Abstract

This paper focuses on the ADVANCE project, “Advancing the Careers of Women in STEM at Predominantly Undergraduate Institutions (ASAP),” undertaken to support women STEM faculty by understanding and responding to the multi-level effects of gender on their careers in academic science. The goal of the project was to create an environment of formal and informal interactions that allowed participants to explore the social, institutional, and individual contexts that both advance and hinder their careers, in part through building a framework for peer support and mentoring that was embedded in career-level and discipline-focused networks. The professional development opportunities provided were relevant because they emerged from the information that participants identified as important through their responses to surveys, focus groups, and interviews. Through ASAP, participants generated knowledge about the experiences of women in academic science at predominantly undergraduate institutions and improved their own careers and engaged more deeply with their professions.
This paper discusses the NSF ADVANCE project, “Advancing the Careers of Women in STEM at Predominantly Undergraduate Institutions (ASAP),” which focused specifically on supporting women faculty in STEM fields at institutions of higher education with a primary mission emphasis on teaching. Predominantly Undergraduate Institutions (PUIs) are defined as “accredited colleges and universities (including two-year community colleges) that award Associate's degrees, Bachelor's degrees, and/or Master's degrees in NSF-supported fields, but have awarded 20 or fewer Ph.D./D.Sci. degrees in all NSF-supported fields during the combined previous two academic years” (National Science Foundation, 2014). While most academic institutions have many goals and characteristics in common such as the advancement of knowledge through scholarship, the education of students through teaching, and the support of communities through service, different institutions may provide more or less focus on each of these areas. Most work looking at academic careers in STEM has focused on research intensive institutions. Our work adds to the literature by focusing on women’s career experiences in PUIs where research is valued but balanced with a strong focus on teaching and service.

PUIs contribute significantly to the number of bachelor degrees awarded in STEM. While in 2015 doctoral granting institutions with very high research activity granted 37 percent of bachelor degrees in science and engineering, masters colleges and universities awarded 28 percent, and baccalaureate colleges granted 11 percent (National Science Foundation, 2018). We also see evidence of the important role that institutions other than very high research activity universities play when we consider the role of historically black colleges and universities (HBCUs) in the training of black STEM doctorate holders. In 2011, for example, 24 percent of all black doctorate holders received their baccalaureate degree from an HBCU (Fiegener & Proudfoot, S.L., 2013). Our study does not specifically address the role of HBCUs in preparing
students for doctoral studies, but we do acknowledge the role of diverse institutions in preparing future scientists. Given the overwhelmingly high proportion of white participants in this study, further research in this area on a more diverse sample would be beneficial and most helpful in understanding a broader set of influences on STEM faculty at PUIs.

The underrepresentation of women, and especially women of color, in academic science persists because it is reinforced through multiple channels and mechanisms. Through our ASAP project we worked with women STEM faculty from multiple disciplines and career stages over a five-year period to explore their careers in the context of the marginalization they may have experienced based on social structural conditions, institutional context, and individual embodied realities. Participants engaged in group activities and conversations that allowed us to uncover important experiences and perspectives of women STEM faculty at PUIs. Through discussion, analysis and support, our participants were able to better understand and ultimately challenge the status quo in their fields. Over the course of the project, we created a context within which participants were able to consider and discuss their experiences as women as they affected their career trajectories, their balance of work life and home life, and their general degree of satisfaction in their careers. In the following section we employ a multi-level system of gender which encompasses social and cultural beliefs, organizational practices, and individual-level beliefs (Ridgeway & Correll, 2004) to understand and address the underrepresentation of women in academic science. We first briefly discuss the influence of gender on women’s careers in academic science at social/cultural, individual, and institutional levels, and then apply a specific focus on women faculty at PUIs. We follow this discussion with a detailed description of our ASAP project to demonstrate how exploration and understanding of gender in academic science can improve the professional experiences of women STEM faculty.
Gender Dimensions

First, at the social/cultural level, women in STEM fields face the same issues related to gender equity that all women face, even while the status of women is also associated with other intersecting sources of inequality and privilege such as race and class. And, like women in many fields, women STEM faculty face the challenge of being underrepresented and often isolated from significant numbers of others facing similar issues and responsibilities related to their work (Bates & Borland, 2014). Of central concern here are the enduring effects of what are understood as “gendered institutions” (Acker, 1990; Mackay & Waylen, 2014). Second, at the individual level, the effects of these institutions on women can be understood thematically as a) regulating behavior toward established gendered effects; b) obligating actors to behave in these particular ways; and c) then providing narratives that legitimate the institutional order (Lowndes, 2014, p. 689). For example, Rhoton (2011) finds that women scientists often distance themselves from other women scientists whom they perceive as stereotypically feminine so that they can signal their own allegiance to the dominant male culture. In this way, social structures and institutions associated with race, class, and other systems of inequality and privilege as well as gender exert a powerful formative influence on the identities, subjective experiences, and embodied experiences of people (Foucault, 1973; Ridgeway & Correll, 2004; Scott, 2008; Shilling, 2012). Third, at the institutional level, the lack of acknowledgement and representation of women in academic science has resulted in institutions that are biased away from inclusion and recognition of women’s contributions (Maranto & Griffin, 2011). The organizational experiences of men and women differ in several contexts including hiring and selection, performance evaluation, and compensation. Moss-Racusin et al. (2012) demonstrated this gender disparity in terms of selection and compensation when they asked a national sample of male and female biology,
chemistry, and physics professors to rate applicants for a laboratory manager position. The application presented the same experience and qualifications but was randomly assigned a male or female sounding name. Both male and female faculty subjects rated the applicant as more competent and more likely to be hired when the name attached was male. The study subjects also offered a higher starting salary and expected to offer more mentoring to the male applicant than to the female applicant. In addition to experimental work, analysis of Census Bureau Data also shows that women earn less than men from the start of their careers, although this gap diminishes when STEM field and marital status are taken into account (Buffington et al., 2016).

