education sciences

MDPI

Article

Barriers and Assistance for Female Leaders in Academic STEM in the US

Laura McCullough

Department of Chemistry and Physics, University of Wisconsin-Stout, Menomonie, WI 54751, USA; mcculloughl@uwstout.edu

Received: 21 July 2020; Accepted: 25 September 2020; Published: 27 September 2020

Abstract: Women in science, technology, engineering, and mathematics (STEM) fields are under-represented, and women are also less likely than men to be in leadership positions, generally. Little is known about the intersection of these areas: women in leadership in STEM. To determine what sort of barriers and assistance female STEM leaders have encountered, a survey was developed asking women who are in academic leadership positions in STEM about their experiences. The main barriers were similar in the STEM area and in leadership: balancing work/home life, devaluing of achievements, and imposter syndrome. The main two types of assistance in both STEM and leadership were support from spouse/partner, and encouragement from peers. The main barriers women encounter are cultural and will take time to overcome. The main assistance women have had comes from people, not training or institutional structures.

Keywords: gender; academic; STEM; leadership; barriers; assistance

1. Introduction

In the United States, women make up 50.8% of the general population, 57% of college graduates, and 39% of science, technology, engineering, and mathematics (STEM) bachelor's degree recipients [1]. In certain fields, the percentage of women is particularly low: physics grants only 20% of its bachelor's degrees to women; engineering, 21%; and computer science, 19%.

While there are many issues involving women's participation in STEM, this study focuses on one piece: the presence and participation of women in leadership in STEM fields in academia in the US. McCullough reported recently on the proportions of women serving in academic leadership positions in the US [2]. The rate of participation in leadership tends to be lower than the proportion of women in science and mathematics. Female department chairs were recorded at 3–19% lower than the PhD rate for their respective fields for a random sampling of departments, and the range was 5–22% lower for top departments in the world. Why are women not found in these positions at the same rate as they are found in STEM? What are the barriers women encounter on their path to a STEM leadership position?

1.1. Literature Review

There is very little research on women's leadership in STEM [3,4]. What little is known matches with the typical barriers encountered by women in leadership and in STEM. In a survey of its membership, the US-based Association for Women in Science found that cultural issues were the largest part of what female STEM leaders encountered: ideas or work being credited to men, feelings of inadequacy leading to fear of being called a fraud (imposter syndrome) [5,6], being assumed to be less competent, and general gender bias [7]. In a study of US women in STEM leadership positions, Ritzdorf looked at internal and external factors affecting the careers of seven leaders. She found common themes of growth mindset, self-efficacy, barriers from stereotype threat, and issues of bias in communication [8].

The literature on the barriers to women's leadership is extensive. A good overview is provided by the American Association of University Women [9], listing broad categories of barriers as recruitment and retention problems, gender discrimination, caregiving, lack of mentors, stereotyping, and bias. Examining the research on specific issues, one finds that female leaders have faced harassment [10,11], implicit gender bias [12], imposter syndrome [13], and issues with caregiving [14] and other home/work problems [15,16]. The book "Through the Labyrinth" by Eagly and Carli provides a useful overview of women's leadership research [17].

In the STEM fields, research on barriers to women's participation has been conducted for decades. There is no one easy answer to encouraging women to go into and stay in STEM. Initially the research suggested a chilly climate [18,19], then focused on deficiencies in women's attitudes and behaviors [20] and has now become focused on issues of society, life choices, and bias [21]. The latest research suggests that many of the problems women face are cultural, and similar to what women in leadership positions face: implicit gender bias [22], harassment [23,24], dual-career couple issues [25], imposter syndrome [5,6], home/work balance [26], and lack of sense of belonging [27]. Many of these issues are discussed in references [28,29].

The factors that support women's advancement in leadership are quite varied. Support comes in many forms: from one's spouse [30,31] and family [32], from peers and superiors [33]. Advocacy from mentors and sponsors can help women progress [33,34], and formal leadership training programs can provide useful skills [33,35]. Many of these supports can be part of the networking [31,36] that is useful for women looking to lead.

For women in the STEM fields, similar drivers support career progression. Encouragement from teachers [37], family [38], and peers [39] can help set a young woman on the STEM path. Networking and mentorship help women stay the course [40]. Sponsorship and advocacy help progression in the field [41]. A useful meta-analysis of literature is provided by Blackburn [42].

Given that the most common problems women encounter in STEM and in leadership are similar, do these experiences interact with one another? Having dealt with a particular issue once, is dealing with it again easier? This study focused on determining what barriers women faced as leaders in STEM.

