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Advancement Experiences of Women in Academic Senior Leadership Positions in STEM Disciplines: A Delphi Analysis

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Abstract

This article explores structural support systems that lead to women's advancement and hindrance factors that either catalyze or delay women's career acceleration in higher education, specifically within STEM-related and workforce education disciplines. Through a consensus-building approach, a four-round Delphi analysis explored the experiences and perceptions of 17 panelists who currently or formerly served in a senior-ranked position within a higher education setting at five institutions in the Southeast United States. The panel included women who met the eligibility criteria as subject matter experts and held positions as deans in a STEM discipline, principal investigators over federally funded STEM and workforce education programs, and Assistant Vice Presidents. A consensus was reached on nine factors supporting advancement and three factors inhibiting advancement for a total of 12 factors that were considered relevant to the research questions based on the mean score of 3.50.

The panelists identified the following factors as relevant for supporting advancement: Support Systems, Personal Attributes, Willingness to Advance, Leadership Skills, Curiosity about New Experiences, Role Models, Opportunities for Leadership Roles, Experiences in Undergraduate and Graduate Studies, and Awareness of Institutional Environments; and those for inhibiting advancement: Conflicting Family Obligations, Lack of Compensation, and Personal Concerns. Support Systems and Personal Attributes were the top-rated factors contributing to advancement, while Conflicting Family Obligations and Lack of Compensation were the leading hindrances.

Keywords: Women's advancement, women leaders, Delphi, women in community college, women in STEM, gender issues, women in leadership.

Introduction

The lack of institutional support structures has negative and unintended consequences on women's advancement in STEM fields in higher education settings. Although previous studies have contributed to understanding the gender gap, additional research is needed to investigate systemic approaches that increase representation and promote gender equity in higher education (Leech et al., 2017; Wang & Degol, 2017). In response to the shortage of women in STEM, higher education leaders, policymakers, and practitioners made efforts to address gender equity within higher education and identify institutional strategies to broaden the participation of women serving in senior ranks within academic leadership positions (Holmes et al., 2016). The messages of inclusion are frequently raised as important goals within academic constructs and institutional strategic plans; however, institutional commitments related to achieving these goals require systemic changes in departmental policies and processes to increase STEM participation (Moss-Racusin et al., 2016). For the purposes of our research, we consider inclusion as offering all individuals, regardless of exceptionality, the same opportunity and providing resources for those who may be excluded such as members of minority groups (Collins et al., 2019).

This study explores both support and hindrance factors related to women's advancement in STEM at both public and private institutions that offer two-year degrees. The research is centered on the experiences of women who have served at this specific institution type to better understand how the conditions at two-year degree offering institutions may differ from those at larger research institutions in the context of advancement opportunities. Two-year degree offering institutions have unique missions focused on student success in general studies and relevant workforce education which is often reflected in the requirements for promotion and

tenure (Mellow & Heelan, 2014; Shattuck et al., 2018).

A better understanding of the factors that impact women's advancement has the potential to increase awareness about supports and barriers for those who want to ensure the equitable advancement of women. Increased knowledge about structural policies and procedures to reduce barriers for all women pursuing academic leadership roles can create pathways for others (Su et al., 2015). The knowledge generated through the voices of women in these positions can inform the application of new practices and institutional strategies with the potential to improve gender equity (Williams et al., 2016). In turn, these new structures of support may increase the participation and advancement of women.

Strategies may include creating a priority pipeline of female leaders to address the future and immediate needs for a diverse scientific community within STEM. The definition of diversity for the purposes of this research is the ability to promote an acceptance of differences rather than an elimination of differences (WEPAN, 2021). Furthermore, diversity in education equals opportunities and education of all sectors of society by including different perspectives and cultures (Astin, 1993). This is important for the context of this study as we aim to explore differences to support gender equity in organizations in an effort to promote systems that benefit both men and women.

Two-year institutions attract faculty members who prioritize teaching and service within postsecondary two-year degree programs designed to address regional STEM workforce needs (Stout et al., 2018). Two-year institutions are traditionally open-access and tend to have a more diverse student population with specific needs that require additional attention of faculty to engage in best practices for teaching and learning (Alexander et al., 2012). This is reflected in promotion criteria as faculty members at two-year degree programs often are evaluated and

promoted on their abilities to contribute to the institutional benchmarks for student retention and learning, among others without research and publication pressure that is the hallmark of research-intensive universities (Shattuck et al., 2018).

As a result of these differences between two- and four-year institutions, the current study considers the unique workplace climate at two-year degree offering institutions that has potential to positively impact the experiences of the participants in this study. These experiences within the support structures available at these institutions may have offered alternative pathways to promotion for the panelists who successfully advanced in their careers to senior ranking administrators at two-year degree offering institution types compared to other private and public institutions in the higher education system (Cohen & Brawer, 2008).

By documenting successful strategies as well as barriers, we focus on the assets of women and what makes them successful. We also consider the systemic issues that hinder them rather than looking at the women from a deficit perspective. Therefore, core questions surrounding the factors that led to the academic advancement and retention of women in STEM-related administrative and senior-ranked positions are explored. Women in upper leadership roles in STEM are currently a minority and thus require additional attention through research so their voices are represented and not ignored (Casad et al., 2021).

Women can have a positive effect in these positions as institutions build more equitable conditions for women. They can create pathways for the next generation to move into leadership positions that can be seen as gatekeepers in the promotion processes. The appointment of the department chair, dean, and senior-ranking administrators often has a greater influence on the promotion of others due to their access to resources and financial support to provide mid-career faculty with additional professional development opportunities, course releases, and funding to

support research (Kogovšek & Kogovšek, 2017).

To further support this national movement to reduce barriers for women in STEM disciplines and workplace education, this study identified factors that can be used as a conceptual framework for establishing institutional conditions and a work environment across higher education institutions that support women in senior-ranked positions. Although the academic community may be cognizant of the factors, the study offers a framework to identify barriers and create spaces that reduce biases that often impede the career acceleration of women. As a result of this study, academic leaders can further investigate current institutional strategies and predictors for women's success and retention in STEM disciplines. Such an exploration addresses pathways to gender equity by identifying discriminatory structural and procedural barriers, as well as documenting the best strategies to promote tolerance and understanding of differences to support women in STEM (WEPAN, 2021).

Research Questions

The following questions framed this study:

1) What factors support women's professional advancement and success in leadership positions within STEM and workforce education-related disciplines at two-year institutions?
2) What factors inhibit women's professional advancement and success in leadership positions within STEM and workforce education-related disciplines at two-year institutions?