Once women join organizations, their performance continues to be evaluated differently. In areas such as leadership, women are evaluated more negatively than men as leaders and this negative evaluation intensifies if women’s leadership style is perceived to be more “masculine” (Eagly et al., 1992; Vial et al., 2016). MacNell et al. (2015) demonstrate a gender effect on evaluation in teaching. They used the context of an online class to allow one male and one female instructor to teach one section identified as male and one section identified as female. Students rated the instructor that they perceived to be male higher than the instructor perceived to be female regardless of the actual gender of the instructor.

Women scientists experience a significantly level of sexual harassment. A report by the National Academies of Sciences, Engineering and Medicine (2018) notes that academic science is particularly susceptible to sexual harassment including gender harassment which is defined as “verbal and nonverbal behaviors that convey hostility to, objectification of, exclusion of, or second-class status about members of one gender” (p.13) because the field is male-dominated, hierarchical, and often involves working in isolation. The report finds that more than 50 percent of women faculty and staff have experienced sexual harassment. Women in these fields report
experiencing harassment from superiors, peers, and students. Most harassment involves gender harassment including sexist hostility and crude behavior. When faced with sexual harassment, women scientists often choose not to take positions of leadership, to leave their institution, or to leave their field of work. All of these conditions help to explain why gender inequity persists. According to the study, sexual harassment is more likely to be a problem when universities do not address the organizational issues that allow harassment to occur. These organizational characteristics include insufficient attention to the topic from campus leaders, symbolic compliance with laws addressing harassment, lack of effective training, measuring the extent of the problem based on formal reports, and insufficient attention to the overall culture that fosters harassment.

Women in Academic Science at PUIs

Women faculty at PUIs experience the same issues associated with gender inequality as their counterparts in research intensive universities (Borland & Bates, 2014. But in addition, faculty in PUIs face a complicating set of other issues related to the broader culture of academic science. Institutions in every category tend to emulate the practices of the most prestigious research intensive universities. O’Meara (2007) describes the way institutional isomorphism (Riesman, 1956; DiMaggio & Powell, 1983) leads most colleges and universities to model themselves on the policies and practices of elite research intensive universities despite the differences in mission, focus, and resources. Wolf-Wendel and Ward (2006) point out that less than one-third of all faculty work in research intensive universities, even though almost all graduate students are trained and socialized to work in research-intensive universities. They also suggest that women faculty in particular may choose to work outside research intensive institutions in order to avoid what are considered the all-consuming demands of academic
careers at research intensive universities. Eddy & Hart (2012) highlight the deficiency of socializing doctoral students to work only in research intensive institutions since most doctoral students will not be working in that context. They show a need to prepare doctoral students for careers in institutions that have higher expectations for teaching and service, where they may be geographically isolated, where there are only a few members of their discipline at the school, and where they are experiencing a culture that is very different from the culture of the research intensive universities where they pursued their doctoral training.

Academic departments are often smaller at PUls than at research intensive institutions and therefore it is more likely that women faculty may be even more isolated in specific departments. The stronger focus on undergraduate teaching at PUls means that faculty spend more time in the classroom and more time interacting with students outside of class. In contrast to colleagues in research intensive institutions, STEM faculty in PUls typically are intensely involved in teaching undergraduate laboratory courses. There are also strong expectations to mentor students conducting undergraduate research projects even when this mentorship is not counted as part of the faculty member’s teaching load. Both are extremely time intensive and often contribute little to the faculty member’s own research agenda.

The differing work environments of research intensive universities and PUls collide with an on-going national pattern of institutional striving in PUls (Eddy & Hart, 2012; O’Meara & Bloomgarden, 2011; O’Meara, 2007; Finnegan & Gamson, 1996) with a shift in focus to greater research outputs and prestige. O’Meara defines striving as “the pursuit of prestige within the academic hierarchy,” (O’Meara, 2007, p. 123). O’Meara & Bloomgarden (2011) report that many faculty members at liberal arts colleges model their career expectations upon the experiences of faculty at research intensive universities. They found that this comparison
occurred at the organizational level where faculty compared the overall performance of their liberal arts college to prestigious research intensive universities. They also found that comparison occurred at the individual level where faculty at liberal arts colleges compared their own resources and performance to faculty at prestigious research intensive universities. Gardner & Veliz (2014) suggest that through the phenomenon of institutional striving faculty in STEM fields may have greater research and funding demands placed upon them while faculty in the humanities were more likely to face increased demands related to teaching and advising students. The increasingly demanding nature of teaching and advising students in PUIs along with the more recent emphasis on research creates an overwhelming amount of work and pressure on faculty.