1.2. Research Questions

What barriers do women encounter as they move through STEM, and as they move into leadership? What forms of assistance do they encounter in these two areas?

Do female STEM leaders feel that having encountered bias in one area has helped them deal with bias in the other?

2. Materials and Methods

Based on the literature, a survey [Appendix A] was developed to gather information about what has helped women attain leadership positions in STEM, and what has hindered their path. Barriers and assistance questions were developed based on the literature as discussed above. Basic demographic questions weeded out those who were not female and those not in leadership positions. The survey was designed for women in active STEM leadership positions. Leadership was not defined for respondents, allowing a broader range of participants. The focus was on academic leadership, so the chosen position titles included department chair, dean, and program director. Other leadership positions aligned with academia were also included, such as directors of centers and labs.

The survey included both multiple-choice and short answer questions, and also gathered demographic and leadership position data from respondents. Questions were designed to separate out barriers and assistance in the STEM area from those experienced in the leadership arena. Demographic information included STEM field and type of leadership position, but small sample size did not allow for further analysis at this level.

The survey was pilot tested with 13 women, contacted through social media (Facebook and Twitter, non-random snowball sampling). After the pilot-testing, the survey was revised. Additional assistance and barriers were added based on written comments, as well as broader definitions of current employment (retired, non-profit). An additional question asked about intersectionality issues that were not addressed in the rest of the survey. Then the formal survey was activated, and survey participants were invited through word of mouth, social media (Facebook and Twitter, listservs, snowball sampling), and via flyers at appropriate conferences. Conferences included the American Association of Physics Teachers meeting, the International Conference on Women in Physics in England and the Women Leaders in Science, Technology, and Engineering in Kuwait.

A total of 134 responses were received at the time of analysis. To control variables, only US participants were analyzed. Similarly, those whose leadership position did not match the criteria above were removed from analysis. Removing those not currently in STEM, and those not currently in academic leadership (dean, department chair, program director) left 62 responses.

An assumption that was made in this research study was that women in leadership positions would be able to distinguish between the barriers they encounter in STEM and the barriers encountered in leadership. For the majority of women, being in STEM comes first, and women encounter issues with STEM first. Then, in mid to later career, they move into leadership and encounter separate issues. They have been in STEM long enough to have acclimated, and so the new environment makes new challenges more obvious. This assumption may not be true for all respondents.

3. Results

3.1. Demographics of Sample

The 62 women in the analysis worked in a variety of fields in STEM. The field in which they served as a leader is listed in Table 1. Their titles are grouped into rough categories and data are shown in Table 2.

Table 1. Fields in which female STEM leaders worked.

Field	Number of Respondents
STEM or STEM plus others	12
Biology/Life Sciences	7
Chemistry	3
Computer Science	4
Earth Sciences	1
Engineering	10
Mathematics/Statistics	4
Physics/Astronomy	17
Technology	3

Table 2. Titles of leadership positions (grouped).

Title	Number of Respondents
Department Chair	14
Program Director	5
Dean/Associate Dean	12
Director/Founder	19
Project Leader/Manager	10

3.2. Barriers to Women's Participation in Leadership and in STEM

How do the barriers women encounter compare in their path through STEM and their path to leadership? Table 3 lists the number and percentage of women who had encountered certain barriers in their path to leadership. Respondents could choose more than one, so totals do not add up to 100%.

Table 3. Number and percentage of women encountering barriers to leadership.

Barrier	% of Respondents	Number of Respondents (of 62)
Balancing work and home life	81	50
Devaluing of your achievements	66	41
Feeling of inadequacy/imposter phenomenon	65	40
Microaggressions	63	39
Discouragement from peers or supervisors	56	35
Blatant gender bias	56	35
Disparaging comments about your gender	52	32
Dual-career couple issues	42	26
Blatant sexual harassment	16	10

The data for barriers in STEM are similar. Table 4 lists the barriers encountered in STEM, separate from leadership. Figure 1 is a side-by-side comparison between leadership and STEM.

Table 4. Number and percentage of women encountering barriers to STEM.