Conceptual Framework

Eagly and Carli (2003) define role congruity theory as prejudice towards women when they are occupants of leadership roles that require certain characteristics traditionally associated

with men. Evidence from the work of Eagly and Carli (2003) suggest that women are less likely to advance or be successful in areas that fall outside traditional gender roles due to the sometimes subconscious, underlying belief that men believe women do not have the attributes or inherited leadership traits that men possess in similar administrative and executive positions. The focus of this study is on women's career mobility in an organization and system that is inherently masculine, such as STEM. This offers the conceptual basis for understanding institutional and organizational effects on women faculty who advanced in academia (Schock et al., 2019).

Schock et al. (2019) found that women were most likely to emerge as leaders who were self-aware and exhibited "communal behaviors" as a strategy to avoid backlash such as being kind and showing empathy to others (p. 189). Therefore, this study considers concepts for advancement to include characteristics of leadership that encourage open communication, maximize positive gender differences in leadership traits, challenge gender stereotypes about role perceptions, and advocate for mechanisms to eliminate bias in the organization. Eagly (1987) alludes to behavioral tendencies to be norms that men and women adopt as ideal social roles. In turn, beliefs about gender differences and the requirements of leaders in certain power roles are reinforced, and expectations for women and men are different depending on the type of leadership position being occupied (Iskander et al., 2013).

In academia, perceived gender roles and expectations for women are often associated with women who are successful in teaching and in education roles compared to higher-paid research and administrative roles (Wiedman, 2020). At most two-year institutions, the promotion and tenure processes prioritize faculty's efforts in teaching and service compared to four-year institutions that require notable achievements in research and scholarship to advance. The focus on teaching and service are common attributes associated with gender roles for women and are

consistent with Eagly (1987) regarding perceived roles for women. These roles can contribute to behavioral tendencies leading to advancement in the two-year college context (Wiedman, 2020).

Although women advance under conditions that promote and prioritize stereotypical roles for women such as teaching, education, and service, the gender pay gap in academe still exists (Wang et al., 2019). The traits associated with women based on role congruity theory are often categorized under positions that do not have equitable pay even if equal or more service is required for the position of leadership. While this gap has partially eroded over time, it appears that there is a direct relationship between a gender pay gap in higher-level positions as women with more years of experience are impacted the most (2019).

The study considers the effects of this pay gap on women in leadership and the institutional structures available at two-year institutions that create opportunities to advance women even if the advancement doesn't afford an increase in pay. Wang et al. (2019) presented similar findings, noting a gender pay gap between male and female CEOs. They determined that women who exercise less communal traits such as risk-taking reduce the gender pay gap. They also noted that women who lead in female-dominated industries outside of academia narrow the pay gap because those traits are more highly valued.

Comparatively, female leaders who possess feminine qualities, such as the ability to inspire and motivate others, are more likely to succeed in leadership roles at organizations that promote these characteristics (Eagly & Carli, 2003). In support, the findings of Eagly et al. (2000) claim that expectations about behaviors for men in leadership roles are strongly described as aggressive, dominant, forceful, and self-sufficient, where women are more likely to succeed in areas with less responsibility that are more service-oriented

Eagly and Carli (2003) discussed specific norms about what members of a group are

expected to do that permeate an organization. These gendered interactions are further personified in leadership roles in STEM as women who advance are less likely to receive equitable pay in areas related to research and scholarship (Goldin, 2014). Role congruity theory provides the foundation for the study as women in STEM often face potential prejudice regarding male role expectations, but can advance through coping strategies traditionally viewed as a feminine quality such as effective communication and mentoring relationships (Eagly & Carli, 2003).

Contrary to stereotypical beliefs, research findings on role congruency theory show that women were undervalued when they practice leadership styles associated with men and were more successful when they practiced leadership styles associated with women (Eagly et al., 2000). This phenomenon is seen in teaching roles and areas within academia that reward and perpetuate women in service positions and teaching appointments that advance through informal networks and mentoring relationships (Rankin & Adkins, 2014).

However, research suggests that women experience less success when they are in organizational areas such as some traditional STEM departments controlled by common roles and leadership styles that are more democratic and masculine. Leadership roles in these areas require expertise related to an individual's motivation that are often associated with men (Wiedman, 2020). As more women seek prestigious positions through research, grant activity, and scholarship, it has the potential to shift the academic hierarchy away from traditional stereotypes that prevent women from achieving higher-level positions in academia that occur on merit not necessarily related to teaching.

Review of Literature

Women advance and accept specific responsibilities and roles that prepare them to lead others (Bichsel & McChesney, 2017). Academia as a workplace has made great strides toward

offering social justice for women (Risman & Adkins, 2014). Through the ADVANCE grants, designed by the National Science Foundation to increase institutional gender transformation in STEM, many barriers have been identified and replaced by support mechanisms to aid women's retention and build equity in the STEM academic workforce and STEM workforce in general (Monroe et al., 2014).

Societal efforts to address cultural stereotypes have led to an increase in the number of women who earn advanced degrees and reduce the pay gap between men and women in the STEM academic workforce (Bichsel & McChesney, 2017). As a result, positive changes in policies evolved as an increase in women both married and single left the home to find equal work opportunities (Hill, 2014). Therefore, University policies required more intentional language regarding inclusion practices to recruit women into positions with equitable pay that were traditionally male-dominated and required advanced degrees (Holmes et al., 2016).

Efforts to increase opportunities for women continue to build through women's advocacy groups and federal programs that focus on gender equity in STEM (National Science Foundation [NSF], 2017). This change in messaging increases awareness about the strength of women who persist in these roles with limited support and can create new opportunities for others' career mobility. In turn, this will increase the diversity of the workforce to include women in STEM academic disciplines (Office of Science and Technology Policy, 2016).

A substantial body of literature explores the leadership capacity and efficacy of women in STEM and factors that contribute to the disproportionate number of men compared to women that serve in leadership roles (Charleston & Leon, 2016; Xu, 2017). The studies address critical points of attrition for women in their early and mid-career who seek to enter academic leadership positions. Spiceland (2018) document the rise of women moving into leadership positions as well

as the necessary support systems that were previously unavailable and are starting to emerge.

The increase can be contributed to the national movement to build capacity for women to enter STEM by building support at the early stages of their academic careers (Perez-Felkner et al., 2017; Wladis et al., 2015). Specifically, studies show the increase of women in secondary and postsecondary levels entering STEM fields can be contributed to their abilities to leverage both resilience capital and navigational capital (Rincón et al., 2020).