Recognizing the effects of institutional and structural forces on personal lives and feelings has become increasingly important to both employees and employers (Amaya, et al, 2017). Diekman, et al., (2017) observed that engagement is directly associated with both feelings of gender inclusion as a communal goal and the possibility of aligning positive role identification with professional goals. The individual voices of participants in this project describe the complexity of their social experience negotiating their lives as STEM faculty. Butler (2015) expresses the dilemma of individual identity and the social when she tells us that,

To be a subject at all requires first finding one’s way with certain norms that govern recognition, norms we never chose, and that found their way to us and enveloped us with their structuring and animating cultural power. (p. 40)

This is a critical dimension of interpreting social experience as oppressive or coercive. Within this perspective there is no question that human beings are socially constituted and that this process begins early. A key consideration is how it may be possible to “speak back” to these
forces by creating spaces where women can work on this refashioning. Our ASAP project provided the space and support for exploration of social, institutional, and individual impacts on women’s experiences as STEM faculty. We also created a means to support participants’ career development and satisfaction through participation in the project.

Addressing Inequality through Mentoring

One promising approach towards mitigating gender inequality is mentoring (Gibson, 2006). The traditional understanding of mentoring was that a more senior, powerful person offers advice and support to a more junior person. This perspective is particularly resonant with the relationship between academic advisors and doctoral students. This approach to mentoring often relied upon the quality of the match, including similarity between mentor and protégé (Ensher & Murphy, 1997). This form of mentoring may be most helpful, while at the same time least available, to women and other underrepresented groups in organizations (Gibson, 2006).

Perspectives on mentoring have evolved to allow for individuals to cultivate a constellation of people who support their careers, providing multiple types of assistance from within their own organizations and from their family and community (Higgins & Kram, 2001). This approach has been explored specifically within the university context (deJanasz & Sullivan, 2004), especially in response to the evolution of academic careers. Formal interorganizational mentoring programs that extend beyond a single organization have been found to be effective for groups that are underrepresented in single organizations (Murrell et al., 2008). We attempt to extend the same benefits of interorganizational mentoring networks to women STEM faculty by creating a project which provides opportunities for women STEM faculty from PUIs by creating a framework for formal and informal interaction that would nurture the development of
relationships that would offer support and understanding to participants individually and as a community.

**NSF ADVANCE ASAP Project**

Our project involved 70 tenured or tenure-track women teaching in STEM fields from 27 PUIs located across the United States. Seventy-five percent of the project participants were white and the median age was 41 years. The youngest participant was 32 and the oldest was 66. Eighty-two percent of the participants were married or living with a partner and 75 percent reported having had responsibility for the care of children currently or in the past.

The project had equal representation based on career level and scientific discipline because participants were selected to be part of a group of faculty in the same discipline and career stage which were referred to as “an alliance.” Each of the 15 alliances was embedded into two networks, a horizontal network based on career stage: senior career (more than 20 years in the academy), mid-career (tenured with less than 20 years in the academy), and early career (pre-tenure) and a vertical network based on scientific discipline: biology, chemistry, math, physics/computer science/engineering, as shown in Table 1.

<table>
<thead>
<tr>
<th>Horizontal/Vertical</th>
<th>Biology (15)</th>
<th>Chemistry (13)</th>
<th>Math (15)</th>
<th>Physics/Computer Science/Engineering (27)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior career (23)</td>
<td>B1 (5)</td>
<td>C1 (4)</td>
<td>M1(5)</td>
<td>P1(4) and P2(5)</td>
</tr>
<tr>
<td>Mid-career (20)</td>
<td>B2 (5)</td>
<td>C2(5)</td>
<td>M2(4)</td>
<td>P3 (6)</td>
</tr>
<tr>
<td>Early career (27)</td>
<td>B3 (5)</td>
<td>C3(4)</td>
<td>M3(6)</td>
<td>P4 (4), P5 (4) and P6 (4)</td>
</tr>
</tbody>
</table>

Participants were recruited so that each vertical network had at least one senior career alliance, one mid-career alliance, and one early career alliance. Initial recruitment efforts
occurred at the 12 institutions that contributed to the ADVANCE proposal. The initial efforts led to the recruitment of 51 participants: 15 biologists, 10 chemists, 14 mathematicians, and 12 physicists/computer scientists/engineers. The remaining 19 participants were recruited from underrepresented groups or departments with a solo female faculty member. Four women were recruited to ensure that an institution had two participants to enhance the possibility of institutional transformations at those institutions.

In total, the project included faculty from 27 different PUIs. Participants worked at a variety of types of institutions based on Carnegie Classification data (Indiana University Center for Postsecondary Research (n.d.)). Most faculty participants worked in private institutions, but five public institutions were represented in our project. One HBCU, three women’s colleges and six religious institutions were also represented in our project. All institutions had undergraduate populations of at least fifty percent. Three institutions were exclusively undergraduate, twelve institutions had at least 90 percent undergraduates, and 22 institutions had at least 75 percent undergraduates. Six institutions were reclassified from “Master’s Colleges and Universities” to “Doctoral/Professional Universities” in the most recent (2018) Carnegie classification.