Barrier	% of Respondents	Number of Respondents (of 62)
Balancing work and home life	81	50
Feeling of inadequacy/imposter phenomenon	68	42
Devaluing of your achievements	61	38
Blatant gender bias	53	33
Disparaging comments about your gender	53	33
Dual-career couple issues	53	33
Microaggressions	52	32
Discouragement from peers or supervisors	50	31
Blatant sexual harassment	23	14

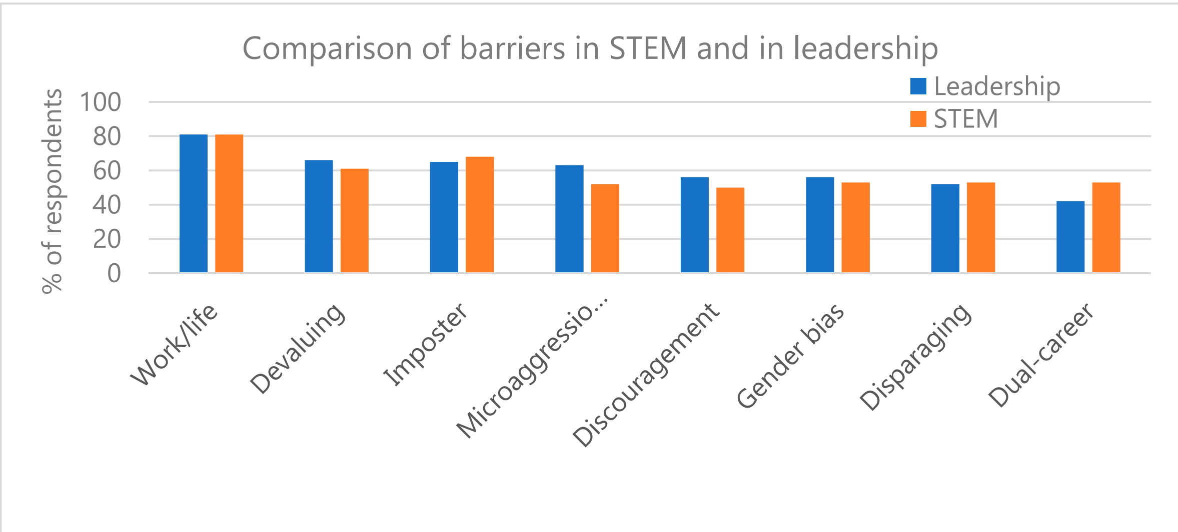

Figure 1. Comparison of barriers to women in leadership and in STEM.

Respondents could also list other problems they dealt with in either STEM or leadership. For leadership, 16 respondents listed additional barriers, paraphrased here:

- Goalpost moving/lack of clarity in metrics for promotion;
- Targeted negative pushback to leadership;
- Told I'm "too young" or "not ready";
- Salary discrimination;

- Discouragement from superiors;
- Age;
- Academic sabotage, toxic work culture;
- Ideas ignored then offered by male peer.

Perhaps the most disheartening response was the woman who said she had encountered "normal gender and minority challenges, nothing unexpected".

Only four women wrote of other barriers in STEM: not being considered when openings arise, a "sink or swim environment on campus", the same barriers as leadership, and being a first generation academic.

When asked what the biggest challenge was for women in the leadership track, 20 of 62 said gender bias: examples include "Men dominating conversations, meetings, arguments" and "Male colleagues pushing back against my authority and decisions". Recognition or being taken seriously was cited by 17 women: "Being taken seriously by senior men who dismiss most things said or done by women as 'taking advantage of affirmative action'" or "Not being recognised by others as having a leadership and decision making role for the institute I am now the director of".

In STEM, the biggest challenge for 20 of the women was gender bias of some form or another: "Systematic devaluing of women faculty in department" or "Not being seen as possessing hard skills because of my gender and attractiveness" or "Having to be twice as competent to be viewed as good enough". One woman wrote that "I've been flat out told by people 'I wouldn't have consulted you on this project if I knew you were a woman. But you seem okay, so we can work together.'".

3.3. Intersectionality

Near the end of the survey, respondents were asked if there were other aspects of their identity that contributed to barriers in their career. Responses are in Table 5. Age was by far the most common (mostly youth, not old age) and race/ethnicity second most common. Two women noted sexual orientation but that it was not an issue.

Table 5. Intersectional identity issues reported by respondents.

Identity	Number of Respondents
Age	11
Race/ethnicity	5
Disability (invisible)	2
Physical appearance	2
Sexual orientation	1
First generation	1

3.4. Interaction of Gender Bias in STEM and Gender Bias in Leadership

One of the key questions on the survey was about the interaction of gender bias in leadership with gender bias in STEM. The survey asked: "Research suggests that the barriers for women in leadership and the barriers for women in STEM are very similar. Considering your experiences in STEM and in leadership, which best describes your experience?" Answers to this question are in Table 6.