The ability of women to persist is documented through studies that emphasize the obstacles women overcame during their pursuit of tenure and promotion to include factors such as bias against women in leadership in STEM (Williams et al., 2016). In support, Su et al. (2015) highlight the conditions that many women may have faced in early- and mid-career faculty roles that influenced career choice and willingness to advance. The positive conditions include departmental climate, work/life balance, and collegiality relative to gender differences.

As the gender gap continues to close (Speer, 2017), the rise of women in STEM may be contributed to increased messaging to show the barriers for women are more aggressively being addressed (Polkowska, 2013). The transition into and retention in a faculty position for women after the doctorate is a critical juncture for women in their early careers and the greatest point of attrition for women compared to men (Xu, 2017).

Furthermore, the ability of women to persist in the last decade under unfavorable conditions at times requires women to conform to gender norms to survive (Lester et al., 2011). This finding may be associated with challenges women face when their equivalent achievements go unrecognized among peers or supervisors compared to make counterparts. These challenges inside and outside the workplace present may require conformity to the current norms for women to advance. As such, the pace of women to fill leadership positions compared to men may be

slower with limited representation in senior-level positions (Wang, & Degol, 2017). As a result, the low representation has the potential to reduce opportunities for others (Su et al., 2015).

Goldin's (2014) study supported the findings of Su et al. (2015) and examines non-linear compensation when women leave full-time positions for flexible work conditions that perform similar work. Goldin (2014) claims women are more likely to leave a work environment that does not accommodate the flexibility needed for a healthy work-life balance. As a result, structural changes to an organization, including technological advantages, make it easier for companies to provide flexible hours for employees without compromising the quality of work. However, the gender wage gap exists as women leave positions with traditional hours for work accommodations that pay less and are not as likely to receive career advancement but offer flexibility for remote work if needed.

Similar to the findings of Su et al., (2015), Goldin (2014) argues many women experience interrupted career paths and delayed upward career mobility when they choose professional appointments in which they are overqualified with a reduction in pay to attain the needed flexibility. These conditions can have a negative impact on women's scholarly contributions in STEM fields as well as affect the hiring, promotion, and retention of women in STEM (Kincaid, 2015). Fortunately, women continue to enter the STEM fields as shown by the 60% increase of the number of STEM degrees that women received between 2019 and 2018 (National Center for Education Statistics, 2018). The increase in women who choose STEM majors and graduate with STEM degrees has the potential to influence the composition of faculty in those disciplines as more women choose to stay or return to academia.

Research Methods

Authors' Positionalities

As domestic-born, white authors representing gender differences, we believe in developing diversity within our research practice. Though the research goal is to explore women's experiences in a higher education setting, we individually come to our work differently with unique views of the world based on our backgrounds, life experiences, and professional roles at separate higher education institutions. One author identifies as a white woman with a background in STEM education. She is a social science researcher who served as a doctoral candidate at the time of data collection. As a mid-career faculty member seeking to advance within STEM, the author was very close to the research and the findings related to her personal experiences. This helped her build a rapport with the panelists and added more depth and breadth to her understanding of the responses. Although the author was not able to be completely objective due to the closeness to the research, her experiences influenced how the data were interpreted and offered further guidance in the practical application of the findings in academia.

The second author identifies as a white male and a career and technical education researcher. He is currently an associate professor with an appointment as Department Chair of the STEMPS Department, and has worked in business, education, and academe with diverse populations in each. As such, our backgrounds may differ considerably from the panelists in this study. Although it is not possible to mitigate subjectivity or bias completely, we entered and ended this study by practicing ongoing reflexivity as a way to preempt a reader’s curiosity. We understand that our views of the world may differ from others, and we consider how our identities may influence our interpretations of the findings and conclusions.

Protection of Vulnerable Populations

We applied the following strategies to protect the participants in the study who were part of a select regional group of women who currently or formerly served in leadership positions. These women represented a variety of ethnic and racial groups and, while they were not asked, they may have identified as part of the LGBTQ community. We engaged in a thorough recruitment process with informed consent to ensure the individuals invited to participate in the study, who may be marginalized and experienced vulnerabilities because of their gender, understood the purpose of the study and future plans for research. During data collection, the participants were provided guidance that they did not have to respond or offer identifying information regarding their own experiences. Pseudonyms were assigned and used during data collection and analysis. Due to the small population of women who met the eligibility criteria, recruitment included women who served at various institution types (public and private) that offered two-year degrees and was not limited to public, two-year institutions. Confidentiality and data security were in adherence to institutional IRB protocol and personal identifiers were removed to reduce deductive disclosure and protect participants' identities.

Methods

An exploratory approach with guidelines on identifying the most critical issues related to the research topic is needed to address factors specific to the advancement or inhibitions regarding women in the academic workforce. The Delphi technique offers the ability to obtain opinions and consensus from experts across STEM disciplines (Dalkey, 1972; Stitt-Gohdes & Crews, 2004). The study includes four rounds built on the framework of Schmidt (1997) that offers guidelines for conducting a Delphi to explore the research questions. Panelists were asked to participate in four rounds to 1) identify factors related to both research questions; 2) examine

the aggregated list of factors identified by the panel in Round 1 and identify missing factors; 3) rate each item based on panelists' perceptions of each item; and 4) confirm individual ratings from Round 3 based on the group responses. The Delphi technique is the most appropriate approach based on the structure that helps panelists to draw conclusions based on group consensus (Delbecq et al., 1975). The process builds consensus after soliciting experts to explore an emerging phenomenon specific to the academic STEM workforce (Martin, & Ritz, 2012).

The factors are examined through a controlled process to create the "gradual formation of a considered opinion" (Stitt-Gohdes & Crews, 2004, p. 62). Since the identities of the other panelists are confidential, the process encourages a consensus free from peer group pressure through the successive rounds of considering and revising information. The approach offers the flexibility for the panelists to arrive at a consensus without having to meet each other or be inhibited by one or more dominant panel members (Williams & Webb, 1994).

Participants. We used established eligibility criteria to identify panelists and additional selection criteria to select the final panel. Eligible panelists currently or previously served as an administrator in higher education at an institution that offers two-year degrees. Once we identified individuals who met the eligibility criteria, we used selection criteria to determine the most appropriate panelists. Additional criteria included gender affiliation, educational background, diversity of STEM disciplines, and membership within women's advocacy organizations and related workforce fields (e.g., membership in national or regional chapters of the Society for Women Engineers, American Association for Women in Community Colleges, Society for Women Chemists), and selected federally-funded programs focused on broadening participation in STEM. Subject matter expertise, career longevity within STEM, and the individual’s proficiency and experience level to understand issues related to leadership and

gender equity within STEM fields were considered.