**Project Leadership and Activities**

Project leadership included a six-member steering committee, three horizontal network leaders and four vertical network leaders. A steering committee provided day-to-day leadership for the project, and was composed of five senior participants and one half-time staff project coordinator. The professional expertise of the five senior participants on the internal steering committee spanned five of the six disciplines represented in the project: biology, chemistry, math, physics, and computer science. In addition, the internal steering committee regularly solicited program suggestions and recommendations from the three horizontal network leaders
and the four vertical network leaders. Throughout the project, the steering committee met through weekly video conference and annual planning meetings.

The internal steering committee regularly solicited input from a three-member external advisory board composed of program directors from the Council of Undergraduate Research, American Association of Colleges and Universities, and Project Kaleidoscope, three national organizations dedicated to building and sustaining strong undergraduate programs, and an outside consultant who had successfully implemented a previous ADVANCE project involving 20 women STEM faculty. The external advisory board was a rich resource for the steering committee because they provided insight into the most current opportunities in higher education.

Two project evaluators were responsible for designing data collection and informing project design from the initial planning stages to the completion of the project.

Throughout the five-year project, participants engaged with each other and with experts from various fields to address the multiple topics that the project focused on including STEM discipline concerns, issues related to teaching and research, career concerns, and social support. Participants engaged in different ways for each of these topics that included the following.

Alliance meetings

Participants were told that the alliance was the heart of the project and that one of the project’s guiding principles was that through relationships with other women in similar disciplines, similar career levels, and similar institutions, new options for addressing career challenges and new approaches to career advancement could be discovered. Participants were asked to commit to developing strong relationships with the other members of their alliance and to commit to peer mentoring. Alliances were encouraged to video conference using a project-provided platform (Webex or GoToMeeting) or a free platform of their choice (Google Hangout...
Participants were assured that any conversation that occurred during their alliance meetings would remain confidential.

Volunteers were recruited annually from each alliance to serve as alliance leaders. Some alliances kept the same leader all four years while others rotated the leadership position amongst their members. In total, 26 women served as alliance leaders during the four-year period. Alliance leaders were offered video conference training and asked to organize monthly alliance video conferences. At the end of each academic year, alliance leaders were asked to report the number of alliance meetings that had occurred. In the first three years, 89% of the leaders responded to the request and reported an average of seven alliance meetings during the nine-month academic year.

**All-participant meetings**

Face-to-face meetings including all participants occurred in the first, second, and fourth year of the project. Funds were provided to participants to attend a one-and-a-half day all-participant meeting and in the third year funds were provided to individual alliances to meet at a location of their choice. To minimize costs and to provide opportunities for professional skill development, the three all-participant meetings were scheduled to overlap with the last day of an annual conference of the Council of Undergraduate Research or Project Kaleidoscope. By leveraging project travel funds to garner institutional support, sufficient funds were available for each alliance to have one representative at the second and third national conferences. Participants who attended national conferences were encouraged to share what they had learned with their alliance members.

Along with the steering committee, vertical and horizontal leaders engaged in the development of all-participant meetings. At the first all-participant meeting, vertical and
horizontal leaders facilitated a discussion in their networks to understand the career needs within specific disciplines and career levels. Network leaders shared the collected information with the steering committee to develop programming for subsequent meetings. Table 2 shows the theme for each all-participant meeting. Alliance members met each other as well as the other members of their horizontal and vertical networks for the first time at the first all-participant meeting. The first meeting focused on making connections and identifying career challenges. Using information collected from the participants at the first meeting, the second meeting focused on strengthening connections between participants and providing training on essential career skills. At the final meeting, participants were asked to look for connections beyond the project networks and to consider actions they could take to positively influence the greater STEM community.

Table 2
Themes and programs offered at the all-participant meetings.

<table>
<thead>
<tr>
<th>Focus</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Making connections and identifying challenges</td>
<td>Strengthening connections and developing skills</td>
<td>Expanding connections and moving beyond the network</td>
</tr>
<tr>
<td>Speaker topics</td>
<td>Implicit bias</td>
<td>Negotiation skills</td>
<td>Family-life-work policies</td>
</tr>
<tr>
<td></td>
<td>Peer mentoring</td>
<td>Grant writing skills</td>
<td>Mentoring networks</td>
</tr>
<tr>
<td>Horizontal networks activities</td>
<td>Discuss challenges faced by women at specific career levels</td>
<td>View and discuss “What works for women at work?”</td>
<td>Discuss the institutional policies and practices to advance of women in STEM disciplines</td>
</tr>
<tr>
<td>Vertical</td>
<td>Discuss the</td>
<td>Share professional</td>
<td>Discuss definitions of</td>
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</table>
The project leadership team invited speakers and created activities to support the meeting themes as well as provide participants with professional skill development, strategic career support and social support. Breakout sessions were scheduled for the horizontal networks and vertical networks to discuss questions or topics suggested by the leadership team. Lightning talks and poster sessions provided opportunities to share scholarly work, get perspectives from faculty with diverse backgrounds, and develop collaborations. Birds-of-a-feather sessions brought participants from all career levels and disciplines into small groups discussions around a common ambition such as becoming administrators, pursuing sabbatical leave opportunities, thriving as an international faculty, or looking ahead to retirement. At all three meetings, a variety of social events were included to encourage conversation and develop connections. The use of color-coded name tags identifying alliance, horizontal network, and vertical network helped participants quickly connect with others. Participants were encouraged to eat meals with their alliance members to maximize face-to-face interaction within alliances.
The all-participant meetings provided an opportunity to observe many different types of networking and support interventions. At each meeting, content was shared around topics such as implicit bias, or negotiation skills. By the end of the project, participants had gained knowledge that related to their experience as STEM faculty. Participants had the opportunity to connect with others who were not part of their specific alliance which increased the pool of individuals who might share social support, information, or opportunities to work together. Additionally, the all-participant meetings created a group identity experience where participants had the opportunity to see themselves as part of a larger group working to support women in STEM. And finally, the meetings provided a powerful experience where participants shared their stories and saw strong evidence of the commonality of their experiences.