Responses add up to 50 because 12 respondents chose "other". These responses were quite varied:

- "I don't think gender bias in my career HELPED me as a leader... it just thickened my skin, made me tougher, and also gave me a zero tolerance attitude as a leader. Targeted negative pushback to leadership"
- "I've experienced gender bias, but I didn't really feel like there was a change when being a leader."
- "I experience gender bias and I still don't know how to deal with it. I probably don't even always recognize it."
- "I probably have experience [sic] gender bias in both but I don't let it be a barrier."

- "I made a radical change moving from a career in IT to pursuing a graduate degree and later in employment in astronomy. The barriers were very different; specifically, impostor syndrome became a factor—completely unrealized by me until too late."
- "I overlook all biases due to determination to reach business goals, that is take one challenge at a time deal appropriately with it and move on."
- "I'm not sure how one "deals with gender bias."
- "I don't know how to separate one from the other."
- "Where is the option for yes, gender bias BOTH as a leader or a woman in STEM?"
- "Gender bias has been a minor issue both as a leader and as a woman in STEM."
- "The gender barriers are higher as a leader."
- "I don't think I am very good at dealing with gender bias. It frustrates me too much."

Table 6. Responses to survey question on interaction of bias in STEM and in leadership.

Experience	% of Respondents	Number of Respondents (of 50)
Dealing with gender bias in STEM has helped me deal with gender bias as a leader.	72	36
I have not experienced gender bias in STEM, but I have as a leader.	2	1
I have not experienced gender bias as a leader, but I have as a woman in STEM.	8	4
Dealing with gender bias in STEM did not prepare me for gender bias as a leader.	16	8
I have not experienced gender bias either as a leader or as a woman in STEM.	2	1

3.5. Assistance to Women's Participation in Leadership and in STEM

Similarly to the questions about barriers, questions on the survey asked about what help respondents had encountered in their path through STEM and their path to leadership. Table 7 lists the number and percentage of women encountering certain types of assistance in their path to leadership.

Table 7. Number and percentage of women encountering assistance to leadership.

Type of Assistance	% of Respondents	Number of Respondents (of 62)
Encouragement from peers	79	49
Support from spouse/partner	76	47
Mentorship	66	41
Encouragement from superiors	65	40
Informal peer networking	63	39
Leadership training	58	36
Encouragement from family	48	30
Sponsorship/advocacy	40	25
Formal networking	19	12

A similar question was asked about help received along the path to *STEM*; results are shown in Table 8. Figure 2 is a side-by-side comparison between leadership and STEM.

Table 8. Number and percentage of women encountering assistance to STEM.

Type of Assistance	% of Respondents	Number of Respondents (of 62)
Support from spouse/partner	77	48
Encouragement from peers	74	44
Informal peer networking	73	45
Encouragement from family	69	43
Mentorship	63	39
Encouragement from teachers	61	38
Encouragement from superiors	60	37
Sponsorship/advocacy	42	26
Formal networking	22	14

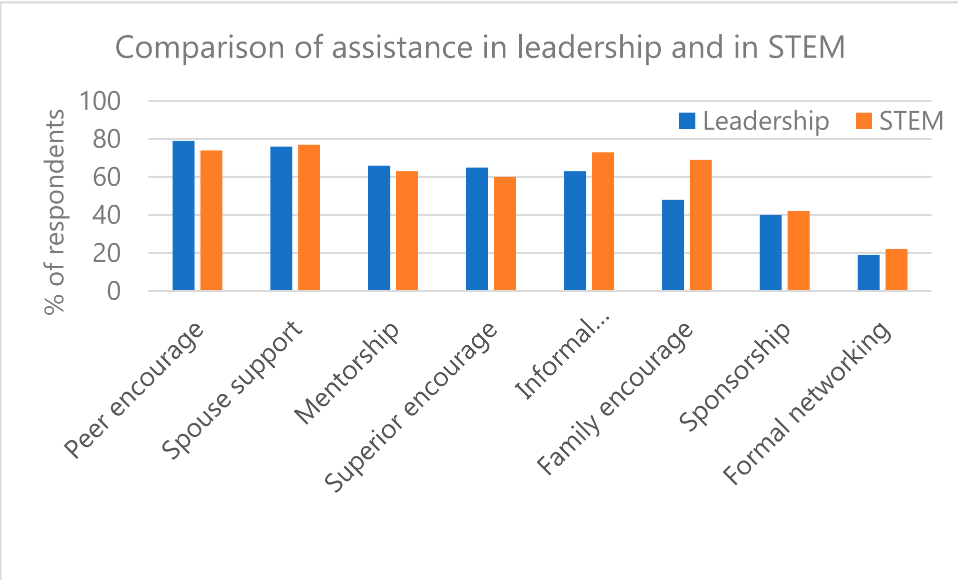

Figure 2. Comparison of assistance for women in leadership and in STEM.