Due to the small population of women in these fields, the authors chose to protect the panelists by not identifying the participants by race/ethnicity. Although the panelists represented diverse groups of women including those who identified as African-American, Hispanic, Latino, White, and Pacific Islander, the focus of this research was on including panelists that represented diverse groups within professional STEM disciplines. The context of inclusion was addressed by discussing our aim to bring forward the voices of a small population of women who meet the eligibility criteria. These voices are often ignored and require small, focused group sizes such as those used through the Delphi technique as well as case studies. The small group process with anonymity between participants is important to create equity and include individuals in research from groups not always represented in studies with survey designs targeting large population sizes. For example, because the population of women in STEM leadership positions at two-year degree offering institutions is small, we worked with a small group of panelists out of necessity.

The study relies on guidelines in the Delphi process for choosing the most appropriate experts with knowledge about the research questions to increase the quality of the responses (Rohrbaugh, 1979; Schmidt, 1997; Williams & Webb, 1994). We solicited a panel size of up to 20 individuals to ensure a minimum of 10 after attrition (Reid, 1988; Reid & Nygren, 1988). The target panel size is consistent with Dalkey's (1972) group estimation process to achieve experimental results with small group size. We used a purposive sample that required specific criteria regarding the position of leadership held by each panelist. The leadership positions include roles such as principal investigators of large federally-funded STEM grants, deans, associate vice presidents, or vice presidents within the identified STEM fields.

We recruited experts based on guidelines to include their expertise, experience, and skill

in offering sound judgment and information processing capability to explore the factors (Delbecq et al., 1975; Jones & Twiss, 1978; Schmidt, 1997). We invited an initial purposive sample of 10 former and current female administrators to participate. Then, we used a snowball sampling technique to recruit additional panelists based on the criterion to reach 20 eligible panelists to participate in Round 1. Through background research, we obtained information necessary for the selection criteria for each panelist and requested additional information through email and phone correspondence to ensure the panelist was the most appropriate to be considered as experts.

Sampling frame. The study consists of four consecutive rounds conducted through email. After the introductory letter, panelists were sent the Round 1 survey and asked to identify two or three factors related to the research questions along with a few descriptive sentences for each. The descriptive sentences give additional context to include personal experiences or perceived experiences based on knowledge of STEM departmental conditions and women's career progression within higher education settings. A review committee of research and content experts who did not participate in the study identified common themes in the responses and then aggregated the data. In Round 2, the panelists reviewed the aggregated responses and additional modifications to the current list of factors such as factors they felt were omitted from the list.

In Round 3, we sent panelists the modified list and asked them to rate the resulting factors on a Likert-type scale (Kosloski & Ritz, 2016). Measures of central tendency and level of dispersion were used to determine the collective relevance of the factors. We determined a factor as relevant based on the final mean (*M*) score of 3.50 or higher on the 5.0 scale based on Delphi studies that used a similar cut-off score as appropriate (Kosloski & Ritz, 2016; Pate et al., 2012). We established that consensus was reached for any factors that had an interquartile range (*IQR*) 2.00 or below based on similar studies that used 2.00 as an acceptable threshold to indicate

consensus (Kosloski & Ritz, 2016). Factors with an *IQR* higher than 2.00 indicate that consensus was not reached due to the high dispersion of the ratings for each factor.

At the end of the rating phase, we compiled the list and sent it back to the panelists to reconsider agreement or disagreement with the rated items. In this final stage of Round 4, the panelists submitted the refined list with the overall mean scores for the group and their ratings. We asked the panelists if they wished to adjust their scores or leave them as is after reviewing the group responses from Round 3 (Okoli & Pawlowski, 2004). As part of the process, panelists had the opportunity to compare their initial rating from Round 3 to the group rating through mean, median, interquartile range, and standard deviation.

The panelists' opinions are based on their experiences on the topic to elicit a broad range of responses. However, a narrow range of opinions is possible because of the small sample size of women that were enlisted by a specific set of criteria related to their role in academic senior-ranked positions within STEM disciplines and knowledge of issues pertinent to women's advancement in higher education (Judd, 1972).

Findings

Data Collection and Analysis. The four rounds of the Delphi were presented to the panelists from February 2019 to May 2019. Invitations were extended to 28 potential eligible panelists. A total of 20 panelists who responded yes to the initial invitation were selected to participate in the Delphi study. In Round 1, 17 out of 20 panelists that committed to participate in the study responded to the Round 1 survey. Three were lost due to attrition. Table 1 provides a breakdown of the panelists' academic specializations to show the diversity in the panelists' professional backgrounds and academic appointments.

Eight panelists served as deans within a STEM academic discipline. Six of the panelists

were in administrative roles and oversaw federally funded STEM and STEM-related workforce education programs as a director or principal investigator. Three of the panelists served as Assistant Vice Presidents responsible for STEM and workforce education-related programs. All panelists had a minimum of three years of experience within an administrative role as a program chair, dean, principal investigator, or assistant vice president. All panelists had extensive research and academic experience within their related STEM discipline and held a terminal degree within their field and were active members in at least one organization that promotes the advancement of women in leadership and STEM fields.

Table 1

Panelists' Area of Responsibility by STEM and Workforce Education Program Affiliation

STEM and Workforce Education Program	# of Panelists
Mathematics and Related Fields	5
Workforce and STEM Education	4
Health	3
Engineering	2
Computer Science	1
Aeronautics	1
Environmental Sciences	1
Total	17

The panelists contributed a maximum of three factors for each research question with a description that served the purpose of providing an open-ended element to use when interpreting the panelists' intent. Similarities reduced the categorized list of factors and descriptions to 10 factors that support advancement and 12 factors that inhibit advancement for a total of 22 factors

with associated descriptions and examples of personal experiences for context. The descriptions were based on similar responses and themes such as mentoring, support systems, industry experience, parental and caregiver responsibilities, and desire to advance.

Round 2. The second round utilized a modified questionnaire that included the consolidated list of randomly ordered factors based on the analysis of Round 1 data. The panelists were asked to suggest modifications to the existing factors and add any factors they felt were omitted from the original lists (Dalkey, 1972). This round provided a basis for achieving agreement on the researchers' interpretation of each category to ensure a valid, consolidated list was produced by the review committee. In Round 2, 17 out of the 17 (100%) panelists responded. Five panelists provided additional modifications to the factors and descriptions.