In the third year, alliances met individually at a location of their choice to discuss individual career goals and create career action plans. Each alliance was asked to submit a brief descriptive overview of their meeting plan and expected outcome along with a budget. Alliance members chose a variety of venues and focal subjects. Five alliances met at national conferences and scheduled meeting time to strengthen relationships and further develop their networks. Two alliances organized their own workshops with a specific topic: financial planning, and grant writing/leadership skills development. Three alliances chose locations that allowed them to visit faculty at other universities or research centers with the purpose of establishing research partnerships or gaining insight about teaching and learning. Eight alliances devoted part of their meeting to discussions around career advancement, including the administrative barriers created by the lack of women-friendly policies. Eight alliances included discussions about pedagogy, including sharing best practices for specific courses, developing curricula based on a deeper understanding of how students learn, and discussing the impact national curricular reform.
Between face-to-face meetings, the internal steering committee used e-mail to communicate with project participants. Alliance members were encouraged to interact with other members of the horizontal and vertical networks through a secure social network site the first two years and through a closed membership listserv or a Facebook page the last two years. The project coordinator created and maintained a project website and published annual newsletters highlighting participants’ accomplishments. To provide opportunities for interactions in the third year, which did not have an all-participant meeting, two participant-hosted webinars were offered, one pertaining to the role of metacognition in student learning and the other focusing on attracting and retaining women faculty in STEM fields.

**ASAP Project Results**

The project design accounts for the challenges of capturing the institutional, organizational, and embodied experience of STEM women faculty. Our approach was pragmatic and transdisciplinary and intersectional. Pragmatism was necessary because we had to remain open to changes in our plans and ideas for what our cohort of faculty needed and/or wanted; the transdisciplinary and intersectional focus was important because we addressed multiple levels of reality simultaneously with a coherent meta-theoretical perspective (Bhaskar, Danermark, & Price, 2018). We also needed to account for and address issues of power and power relations that cut across numerous categories describing and defining participant experience (Pulkkinen, 2015). Throughout the project we maintained a balance of learning from our participants while also supporting their individual career advancement.

**Qualitative and Mixed Method Data and Demographics**

The project evaluators and the steering committee designed evaluation tools informed broadly by social theory, organizational behavior, sociology of science, and STEM higher
education literature. Our methods included collecting the following data: demographic information; attitudinal survey including open-ended questions implemented twice during the project; individual interviews with a cohort of six women during the three face-to-face gatherings; and three focus groups at each of three face-to-face meetings with a consistent cohort of fifteen women representing the full range of STEM disciplines and career levels. In addition, the evaluators were present at all three all-participant meetings where they interacted informally with project participants and steering committee members.

While the purpose of this project was to advance the careers of women faculty in the STEM disciplines it became apparent over the course of the project that the definition of a career was problematized and debated as these women met to share and discuss their experiences. At the project’s first all-participant meeting, Dr. Kelly Mack, a keynote speaker, reminded those assembled that while women, and especially women of color, are increasingly enfranchised in the academy their challenge is to discern which of the institutional aspects of traditional academic institutions they reproduce and which of these they want to change (also see Mack & Shute, 2015). Our project experience was an extended conversation that illuminated both aspects of this question.

**Impact of Multi-level Gender Effects**

Observations of the combined ASAP activities and data collection showed how a multi-level gender system influenced women’s experiences in their careers. We created a collaborative learning environment where participants both contributed to our deeper understanding of the interplay of gender and academic science and provided resources for women to address these issues in their career. The interpretation of these data is the result of connecting our analysis to the conceptual framework outlined previously. However, this conceptual framework grew out of
our ADVANCE proposal and the broad goals of NSF in funding these opportunities. This effort was fueled by the basic question:

How are women in the project understanding their behaviors, constraints on their behavior, and their day-to-day and professional practices as a function of or related to (1) institutional structures, (2) work/life balance, (3) equitable career support and (4) the general empowering (or dis-empowering) of women academics in the STEM disciplines?