Additional assistance in leadership was listed by four women, and includes experience on committees, self-awareness, and training in project management/people management. For assistance in STEM, again only four women added something: proactive learning, taking opportunities, positive interactions in graduate school, and therapy.

When asked what helped the most for leadership, 43 of 62 women mentioned something related to people: support, mentorship, encouragement, or advocacy: "support from my peers in the department - male faculty in my department . . . have _always_ treated me with respect and shown confidence in my leadership." Only seven women mentioned training or opportunities. One woman said she had received no help on her path to leadership.

The data are similar for what is the most helpful for women in STEM: 47 of 62 women said people: mentoring and support. There were 5 women who said they had received no help in their path through STEM: "Honestly, I don't feel I've had much "help"; it's been a struggle in every sense. The best help I have had is from graduate students and postdocs who value my work and my mentoring; and me as a scientist... I can't change my generation, but I can influence the next generation of scientists."

4. Limitations

This research focused on women in STEM fields who have reached academic leadership positions. The sample used for analysis was US women only, and surveyed only women who have been successful both in STEM and in leadership. The sample size is small, and used primarily social connections and networking to reach women, so it is heavy in physics, the author's field.

This is not a representative sample, but serves as a first look into this overlap of two areas where women are under-represented.

The assumption that women can distinguish between barriers in STEM and barriers in leadership may not be true for all women. The comments in Section 3.4 suggest that some women had difficulty separating the two. A brief check of the data showed that for the barriers encountered, there were no barriers where every woman who had encountered the leadership had also encountered the barrier in STEM. For instance, 50 women selected work/life balance in leadership, but 47 selected this in STEM. While the congruity is large, it is not perfect, so women were able to distinguish in most cases.

5. Discussion

While there is a great deal of research on the drivers and restrainers for women in leadership, and separately for women in STEM, there is nearly nothing known about what women in STEM leadership roles face. Because having women in leadership positions can lead to increased rates of women in an organization [43], this is one avenue to explore to help promote the participation of women in STEM. Along with the STEM + leadership results, this study also serves to verify that women are still facing barriers when working in STEM fields as well as in leadership positions.

Based on the results, women in STEM leadership positions have faced similar barriers in STEM and as a leader. The top three barriers in both areas were balancing work/family life, devaluing of achievements, and imposter syndrome. Over half of the respondents had also encountered blatant gender bias, discouragement, and microaggressions in both STEM and leadership. These are all cultural factors that will take time to mitigate.

The majority of female leaders agreed that having dealt with gender bias in STEM had helped them deal with gender bias in leadership. This is encouraging, and suggests that women looking toward leadership positions in STEM may not have twice the difficulty of being a woman in solely STEM or solely leadership.

The types of assistance women received in STEM and in leadership were comparable. The most common types of help for both were support from spouse/partner, and encouragement from peers. More than half the women had gotten the same types of assistance in both STEM and in leadership: informal peer networking, mentorship, and encouragement from superiors. These data suggest that supportive people are at the heart of what women need to stay in STEM and to advance to leadership positions. This is consistent with work by Brue [44] and Nalls [45].

Another study of this issue is in progress, listening to female STEM leaders' experiences through personal interviews. A more focused view of barriers and assistance will be acquired, which will help in furthering the goal of encouraging women to participate in STEM leadership.

The results of this study point to cultural factors as the main barriers and personal support as the main help for women in STEM leadership. If we are to reach an equitable rate of participation for women in leadership roles in STEM, we need to be working to change the culture of STEM and the culture in leadership. From devaluing women's achievements and disrespecting their authority, we need to move towards an environment where every leader is treated with respect.

Funding: This research received no external funding.

Acknowledgments: The author acknowledges the support of the [University of Wisconsin-Stout].

Conflicts of Interest: The author declares no conflict of interest.

Protection of Human Subjects in Research: This research was reviewed and approved by the University of Wisconsin-Stout Institutional Review Board.

Appendix A. Women and STEM Leadership Survey

For the purposes of this survey, "leadership" can mean many things. If you consider yourself a leader, and you are in an area of STEM (science, technology, engineering, and mathematics), you are welcome to complete this survey.

- Do you identify as a woman/female?
- Do you currently hold a leadership position in a STEM field?
- Have you held a leadership position in a STEM field in the past? (If you have held such a role in the past but are not currently in a leadership position, please answer the questions for that previous role.)
- What is the position or title of your leadership role?
- What STEM field was this position in? (If the position was broader than STEM, please explain.)
- Please describe your role as a leader. (Why do you consider this a leadership role?)