The revised list based on panelists' feedback increased the number of related factors and descriptions from 10 to 13 factors that support advancement and 12 factors that inhibit advancement for a total of 25 factors with associated descriptions and examples of personal experience for context. The researchers edited and amalgamated the factors and descriptions using the same method used earlier by the review committee. Table 2 shows the updated list of factors and descriptions.

Table 2

Categorized List of Factors by Review Committee

Factors Supporting Advancement	Descriptions and Examples from Participants
Support Systems	Support such as the presence of a mentor, membership in professional organizations, a supportive organizational climate, access to and funding for professional development, and the support of family members. Examples can extend to a significant other or family member as well as a coach and advocate who offers tangible and emotional support.

Willingness to Advance	Desire and willingness to advance include taking on new experiences and additional roles and responsibilities that come with a change in position. Examples include the willingness to accept an administrative role, although it may mean less time for other scholarship activities (e.g., teaching or research).
Curiosity about New Experiences	This factor includes ambition and desire to seek new positions within leadership and explore new opportunities and education to move beyond one's current role and responsibilities.
Leadership Skills	Skills that made participants qualified for positions, such as soft skills, communication skills, interpersonal skills, leadership training, understanding of data analysis and interpretation, and fiscal management abilities.
Desire to See Women in Leadership	Desire to see women represented in leadership positions that contribute to strong messages and advocacy for other women to advance.
Industry Experience	Related-industry experiences in STEM that gave participants additional qualifications to advance in leadership positions within higher education settings. Further descriptions include one's ability to advance in positions of leadership within the private industry that lacks women in leadership positions, leading to the ability to advance in higher education.
Awareness of the Institutional Environment	Awareness of positive departmental climate, organizational culture, and job factors within STEM departments and higher education institutions that lead to advancement opportunities. This includes teamwork, collegiality, a sense of community, and institutional factors that support women in STEM leadership roles.
Knowledge of Institutional Assessment	Ability to analyze institutional data and offer an assessment of programs for leaders to make data-driven decisions.

Experiences in Undergraduate and Graduate Programs	Positive experiences in undergraduate and graduate programs that gave participants the foundational knowledge and support for future advancement in STEM leadership positions.
Faith	Religious faith and a strong belief in God or in the doctrines of a religion, based on spiritual apprehension rather than proof that offers inner strength and ability to advance.
Personal Attributes	Personal attributes, such as confidence in oneself, passion, vision, emotional stability, and ability to adapt to change.
Role Models	The presence of respected role models in STEM leadership positions who were willing to share/mentor.
Opportunities for Leadership Roles and Professional Development	Additional leadership opportunities and professional development experiences that motivate and prepare a person for academic leadership roles that can be achieved within a current position. These leadership opportunities may not require a job title change but may be accomplished through a temporary leave of absence from the institution, such as a fellowship for a residency at the National Science Foundation, chairing national committees, serving as PI on complex grants, involvement in industry partnerships. Additional examples include sabbatical opportunities, Faculty Senate officer positions, internships in the Dean's/Provost's office, and leadership workshops/retreats.

Factors Inhibiting Advancement	Description and Examples from Participants
Feelings of Isolation	Feelings of being alone, associated with limited interaction, no connection to the institutional community, limited faculty support, and being separated from the main campus. Examples may include working remotely without a support system or a sense of community.

Stereotype Threat	Struggling against perceptions that women do not belong in STEM fields, particularly in leadership roles, or that others are more competent than oneself. Also, the perception that women leaders are thought of as aggressive and dominant.
Discrimination	The presence of negative attitudes from factors such as physical attributes, race/ethnicity, age, gender, and behaviors.
Failing to Perceive Room or Opportunity for Advancement	Positions are not available for women due to factors such as unwieldy policies and procedures and perceived invisible walls for women.
Lack of Support	Perceiving a lack of support and respect for women in leadership positions, challenges, or reversals to decisions. Additional examples include being treated as servants, not being acknowledged as leaders, and limited support from supervisors.
Limited Experience or Degree	Lack of opportunity for experiences and STEM degree-attainment required to advance in leadership.
Lack of Compensation	Taking on more work without a corresponding change in title, recognition, or increased pay.
Personal Concerns	Factors related to health, family, and emotional issues impacting participants' ability to advance.
Limited Skills Training and Ability	Limited access to the leadership training and experiences that prepare participants for STEM leadership positions.
Lack of Desire	Being unmotivated to advance when opportunities arise. Examples may include having little interest in leadership roles because the additional responsibilities are administrative or not relative to one's career interests.
English as a Second Language	Language barriers were causing a problem with communication.

Round 3. In the third round, 15 of the 17 panelists responded and two were lost to attrition. Panelists rated each factor by relevance using a five-point Likert-type scale (5 = Most

Relevant Factor, 4 = Significant Relevant Factor, 3 = Moderate Relevant Factor, 2 = Limited Relevant Factor, and 1 = Not Relevant Factor). Round 3 offered the panelists an opportunity to reach a consensus in the ratings within the categories identified in Round 2. In Round 3, 23 out of the 25 factors had an interquartile range 2.00 or below and met the minimum threshold required for consensus to be reached. Out of those 23 factors, eight factors supporting advancement and one factor inhibiting advancement had a mean score of 3.50 or above for a total of nine factors whereby the panelists reached consensus. Table 3 shows the Round 3 results.

Table 3

Round 3 Results from Group Responses on the relevance of each factor to the research question

Factors Supporting Advancement	*M*	*Mdn*	*SD*	*IQR*
Support Systems*	4.31	4.00	0.60	1.00
Willingness to Advance*	4.06	4.00	1.06	1.00
Leadership Skills*	4.00	4.00	0.63	0.00
Personal Attributes*	3.88	4.00	0.81	1.25
Opportunities for Leadership Roles and Professional Development*	3.88	4.00	0.81	0.50
Curiosity for New Experiences*	3.81	4.00	0.75	1.00
Role Models*	3.63	4.00	0.81	1.00
Experiences in Undergraduate and Graduate Programs*	3.50	4.00	0.73	1.00
Awareness of the Institutional Environment	3.44	3.00	1.15	1.25
Knowledge of Institutional Assessment	3.00	3.00	0.97	0.75
Industry Experience	2.88	3.00	1.02	2.00
Desire to See Women in Leadership	2.50	2.00	1.03	1.00
Faith	2.38	2.00	1.45	2.25

Factors Inhibiting Advancement	*M*	*Mdn*	*SD*	*IQR*
Conflicting Family Obligations*	3.75	4.00	1.34	2.00
Lack of Support	3.44	4.00	1.26	1.75
Personal Concerns	3.44	4.00	1.03	1.00
Feeling of Isolation	3.31	3.00	0.79	1.00
Lack of Compensation	3.31	3.00	1.14	1.00
Discrimination	3.25	3.00	1.13	1.50
Stereotype Threat	3.13	3.00	1.26	2.00
Limited Skills Training and Ability	3.06	3.00	1.06	2.00
Failing to Perceive Room or Opportunity for Advancement	3.06	3.00	1.29	2.00
Limited Experience or Degree	2.63	3.00	1.15	1.00
Lack of Desire	2.88	3.00	1.54	2.75
English as a Second Language	1.94	2.00	1.06	1.25

* Factors that were both relevant and reached consensus.