These four areas then, became the overarching categories upon which our efforts in developing the project and our efforts at interpreting the results rested. We have since assimilated the four categories to which we initially related our qualitative data to the three domains of institutional structure (socio-historical-cultural structures & institutions), community and relationships (social and organizational phenomena in groups), and individual/subjective experience (emotional and embodied meanings). Institutional and structural forces included both the social/cultural and organizational levels of gender systems. Our analysis of the interview and focus group data was done using an open coding scheme (see Saldaña, 2013). Then through a process of multiple readings of the data and of the coding scheme we connected these early codes to the project’s four initial questions. Our final analysis outlined below and following Jackson and Mazzei (2012) will close the circle and relate those findings to our overarching conceptual framework consisting of the three domains mentioned above.

The project followed a trajectory that progressed from a somewhat wary and tentative embrace of the core issues related to social justice and equity to a more explicit and enthusiastic avowal of the power of participatory engagement over an extended period of time. Table 3 summarizes the findings for each of the categories.

Table 3 Emergence of Common Themes through Multiple Data Collection Methods
<table>
<thead>
<tr>
<th></th>
<th>Institutional/Structural Forces</th>
<th>Community and Relationships</th>
<th>Individual/Subjective Feelings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude Survey 2012</strong></td>
<td>- Positive attitudes toward organization&lt;br&gt;- Concerns over tenure and promotion&lt;br&gt;- Teaching loads extreme&lt;br&gt;- University politics annoying</td>
<td>- Desire connection and networks</td>
<td>- Love of teaching&lt;br&gt;- Love of scientific discipline&lt;br&gt;- Not enough time&lt;br&gt;- Quality of life choices</td>
</tr>
<tr>
<td><strong>Attitude Survey 2016</strong></td>
<td>- Mixed attitudes toward organization&lt;br&gt;- Continuing concerns over tenure and promotion&lt;br&gt;- High teaching loads</td>
<td>- Appreciating connections established&lt;br&gt;- Conflicts between teaching load and research</td>
<td>- Friendships formed&lt;br&gt;- Quality of life choices&lt;br&gt;- Awareness of implicit bias Increased confidence in negotiating.</td>
</tr>
<tr>
<td><strong>Focus Groups</strong></td>
<td>- Barriers to tenure and promotion fatalism&lt;br&gt;- Student evaluations biased against women&lt;br&gt;- Teaching/research conflicts&lt;br&gt;- Gendered institutions&lt;br&gt;- Top-heavy administration</td>
<td>- Mentoring and role modeling critical&lt;br&gt;- Solidarity with women appreciated</td>
<td>- Childcare and home life in conflict with roles at work&lt;br&gt;- Fatalism around “not enough time”&lt;br&gt;- Feelings of isolation&lt;br&gt;- ASAP project alleviated isolation&lt;br&gt;- See race, age and gender as barriers</td>
</tr>
<tr>
<td><strong>Interviews</strong></td>
<td>- Multiple barriers to tenure and promotion. Student evaluations biased.&lt;br&gt;- Reducing entry barriers</td>
<td>- Gender inequality common&lt;br&gt;- Lack of “fairness”&lt;br&gt;- Considerable interest in pedagogy and curriculum&lt;br&gt;- Non-instrumental</td>
<td>- Benefits of mentoring explored&lt;br&gt;- Work life integration – not balance&lt;br&gt;- Not alone during the ASAP project</td>
</tr>
</tbody>
</table>
Old-boys network.

- Approach to networking and collaboration.
- Defining success
- Guilt over choices that need to be made

Summary

- Sharing of tenure and promotion guidelines appreciated
- Recognition that some barriers are lifting and that cultures are slowing changing
- Differences between research intensive and predominantly undergraduate institutions maintained
- Administration top-heavy

- Collaboration contrasted with competition
- Solidarity among women

- Shared comfort in doing things differently
- Innovating pedagogy and curriculum
- Integrating work and home

**Institutional structures**

Themes interpreted from the data were consistent in expressing awareness and some dissatisfaction with roles and practices related to gender equity, assessment of curriculum and outcomes, and career support. A larger cultural view was expressed in an interview as:

[W]e operate under a ‘squeaky wheel gets the grease’ kind of model. And we operate in a very traditional, uh, gender role where the men squeak and the women don’t and so the, you know, their wheels squeak and they get the grease and, um, and it’s perceived that you know, if a woman takes some of the aggressive tactics that the men would take that would be very negative because, you know, who does she think she is?
Participants also spoke of perceived inequities in the rank and tenure process for example, one participant’s pregnancy was coded as an “illness”, a claim of gender bias in student evaluations, and perennial complaints about the distribution of resources across the university. Participants also surfaced the theme of “no time.” They were nearly unanimous in describing the conflict and time stress between teaching, research, collegiality, and home life. The problems of childcare, commuting, and institutional structures that fail to support the logistics and coordination of complex schedules result in seemingly impossible schedule demand.

Community and relationships

In these data the intersections of personal and professional activities were articulated broadly as a sense of community – particularly a community that included women. Throughout the project participants expressed the desire for and satisfaction with networking and mentoring. While themes of fairness, teaching loads, and resources were also present there was a consistent thread of relationship throughout. A consistent pattern in the focus group and interview data was the articulation and demonstration of a non-instrumental approach to group activities based on redefinitions of networks, mentors, and teaching. This common factor emerges in contrast to a more traditional, instrumental approach to relationship building that views the establishment of relationships as a means to career building or task accomplishment. One participant observed:

I think in general the point is to be able to meet people who you can bond with in some setting and that becomes a network, a mentoring situation. A place where you can talk about sensitive issues. I mean there is this feeling of, well, we can say anything we want when running. It stays there and it’s safe and...yeah.