Have you experienced any of the following barriers in your path to leadership? (Please select all that apply.)

- Balancing work and home life
- Discouragement from peers or superiors
- Disparaging comments about your gender
- Devaluing of your achievements
- Blatant gender bias
- Blatant sexual harassment
- Microaggressions
- Dual-career couple issues
- Feeling of inadequacy/not being good enough/imposter syndrome
- Other barriers (please describe)

Have you experienced any of the following assistance in your career in STEM, separate from your leadership role? (Please select all that apply.)

- Mentorship
- Sponsorship/Advocacy (less personal relationship, typically from someone higher up than you)
- Encouragement from peers
- Encouragement from superiors
- Encouragement from teachers
- Encouragement from family
- Support from spouse/partner
- Informal peer networking
- Formal networking
- Other assistance (please describe)

Have you experienced any of the following barriers in your career in STEM, separate from your leadership role? (Please select all that apply.)

- Balancing work and home life
- Discouragement from peers or superiors
- Disparaging comments about your gender
- Devaluing of your achievements
- Blatant gender bias
- Blatant sexual harassment
- Microaggressions
- Dual-career couple issues
- Feeling of inadequacy/not being good enough/imposter syndrome
- Other barriers (please describe)

What is the biggest challenge you have faced as a leader in a STEM field?

What is the biggest help you have received as a leader in a STEM field?

What is the biggest challenge you have faced as a woman in STEM, separate from your leadership role?

What is the biggest help you have received as a woman in STEM, separate from your leadership role?

Research suggests that the barriers for women in leadership and the barriers for women in STEM are very similar. Considering your experiences in STEM and in leadership, which best describes your experience?

- Dealing with gender bias in STEM has helped me deal with gender bias as a leader
- I have not experienced gender bias in STEM, but I have as a leader
- I have not experience gender bias as a leader, but I have as a woman in STEM
- Dealing with gender bias in STEM did not prepare me for gender bias as a leader
- I have not experienced gender bias either as a leader or as a woman in STEM
- Other (please explain)

When did you consider taking a leadership position?

- I've always planned to move up into leadership
- In my late career
- In my mid career
- In my early career
- I never planned to go into leadership
- Other (please explain)

What other comments or thoughts do you have regarding women in STEM leadership?

Appendix B. The Following Questions Will Help Me Understand Your Background

What academic background do you have? (Select all that apply and describe if you want to.)

- BS/BA in a STEM field
- BS/BA in a non-STEM field
- Master's degree in a STEM field
- Master's degree in a non-STEM field
- Doctorate in a STEM field
- Doctorate in a non-STEM field

Do you have any training or background in leadership?

- No formal training or background
- Some training in leadership (workshops, short courses, etc.)
- Formal training in leadership (degree or continuing education work)

What is your current career field?

- Industry
- Academia/post-secondary education
- Education PK-12 or informal education
- Government
- National Laboratory

- Nonprofit
- Retired (from . . .)
- Other (please explain)

What country do you work in? (If your leadership position was in the past, what country was that position in?)

Are there other parts of your identity that have created barriers in your career? (Disability, race/ethnicity, sexuality, age, etc.)

Do you identify as more feminine, more masculine, or neither? Please use the slider below to describe how you identify yourself.

Feminine Neither Masculine
0 1 2 3 4 5 6 7 8 9 10

Feminine-Masculine self identity ()

Do you present yourself to others as more feminine, more masculine, or neither? Please use the slider below to describe how you present yourself to others.

Feminine Neither Masculine
0 1 2 3 4 5 6 7 8 9 10

Feminine-Masculine self identity ()

Is there any feedback on this survey that you would like to share?

