because I was a woman. I never felt like I couldn't do it."

"I don't see myself as any different from a guy that would be doing science."

"There was not a single day of my life where I felt like I needed to prove myself to the boys. And I feel like a lot of women in this field *do* need to do that in their mind."

"I've never really thought much of other people's opinions [about women in science]. . . . I mean if I listened to everything that anybody ever told me . . . I wouldn't have been a scientist."

I work harder to prove myself as a scientist:

"[Family members' doubts] gave me motivation to pursue it and keep going. To say, 'I can do this. It's fine for a woman to do this'."

"[Being a woman in science] has made me a little bit more motivated, maybe, to prove myself, just since I realized kind of early on, like I was probably gonna be in a [male-dominated] science field. . . . I kind of always just wanted to show that I was equally able to do that."

"I've always been told that it's a male-dominated field, and so, you've gotta fight harder as a woman to make it in this type of field. I don't necessarily think that will deter you from getting where you wanna go, but, I mean it is male-dominated. But I mean, like all the guys in my classes, like yeah they're smart, but I mean, I think I'm smart too."

I am motivated to serve as a role model for other female scientists:

"[Being a woman in science] has been a motivating factor because it's exciting to be a pioneer in the field."

"[Being a woman in science] has made me more driven to actually want to do what I'm doing because there is a lack of women in the field. So it's kinda like an obstacle that you're trying to get over because there are so limited amounts, and you can show that you have done this and you are getting to where you need to be."

Summary and Discussion

All of the women in this study described an awareness of negative stereotypes purporting women's "natural" aversion toward, and incompetence in science. While the majority of the female graduate students in this study described being impacted by the stereotypes, a few women discussed not feeling deterred by them. Specifically, they explained that disregarding societal messages that women "can't" do, or "shouldn't" pursue science allowed them to maintain confidence in their career choice and their scientific capabilities.

A majority of women however reported that the negative stereotypes were simultaneously challenging and motivating. For example, several of the female graduate students came to question their pursuit of science after being challenged by professors, family, and friends. At the same time, they reported feeling motivated to work harder in their educational and career pursuits to challenge the negative stereotypes (i.e., to prove their scientific capabilities). Furthermore, several women explained that being a minority in their field—and facing challenges—motivated them to keep going and to serve as a role model and/or mentor for other women. These findings align with previous research documenting negative stereotypes' discouraging effects on self-confidence (e.g., NAS, 2006), as well as their tendency to generate higher self-standards of performance by women, relative to men in science (Correll, 2004).

To conclude, this study supports and expands past findings on SE women's views of, and experiences with, stereotypes of women's interest and capabilities in science. An important finding of this study was that none of the respondents reported stereotypes to impact their self-confidence in their abilities. However, research has demonstrated that messages about women's inferiority in science affect self-confidence, performance, and persistence even when they are dismissed (Steele & Ambady, 2006). These findings generate important new insights relevant to science-diversification research and program design from the perspectives of female science graduate students, who represent the next generation of science leaders.

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Contact Information

Silvia Sara Canetto, Ph.D.
Department of Psychology
Colorado State University
Fort Collins, CO 80523, USA
Silvia.Canetto@colostate.edu