Another participant said:
... previously I thought of a mentoring relationship as someone who was older than I was, who was more advanced in their career, who had more experience, who was sort of taking me under their wing. And I think more of what this [the ASAP Project] has done is to do peer mentoring of the people in my group, helping each other. Like we have all needed support at different points… But it’s really sort of changed my perspective on mentoring.

There was an overarching sense of collaboration and cooperation amongst participants and the project leadership – this was in stark contrast to the often painful accounts of a competitive and fractious department and organizational milieu.

**Individual/subjective feelings**

Over the course of these interviews participants revealed an increasingly complex and nuanced articulation of their experience. The notion of work/life balance and its manifestations at various career levels emerged as a significant theme in relation to subjective feelings. The homes, offices, classrooms, and institutional spaces these women occupy are all complexly entangled. A consistent thread eventually resulted in the notion that what women were seeking was not work/life balance but work/life integration. One participant said:

> Who you are is going to blend over into your professional life and I think if you embrace that, still set a few boundaries, but if you embrace that you’re a better teacher and a better person at home too.

Pervading the span of the project and the data is an explicit and principled love of teaching and working with students. As on participant put it:

> I feel as if I have always wanted to be a professor in physics. I'm not sure why. But I love teaching, and I love helping develop young women into physicists.
Equally expressed by participants was a love for their disciplines. Many described the conjunction between teaching and being immersed in their discipline as a gift.

A significant theme in the data reflect a broad appreciation of the project itself. Chief among those aspects praised were the vertical alliances and the sharing of experience between and among career stages, cultural perspectives, class, and age. Participants reveled in the opportunity to learn from one another. Some participants were also frankly aware of the intersectional effects of the above on the presentation of self in the modern academy. One participant noted that:

They’re [senior colleagues] probably coloring their hair. Which is a, uh, which is a nod to a social custom, right, the idea that I look old if I have gray hair.

Another participant noted in reference to race and gender the following:

And so I was a woman in a male dominated discipline, brown-skinned, and I spoke with an accent teaching a subject matter that’s considered hard. . . So I’d see that very often in student evaluations, “please learn English.” . . . so it’s hard being minority in a male dominated field and the bias comes, not just from colleagues from but students as well (focus group participant).

Strongly present in these data was a growing awareness among participants that they are, in their collective expression as women in the STEM disciplines, rewriting much of the academic world. Through the ASAP project, participants shared and refined their understanding of the way gender shaped their experience and how they influence the course of their own and other women’s experiences in the future.

**Project Impact**
The data flowing from this project describe participants coping with a complex of personal, social, and institutional realities. We tracked the force of broad normative social and cultural power and the responses of the subjective experiences of the participants. Participants in this project thus experienced general sociocultural and historical effects as well as the more refined effects of individual disciplinary cultures. In both these cases power was a significant factor. The STEM disciplines understood as a subset of political and economic power centers can be interpreted as a subcategory of “interwoven and reciprocally interacting and interlocking systems” (Staunaes & Sondergaard, 2012, p. 52) that can transmit this normative force deeply into the lives and discourse of the individual participants. This appeared to be the case in this project. Early data showed little or no critique of institutions or cultures related to marginalization as a social group; however, through the course of the project narrative responses suggest an increasing awareness of the gendered nature of participants’ institutional lives. While the radicalness attributed to much intersectional and transdisciplinary analysis is tempered by the pragmatics of survival as middle-class Americans and the rigor and constraints of disciplinary thinking and culture these women scientists nonetheless became increasingly outspoken during the course of the project.

The initial contact with participants (the first survey) revealed a group that showed a marked enthusiasm and love for teaching and a consistent complaint about not having enough time. In the focus groups we began to hear more about perceived inequities in rank and tenure processes, student evaluations, and the recognition that their universities were in fact “gendered.” The interviews, in turn, began to express a more nuanced and intense response to the situation of participants. By the time of the final survey we heard again about participant motivations (e.g.,
love of teaching and love of discipline) but now much more emphasis on networking, mentoring, and being able to have conversations with one another to commiserate and share.

Participants in the project generally used inclusive language and recognized the asymmetric institutional habits and structures that pervaded their experience. For these women, professional development was increasingly interpreted as focusing first on the context and then on the content. Research took a second place to the relational elements of teaching and collaboration. The overwhelming choice of “teaching” as the main motivation for their careers appears not to be a rejection of research and the rigor of their disciplines, but a recognition of the need to fuse the personal with the professional and make their institutions places that can support a “wholeness” of teachers, students, and staff for the production of knowledge.