References

1. National Science Foundation Women, Minorities, and Persons with Disabilities in Science and Engineering. Available online: https://ncses.nsf.gov/pubs/nsf19304/ (accessed on 17 July 2020).
2. McCullough, L. Proportions of Women in STEM Leadership in the Academy in the USA. *Educ. Sci.* **2020**, *10*, 1. [CrossRef]
3. Amon, M. Looking through the Glass Ceiling: A Qualitative Study of STEM Women's Career Narratives. *Front. Psychol.* **2017**, *8*, 236. [CrossRef] [PubMed]
4. Howe-Walsh., L.; Turnbull., S. Barriers to women leaders in academia: Tales from science and technology. *Stud. High. Educ.* **2016**, *41*, 415–428. [CrossRef]
5. Association for Women in Science: Transforming STEM Leadership Culture. Available online: https://www.awis.org/leadership-report/ (accessed on 30 June 2020).
6. Trefts, S. The Imposter Phenomenon in Female, First-Generation STEM Majors. Ph.D. Thesis, Californian Lutheran University, Thousand Oaks, CA, USA, 2019.
7. Chakraverty, D. The Impostor Phenomenon among Postdoctoral Trainees in Stem: A US-Based Mixed-Methods Study. *Int. J. Doct. Stud.* **2020**, *15*, 329–352. [CrossRef]
8. Ritzdorf, M.A. Women in STEM: Attaining and Retaining Leadership Positions under Stereotype Threat. Ph.D. Thesis, College of St. Mary, Omaha, NE, USA, 2015.
9. American Association of University Women. Barriers and Bias. 2016. Available online: https://www.aauw.org/resources/research/barrier-bias/ (accessed on 6 September 2017).
10. Folke, O.; Rickne, J.; Tanaka, S.; Tateishi, Y. Harassment of Women Leaders. *Daedalus* **2020**, *149*, 180–197. [CrossRef]
11. McLaughlin, H.; Uggen, C.; Blackstone, A. Sexual Harassment, Workplace Authority, and the Paradox of Power. *Amer. Soc. Rev.* **2012**, *77*, 625–647. [CrossRef] [PubMed]

12. Anderson, A.J.; Ahmad, A.S.; King, E.B.; Lindsey, A.P.; Feyre, R.P.; Ragone, S.; Kim, S. The effectiveness of three strategies to reduce the influence of bias in evaluations of female leaders. *J. App. Soc. Psych.* **2015**, *45*, 522–539. [CrossRef]
13. Sanford, A.A.; Ross, E.M.; Blake, S.J.; Cambiano, R.L. Finding Courage and Confirmation: Resisting Impostor Feelings through Relationships with Mentors, Romantic Partners, and Other Women in Leadership. *Adv. Women Lead.* **2015**, *35*, 31–41.
14. American Council on Education. American College President Study. 2017. Available online: https://www.acenet.edu/Research-Insights/Pages/American-College-President-Study.aspx (accessed on 12 July 2020).
15. Wolverton, M.; Bower, B.; Maldonado, C. Leading Ladies: Women University and College Presidents: What They Say about Effective Leadership. *J. Women Educ. Lead.* **2006**, *186*.
16. Corcoran, C.F. Women college presidents: Leading with authenticity. Ph.D. Thesis, University of San Francisco, San Francisco, CA, USA, 2008.
17. Eagly, A.; Carli, L.L. *Through the Labyrinth: The Truth About How Women Become Leaders*; Harvard Business Review Press: Boston MA, USA, 2007.
18. Hall, R.; Sandler, B. The Classroom Climate: A Chilly One for Women? Association of American Colleges, 1982. Available online: http://search.ebscohost.com.ezproxy.lib.uwstout.edu/login.aspx?direct=true&db=eric&AN=ED215628&site=ehost-live (accessed on 9 September 2020).
19. Hall, R.; Sandler, B. Out of the Classroom: A Chilly Campus Climate for Women? Association of American Colleges. October 1984. Available online: http://search.ebscohost.com.ezproxy.lib.uwstout.edu/login.aspx?direct=true&db=eric&AN=ED254125&site=ehost-live (accessed on 9 September 2020).
20. Seymour, E.; Hewitt, N. *Talking About Leaving: Why Undergraduates Leave the Sciences*; Westview Press: Boulder, CO, USA, 1997.
21. Ceci, S.; Williams, W. *Why Aren't More Women in Science?* American Psychological Association: Washington, DC, USA, 2007.
22. Farrell, L.; McHugh, L. Exploring the relationship between implicit and explicit gender-STEM bias and behavior among STEM students using the Implicit Relational Assessment Procedure. *J. Context. Behav. Sci.* **2020**, *15*, 142–152. [CrossRef]
23. National Academies of Sciences, Engineering, and Medicine. *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*; The National Academies Press: Washington, DC, USA, 2018. [CrossRef]
24. Lindquist, C.; McKay, T.; RTI International. *Sexual Harassment Experiences and Consequences for Women Faculty in Science, Engineering, and Medicine; Policy Brief. RTI Press Publication No. PB-0018-1806*; RTI International: Research Triangle Park, NC, USA, 2018.
25. Tan-Wilson, A.; Stamp, N. College Students' Views of Work-Life Balance in STEM Research Careers: Addressing Negative Preconceptions. *CBE Life Sci. Educ.* **2015**, *14*, es5. [CrossRef] [PubMed]
26. Minnotte, K.L.; Pedersen, D.E. Department Environment and Work-to-Life Conflict among Faculty in the STEM Fields. *J. Fam. Issues* **2019**, *40*, 1299–1320. [CrossRef]
27. Rainey, K.; Dancy, M.; Mickelson, R.; Stearns, E.; Moller, S. Race and Gender Differences in How Sense of Belonging Influences Decisions to Major in STEM. *Int. J. STEM Educ.* **2018**, *5*, 10. [CrossRef] [PubMed]
28. Carr, P.; Helitzer, D.; Freund, K.; Westring, A.; McGee, R.; Campbell, P.; Wood, C.; Villablanca, A. A Summary Report from the Research Partnership on Women in Science Careers. *J. Gen. Intern. Med.* **2019**, *3*, 356–362. [CrossRef] [PubMed]
29. Seymour, E.; Hunter, A.-B. *Talking about Leaving Revisited*; Springer: Berlin, Germany, 2019.
30. Klotz, A.M. The Journey to the Top: Women's Paths to the University Presidency. Ph.D. Thesis, DePaul University, Chicago, IL, USA, 2014.
31. Porter, A.R. In Line for the Presidency: The AACC Leadership Competencies and the Career Development of Women Leaders in Community College Administration. Ph.D. Thesis, Lindenwood University, St Charles, MO, USA, 2017.
32. Lam, T.L. Negotiating the Labyrinth: Female Executives in Higher Education Leadership in Vietnam and Australia. Ph.D. Thesis, University of Newcastle, Callaghan, NSW, Australia, 2018.
33. Mahady, C. Voices of Women College Presidents: Women's Perceptions of Career Navigation into the College Presidency. Ph.D. Thesis, University of Pennsylvania, Philadelphia, PA, USA, 2018.