Round 4. In Round 4, the panelists were sent their ratings for Round 3 factors, along with the panel's aggregate descriptive statistics to include the mean (*M*), median (*Mdn*), interquartile range (*IQR*), and standard deviation (*SD*) for each factor that reached consensus based on the group response for comparison. Panelists then had the opportunity to change their ratings after comparing their response with the group response and submit a new rating for factors if they deemed it appropriate.

Following the same protocol as Round 3, the mean score was the primary indicator for a factor's relevance to the research questions. All 15 of the remaining panelists responded in Round 4. The literature suggests that a Delphi study must maintain at least 70% of its panel throughout the process to be valid (Vogel et al., 2019). This study was launched with 20 panelists and ended with 15, for a 75% retention rate. Table 4 shows the results of Round 4 and the factors that have a mean of 3.50 or higher and an *IQR* less than or equal to 2.00. Eight panelists responded with the same ratings from Round 3, and seven responded with changes to their previous ratings based on the group responses.

Table 4

Round 4 Results from Group Responses on the Relevance of Each Factor

Factors Supporting Advancement	*M*	*Mdn*	*SD*	*IQR*
Support Systems*	4.40	4.00	0.51	1.00
Personal Attributes*	4.13	4.00	0.74	1.00
Willingness to Advance*	4.07	4.00	1.10	1.00
Leadership Skills*	4.00	4.00	0.53	0.00
Curiosity for New Experiences*	3.73	4.00	0.70	1.00
Role Models*	3.73	4.00	0.70	0.75
Opportunities for Leadership Roles and Professional Development*	3.73	4.00	0.80	0.75
Experiences in Undergraduate and Graduate Programs*	3.67	4.00	0.62	0.75
Awareness of the Institutional Environment*	3.60	3.50	1.12	1.50
Knowledge of Institutional Assessment	3.20	3.00	0.86	1.00
Industry Experience	2.93	3.00	0.88	1.25
Desire to See Women in Leadership	2.60	2.00	0.91	1.00
Faith	2.40	2.00	1.59	2.50
Factors Inhibiting Advancement	*M*	*Mdn*	*SD*	*IQR*
Conflicting Family Obligations*	4.00	4.50	1.20	2.00
Lack of Compensation*	3.67	4.00	0.98	1.00
Personal Concerns*	3.53	4.00	0.92	1.00
Lack of Support	3.47	4.00	1.25	1.75
Feeling of Isolation	3.40	3.00	0.91	1.00
Failing to Perceive Room or Opportunity for Advancement	3.33	3.50	1.23	1.75
Discrimination	3.20	3.50	1.08	1.75
Limited Skills Training and Ability	3.20	3.00	1.01	1.00
Lack of Desire	2.93	3.00	1.33	1.50
Stereotype Threat	2.87	3.00	1.19	2.00
Limited Experience or Degree	2.60	3.00	1.06	1.00
English as a Second Language	1.93	2.00	1.07	1.00

* Factors that were both relevant and reached consensus.

Four rounds were sufficient based on the degree of consensus necessary to build consensus on the most relevant factors based on the established thresholds (Kosloski & Ritz, 2016).

Discussion

Nine supporting factors that reached both relevance and consensus were identified as relevant to Research Question 1, and three hindrance factors that reached consensus were

identified as relevant to Research Question 2. Table 5 summarizes the twelve factors that reached consensus and were deemed relevant after Round 4.

Table 5

Round 4 Summary of Most Relevant Factors According to Group Mean of 3.50

Factors Supporting Advancement	*M*	*IQR*
Support Systems	4.40	1.00
Personal Attributes	4.13	1.00
Willingness to Advance	4.07	1.00
Leadership Skills	4.00	0.00
Curiosity about New Experiences	3.73	1.00
Opportunities for Leadership Roles	3.73	0.75
Role Models	3.73	0.75
Experiences in Undergraduate and Graduate Schools	3.67	0.75
Awareness of Institutional Environments	3.60	1.50
Factors Inhibiting Advancement	*M*	*IQR*
Conflicting Family Obligations	4.00	2.00
Lack of Compensation	3.67	1.00
Personal Concerns	3.53	1.00

The findings are supported by literature that confirmed high levels of leadership efficacy can offset barriers for women (Dugan et al., 2013; Lester et al., 2011). Furthermore, women who achieved positions of leadership may possess characteristics (e.g., personal attributes such as confidence in oneself) that made barriers to advancement less obtrusive. Conversely, the study enlists leaders that may not be entirely and singularly objective. The individual panelists represented leaders within the STEM community with unique personal experiences but still reached a consensus on common themes. The findings contribute to the significant amount of evidence that we all may be biased positively or negatively in some respect but can move to consensus and shared opinions regarding the impact that specific barriers and supports have on career advancement of women (Moss-Racusin et al., 2012; Ong et al., 2018).

An increased level of consensus in Round 4 further validates the study results and adds to

the study's trustworthiness, showing there was less dispersion around the relevant factors. For example, in Round 3, Support Systems had an average group score of $M = 4.31$, $IQR = 1.00$ compared to Round 4 of $M = 4.40$, $IQR = 1.00$. This change between rounds indicates that the group rated this factor with stronger relevance as a factor supporting advancement based on the higher mean score.