What emerged toward the end of the project was an articulation of how participants are, in fact, responding to their awareness of marginality along the lines of race, class, and gender. Our project was limited because our cohort consisted mostly of white women. While we asked about their current family status we do not know about their class background. There was an overarching sense that the cultivation of collaborative and non-competitive practice was preferred and that the problem of work/life balance is not a question of balance but of integration. Participants were clear that relationships, mentoring, and conversation (Shaw, 2002) are crucial to their work and that the taking of time for these practices is transgressive and at odds with most institutional norms. There was more talk of taking on leadership roles in their home institutions and that their work as role-models to students is vital. One of the strongest themes here remained a focus on transforming pedagogy and curriculum. Participants spoke of reducing barriers and changing the filters mediating entry into the STEM disciplines.
In addition to their developing understanding of their potential to influence the institutional conditions of women STEM faculty at PUIs, our participants also reflected upon the ways that the ASAP project improved their own professional lives. In the final year of the project, we requested that all participants answer the question, “Reflecting on your professional activities between September 2012 and June 2016, have any been influenced by your participation in the ASAP ADVANCE network? If so, how and which ones?” Thirty-two participants provided narrative responses to this question. From their responses we are able to describe how participants view the influence of the entire project on their own career. Their responses fell into the categories of individual career enhancement, increased institutional engagement, and increased external engagement, discussed below.

**Individual career enhancement**

The most common benefit of the ASAP project was its contribution to participants’ own careers by increasing their confidence in themselves, providing access to career advice, offering career and social support, and enhancing teaching. Participants described receiving career support in the form of advice from their fellow participants, including creating strategies for career success, providing information about career opportunities, and sharing approaches that had worked for others. For instance, one participant reported, “My alliance encouraged and supported my sabbatical plans, which began with approaching the head of a nationally famous laboratory to request a position as a visiting scientist.” Another participant reported, “Participation has helped me formulate and clarify my goals, which in turn helps me make decisions (and better decisions) about my career path.” In addition to advice, participants also reported that they obtained actionable support from other ASAP participants. For example, one participant reported, “I have used the network in recruiting participants for ACS symposia
presenters and chapter contributors for ACS books in which I was an editor.” Participants also report an increase in confidence attributed to participation in the project. For instance, on participant reported, “I would never have had the courage to apply for the (specific) grant without the support of my alliance.” Another reported, “I feel more competent on committees, I feel more likely to speak my mind in meetings, I feel more likely to make changes to my teaching.”

Throughout the project, participants have discussed the prominence of teaching in their careers and while some participants reported a positive impact of ASAP on their teaching, it was not the most common impact discussed. Participants reported, “I have also benefited from my alliance group in advancing active and collaborative teaching in my entire department. We have made significant changes in the Biology curricula and are incorporating authentic research across the curriculum.”

**Institutional engagement**

Participants reported increased engagement within their own institution as a result of their participation in ASAP. One participant reported, “I personally feel that I have become a better chair in a variety of ways due to participation in the Advance network.” Participants report reaching out more to others within their same university, “It has strengthened my networking with female colleagues within STEM departments in my university.” Participants learned more about resources that are available to STEM faculty at other institutions as well as learning about the importance of asking for resources. Through meeting together and sharing information and support, participants reported that they were more likely to ask for resources for themselves, their colleagues and their students. One participant reported, “Approaching my Chair and asking for
next year’s teaching schedule was easier after hearing from the experiences of others in the group.” Another reported, “I am more aware of my worth to my institution.”

**External engagement**

Meeting one of the goals of the ASAP project, participants reported that participating in ASAP provided to them access to external opportunities. One participant reported, “First of all, my network of great friends are (sic) really enlarged. Being inspired by these great colleagues, I was able to submit an ADVANCE proposal for our own institute and it was funded.” Participating in the ASAP project provided an opportunity to build friendships and social connections with other women scientists. On participant reported, “My alliance became my dearest friends, my refuge when exhausted, my wise council, my professional and personal go to network.” Additionally, participation in the project seems to have fueled women’s faculty commitment to building the STEM pipeline. Participants reported developing summer STEM programs for K-12 students as well as participating in events coordinated by others.

The outcomes of the ASAP project are both a deepening of the understanding of the way gender influences the careers of women STEM faculty at PUIs and an improvement in the professional lives of the women who participated in the project.

**Conclusion**

Women in STEM disciplines possess an increasing potential to remake the practices of these disciplines to be more inclusive and accessible for historically marginalized and oppressed social groups. Our ASAP project provided a closer look at the specific experience of mostly white women STEM faculty at PUIs. They have constructed an approach to teaching, research, and service that takes incorporates both social relationships and care. Throughout the project participants explored the zero-sum relationship between research, teaching, service, and personal
life. By connecting with each other, participants began to envision a new system that was more holistic in its integration of the different aspects of their professional and personal life. The relationships that formed among participants provided access to information and resources while also creating bonds that allowed participants to increase their confidence in themselves and their willingness to ask for resources.

We were able to provide the context for building a new model for scientific engagement in PUIs. Our STEM faculty explored how they might create models of career success that acknowledge their values that balance research, teaching and service. Rather than looking solely at research intensive universities as a model, our participants began to explore alternative models for career success that continue to value all academic endeavors but with a different perspective. Our work was limited by the composition of our project population which was white women. Future work must increase the diversity of our participant pool so that we can speak to the experiences of all women. Successful development of alternative and inclusive models of academic science requires the participation of all members of the scientific community.

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