34. Terry, E.J. In Search of Leadership: A Look at Women Presidents in Georgia's Two-Year Colleges and Technical Colleges. Ph.D. Thesis, Capella University, Minneapolis, MN, USA, 2008.
35. Hannum, K.; Muhly, S.; Shockley-Zalabak, P.; White, J.S. *Stories from the Summit Trail: Leadership Journeys of Senior Women in Higher Education*; Higher Education Resource Services (HERS): Denver, CO, USA, 2014.
36. Sagebiel, F. Gender and Network Awareness in/for Successful Leadership in Academic Science and Engineering. *Int. J. Gend. Sci. Technol.* **2018**, *10*, 1.
37. NSERC: Women in Science and Engineering in Canada. Available online: https://www.nserc-crsng.gc.ca/_doc/Reports-Rapports/Women_Science_Engineering_e.pdf (accessed on 21 October 2010).
38. Aschbacher, P.; Li, E.; Roth, E. Is Science Me? High Schools Students' Identities, Participation and Aspirations in Science, Engineering, and Medicine. *J. Res. Sci. Teach.* **2010**, *47*, 564–582. [CrossRef]
39. Thomas, N.; Bystydzienski, J.; Desai, A. Changing Institutional Culture through Peer Mentoring of Women STEM Faculty. *Innov. High. Educ.* **2014**, *40*, 143–157. [CrossRef]
40. Gorman, S.; Durmowicz, M.; Roskes, E.; Slattery, S. Women in the Academy: Female Leadership in STEM Education and the Evolution of a Mentoring Web. Available online: https://eric.ed.gov/?id=EJ903573 (accessed on 28 September 2019).
41. Huston, W.; Cranfield, C.; Forbes, S.; Leigh, A. A sponsorship action plan for increasing diversity in STEMM. *Ecol. Evol.* **2019**, *9*, 2340–2345. [CrossRef] [PubMed]
42. Blackburn, H. The Status of Women in STEM in Higher Education: A Review of the Literature 2007–2017. *Sci. Technol. Libr.* **2017**, *36*, 235–273. [CrossRef]
43. World Economic Forum. Global Gender Gap Report 2017. Available online: https://www.weforum.org/reports/the-global-gender-gap-report-2017 (accessed on 8 September 2020).
44. Brue, K. Work-life Balance for Women in STEM Leadership. *J. Lead. Educ.* **2019**, *18*, 32–45. [CrossRef]
45. Nalls, S.R.N. Ascending to Leadership: A Phenomenological Study of African American Women Leaders in STEM. Ph.D. Thesis, Capella University, Minneapolis, MN, USA, 2020.