Each of the themes that emerged from Round 1 and Round 2 responses was analyzed through the lens of existing literature on gender and equity within higher education settings. Conflicting Family Obligations was considered the most relevant factor that inhibited advancement according to the mean score analysis ($M = 4.00$). The literature supported this finding that parental responsibilities (Mason et al., 2013), work-life balance (Goldin, 2014), and childbirth (Hill et al., 2010) can create challenges for women's advancement (Su et al., 2015). This finding is a well-documented issue for many women professionals in STEM and was highlighted by the panel in the study as still the most relevant factor. This may indicate that additional institutional support structures are needed to mitigate this issue. Findings by Sheridan et al. (2017) confirm that female faculty had higher levels of productivity when their professional interactions were positive and there was support for work/life balance. To build the necessary institutional support, additional resources need to be offered to support work/life balance initiatives, as well as changes implemented in departmental promotion goals.

For example, in pursuit of inclusion goals, institutions may provide opportunities for faculty to take breaks on the tenure track at times that family obligations conflict with their promotion focus. Additionally, department chairs and committees can be asked to include personal inclusion-related behavioral goals. This may offer a form of transparency so successful interventions can effectively address biased responses from a committee member or

departmental chair that is less incline to make allowances when family-related priorities conflict with productivity (Moss-Racusin et al., 2016).

The panelists had high mean score ratings for Support Systems and Personal Attributes, which may be a result of created countermeasures to factors such as Lack of Support ($M = 3.47$), Feeling of Isolation ($M = 3.40$), Failing to Perceive Room or Opportunity for Advancement ($M = 3.33$) and Discrimination ($M = 3.20$) that did not meet the threshold to be deemed relevant in this study. The inhibiting factors were recognized by panelists in Round 1 and 2 and confirmed in the literature as challenges women faced early in their academic experiences (Gerstenberg et al., 2012). However, the factors were eliminated by Round 4 panelists, perhaps because they had already experienced success, entered STEM careers, and advanced into senior-ranked positions. Therefore, these conditions were less noticeable than factors of support that helped them achieve their current success.

Shattuck et al. (2018) confirm the need for support systems and discuss how faculty members at two-year degree offering institutions need increased access to promotion based on teaching professional development and service. This is important to note as the panelists contributed their success to support systems as well as personal attributes and opportunities for leadership roles that may be more readily available and recognized as part of the promotion criteria at two-year degree offering institutions.

As a result of this finding, institutions can create access for individuals by incorporating opportunities for individuals to highlight their professional development and leadership roles within the tenure criteria. Another notable implication may be for institutions to re-evaluate the promotion process to include an area where faculty include a statement on their contributions to inclusion both in teaching and professional practice (WEPAN, 2021).

Additionally, the study was designed to support findings collected from the panelists during Rounds 1 and 2. Round 1 responses revealed that some women in mid-careers in STEM fields experienced feelings of isolation and felt undervalued and undercompensated for the same work performed as their male counterparts. The literature supports these findings as a relevant factor; however, the mean scores for Lack of Support ($M = 3.47$) and Feeling of Isolation ($M = 3.40$) did not meet the minimum cut-off score to be considered relevant in this study. Perhaps this means that the women who achieved senior status had overcome these potential obstacles in their early career development and did not perceive these factors as significant barriers that stifled their career advancement. On the contrary, women who experienced these barriers may not have made it to a leadership level position and as a result, were not represented in this study.

Although failures to advance and receive equal compensation are often internalized as individual deficits, the STEM education literature described systemic barriers women encountered as they matriculated through STEM pathways (Shaw & Stanton, 2012). Specifically, the research is clear that STEM faculty need additional resources to improve their knowledge of leadership opportunities and practice to achieve career mobility. The panelists reaffirmed the need for professional development (Leadership Skills, $M = 4.00$; Opportunities for Leadership Roles and Professional Development, $M = 3.73$) to provide women with access to innovative leadership strategies that may be relevant in a STEM discipline and more beneficial to women compared to the general population.

The panelists described conditions such as collegiality, a sense of community, positive departmental climate, and female role models as part of their reasons for success within their responses, which highlights the positive conditions that impacted their desire and motivation to advance. The strong level of agreement on the identified support factors indicates that most

panelists believed that women in leadership positions in STEM who advanced were more inclined to focus on the factors that led to their advancement. The findings offer insight into the panelists' judgment to include both personal experiences and observations of other women in the STEM pipeline that highlighted experiences in secondary and postsecondary education, early and mid-career, and tenured track faculty.

Conclusion

The findings embedded in the study can inform decision-making related to individuals in leadership positions who have the ability to (a) transform the culture and improve the campus climate, (b) increase the representation of women across STEM disciplines, (c) improve and ensure equitable workloads and pay distribution, (d) enhance faculty mentoring and leadership development, and (e) implement policies that impact service assignments and workload among faculty. The 12 identified factors can be used to establish institutional conditions and a work environment within higher education that support women's advancement and retention in administrative positions of leadership related to STEM disciplines and workforce education.

Although findings in the literature supported the identified factors, they often reside dormant and overlooked by those who have come to value their objectivity and fairness but are paradoxically likely to fall prey to biases, in part because they are no longer sensitive to subtle bias (Ong et al., 2018; Penner, 2015). An increased awareness of these findings can alter policy and behaviors within all who have already succeeded in scaling the career ladder in academia or industry to improve conditions and carve a path for current and future aspiring women. For example, the panelists' experiences and understanding of the positive institutional conditions available to women at two-year degree offering institutions and behaviors of women who entered into leadership in STEM may have further minimized the relevancy of barriers to advancement

compared to support factors.

A critical feature of this study was to invite academic leaders with science disciplinary backgrounds as research participants. Their engagement revealed the consequences that restrictive institutional structures and cultures have on women's advancement in STEM and how the absence of support systems can create barriers for women to address these factors for others. However, the panelists' focus on advancement factors can be used to discuss potential solutions for these problems and change interventions that target promotion of women faculty networks and improved academic climate. The panelists in the study acknowledged the advancement of women under conditions that provided them opportunities for promotion, but also conditions at two-year degree offering institutions that had higher levels of social capital available offering opportunities to earn tenure and learn from other colleagues (Casad et al., 2021).

More importantly, women who achieved senior academic rank were less inclined to identify and agree on factors such as discrimination and bias that cast a negative taint on their experiences and could be considered a deficiency or blemish that was not overcome during their career progress. This can be contributed to focus on solutions and organizational change interventions (Moss-Racusin et al., 2016). The implementation of targeted gender bias interventions for STEM faculty may be accepted as contributing to positive outcomes, but for positive changes to take place cultural shifts must take place to build acceptance of differences. Conversely, those who had advanced were more likely to describe positive factors that led to and supported their advancement and promote messages of inclusion and personal resilience to combat external impediments.

The advancement of women and increased diversity to include women in academic leadership are part of departmental dialogues, yet institutions often lack the necessary

infrastructure to be accomplished. The discrepancy between academic leaders' willingness to identify support factors while remaining silent about inhibiting factors may be attributed to unconscious biases that are not as obvious to women who have conditioned responses once seniority is achieved (Penner, 2015). These individuals may be less likely to openly acknowledge challenges they experienced while trying to advance through academic ranks.

Therefore, leaders' silence about specific barriers systematically reduces pathways for the next generation of women to confront obstacles and challenges, especially within departmental ranks (Moss-Racusin et al., 2012). The identified factors may help define and assess conditions necessary for a high quality postsecondary institutional culture where women can be supported within their career trajectory if they aspire to reach an administrative position in STEM.

Women have been undervalued as leaders throughout time. However, strides have been made to improve the culture and environment. It may be that some institutions have implemented more rigorous practices for the advancement of women and minorities. As a result, women's experiences vary greatly depending on their institutional affiliations and the strides each institution has made to limit inequities. Therefore, one's own institutional experiences may have led to a lack of consistency or consensus based on their institution's level of effort to promote equity and inclusion.

Limitations. This study was limited to the opinions of females who served at institutions with specific qualifying criteria. The institutions were both public and private and offered two-year degree programs such as an associate of science and associate in arts along with workforce education certificate programs. The study included panelists with varying racial/ethnic backgrounds and did not solicit opinions from one specific group. This may have created a disparity in the experiences of one group that had different experiences based on their racial and

ethnic identity compared to others. Further research on the intersectionality of the impact of both gender differences and racial/ethnic identities is important to identify factors that may be relevant to individuals with similar social experiences centered on both their identity as women in male-dominated STEM departments (Crenshaw, 2017). The panelists were representative of groups from different cultural and ethnic backgrounds. These differences may influence the individual experiences identified in the study and provide a variety of contexts in which the panelists framed their responses. An inherent limitation of Delphi studies is that the amount of time between rounds in a Delphi study is considerable and may have led to the attrition of some of the initially committed panelists.

Practical implications. This study has the potential for wide-reaching practical application with the expectation that the information related to support structures, once fully understood, will become embedded in existing policies within academe, especially policies related to promotion and tenure. The most direct impact may be providing foundational knowledge for stakeholders to begin to create cultures of support and professional development that increase diversity in academic STEM departments. However, information gleaned from this study may also be useful in the contexts of graduate preparation programs, as the experiences highlighted in this study could help inform leadership curriculum development and skill training in higher education programs.

New or modified strategies to address equity issues may be needed to combat unique challenges and opportunities identified during the study. Many strategies such as including statements of equity and inclusion as part of the tenure practice or offering opportunities to stop the tenure clock as needed to address family obligations can be adopted with little modification to existing practices and policies as a result of the lessons learned. Departmental roundtable

discussions can be scheduled to create avenues of support and explore the differences and similarities between departmental faculty. Additional attention highlighted in the findings of this study, can be used to inform department chairs and those in academic positions who have the ability to address equity issues at their institutions on best strategies to increase female academic productivity. For example, inclusion and equity practices are often embedded in written and unwritten policies, procedures and practices for faculty recruitment, tenure and promotion and work-life programs, but can be further implemented through the allocation of resources and financial support to ensure changes are made. This may include resources for departmental training on gender bias and building acceptance of gender differences in faculty populations with varying abilities and research interests during evaluations (Sheridan et al., 2017).

On a macro-level, policy and practice may be better informed through the lens of workers' compensation policies, human resource practices, or even a more detailed articulation of gender equity and inclusion practices as a nationally recognized professional attribute to consider in hiring practices. However, eliminating bias and addressing gender equity at a procedural level will not have lasting impact compared to building a culture that values shared governance of workplace behavior with consensus among faculty that success and leadership can come from broader and more diverse perspectives (WEPAN, 2021).

Policies and practices will need to be revised or eliminated that do not assist the advancement of women in academe, such as limited institutional support regarding the factor Personal Concerns, specifically factors related to health, family, and emotional issues impacting participants' ability to advance. This research effort may be used to increase the representation of women in STEM as well as across all disciplines to enhance women's skills and knowledge about support systems (Gilmer et al., 2014) and directly confront an organizational culture that

has the potential to stifle women's advancement. The revisioning of this work may include creating systems that reward and recognize inclusive practices such as strong systems of communication regarding advancement opportunities targeting all faculty as well as shared decision-making that can give women opportunities to further develop leadership skills (Krawcheck, 2017).

Theoretical implications. In addition to a wide range of practical applications, this study also contributes to a new and crucial niche in higher education research related to how gender-specific barriers and support systems can increase access for women to leadership roles through factors that have not previously been fully explored. The impact of professional suppression in higher education related to gender is an emergent phenomenon, and scholars may choose to extend the discussion by creating additional studies addressing personal contexts and environmental factors that contribute to professionals across institutional types, as well as graduate students who the same conditions may influence as they seek advancement.

Additionally, longitudinal studies may offer a holistic picture of how hindrance factors develop, continue, and/or subside within the context of higher education in STEM departments, as well as academic affairs. Such studies may also provide a reflective look over time to examine whether cultures are improving or worsening. Finally, future discussions about the impact of supervisory support may be a logical next step in understanding how to mitigate gender inequities for those who aspire to move into senior ranks and leadership positions with oversight of STEM and workforce education programs.

Summary

This study can be especially important to key stakeholders: family members, educators, employers, and policymakers. During the four Delphi rounds, the researchers saw a correlation

between the findings in the literature and the results of the Delphi study that related to institutional climates with Support Systems, Role Models, and Opportunities for Leadership Roles and Professional Development that supported women's advancement in STEM disciplines. Just as family support can build confidence in women's ability and willingness to lead, the results showed that caregiving and parental obligations could also inhibit one's advancement into leadership positions as identified by the factors Conflicting Family Obligations and Personal Concerns.

Employers and policymakers can be influential in hiring and supporting women for STEM-related leadership positions and initiatives that offer opportunities for professional development and support networks (Spiceland, 2018). It was especially noted in this study that women valued and appreciated institutional leaders and institutions that focused on inclusion of both men and women. The next steps in research may include a panel of women of color and a separate panel of men to explore the same research questions. Also noted was that women's perceptions of the organizational environment impacted their decision to move forward into leadership positions and administrative roles. The panelists explored factors related to lack of compensation and gender inequities that affected them in their willingness and ability to advance into leadership roles. Higher education institutions that are consciously progressive can motivate and empower women to achieve and succeed.

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