Innov High Educ (2015) 40:143–157
DOI 10.1007/s10755-014-9300-9

# Changing Institutional Culture through Peer Mentoring of Women STEM Faculty

**Nicole Thomas · Jill Bystydzienski · Anand Desai**

Published online: 25 May 2014


**Abstract** Higher education institutions often use mentoring to socialize faculty members into their academic disciplines and to retain them. Mentoring can also be used to change organizational culture to meet the needs of historically marginalized faculty members. In this article we focus on peer mentoring circles for women STEM faculty at a large, midwestern research university. Participants reported diverse, context-dependent mentoring needs and expressed interest in communicating issues raised in the circles to administrative leaders. A workshop for circle participants and administrators led subsequently to college-wide teams that addressed problems identified in the circles. We conclude that peer mentoring as a means to facilitate institutional change has great potential.

**Keywords** Peer mentoring circles · Culture change · Women STEM faculty · Higher education

The cost of faculty attrition in institutions of higher learning is substantial, and mentoring has been proposed as one strategy for reducing this cost (National Academy of Sciences, 2007).

**Nicole Thomas** is a doctoral candidate at the John Glenn School of Public Affairs of The Ohio State University in Columbus, OH.

**Jill Bystydzienski** has a Ph.D. from SUNY Albany and an M.A. and B.A. from McGill University. She is Professor and Chair of the Department of Women's Gender and Sexuality Studies at The Ohio State University in Columbus, OH. Her current research focuses on women and gender in STEM fields.

**Anand Desai** is Professor in the John Glenn School of Public Affairs of The Ohio State University, in Columbus, OH. His current research focuses on the role of complexity in public policy research.

A summary of this project was presented at the 6th Annual Mentoring Conference at the University of New Mexico and recorded in the proceedings of the conference distributed to conference participants.

N. Thomas (✉) · A. Desai
John Glenn School of Public Affairs, The Ohio State University, 1810 College Road, Columbus, OH 43210, USA
e-mail: Thomas.1450@osu.edu

A. Desai
e-mail: desai.1@osu.edu

J. Bystydzienski
Department of Women's Gender and Sexuality Studies, The Ohio State University, Columbus, OH 43210, USA
e-mail: bystydzienski.1@osu.edu

Mentoring of faculty members in higher education has been identified as a significant mechanism for helping them to obtain tenure and promotion and to develop a sense of support and belonging, and thus remain at their institutions (Baldwin et al., 2008; Berk et al., 2005; Chesler & Chesler, 2002; Cunningham, 1999; Mathews, 2003; Sambunjak et al., 2006; Stockard et al., 2010; Yen et al., 2007). In addition, many scholars have suggested mentoring as a strategy for faculty members to become socialized into their respective academic disciplines (Cawyer et al., 2002; Schrodt et al., 2003).

Despite the attention paid to mentorship, effective forms of mentoring for retaining women faculty, in particular, remain unclear. This lack of clarity may be because researchers who study mentoring have yet to develop comprehensive explanations to account for the contributions of mentoring to academic success as well as discover contextual factors that affect the success of a mentoring relationship. For example, while existing literature has emphasized the benefits of informal mentoring, few studies have focused on how the context of the mentoring relationship and the characteristics of the participants, such as gender, are related to the need for different types of mentoring (Jones & Corner, 2012; Zellers et al., 2008), including informal or formal mentoring structures. Moreover, although one group of female faculty may benefit from a particular mentoring approach, others may prefer a different approach.

While a large body of scholarship focuses on mentoring faculty in higher education, scholars also need to explore how mentoring of faculty may be used to bring about institutional change to support faculty needs (Angelique et al., 2002; Darwin, 2000). It is particularly important to understand how mentoring in the context of institutional change can enhance the careers of faculty members who have been historically excluded or marginalized, especially in science and technology fields.

In this article, we discuss group peer mentoring compared to other forms of mentoring, including senior-to-junior, one-on-one mentoring, and mentoring networks (Sorcinelli & Yun, 2011). Our focus is on examining how groups—peer mentoring circles—of women STEM (science, technology, engineering and mathematics) faculty members engaging in facilitated meetings can serve as mentors to each other, provide mutual support, and help bring about change in higher education.

In many STEM fields women faculty members are significantly outnumbered by men and experience barriers to advancement (Bystydzienski & Bird, 2006; Rosser, 2012). A driving question for our research on the mentoring circles was whether or not these circles can contribute to the retention of women faculty members. We begin with a review of formal and informal mentoring approaches and examine extant research on peer mentoring with implications for women faculty in STEM. Next we provide a description of peer mentoring circles for STEM women faculty at a large, midwestern research university and then discuss our research results. The findings and discussion are of importance for those who wish to design mentoring programs that can contribute to meaningful institutional transformation of their colleges and universities.

## Potential Advantages of Peer Mentoring

Definitions of *mentor* range from very specific to very broad. Mathews (2003) discussed traditional definitions from nine different authors; among them, Garrick & Alexander (1994) defined a mentor as a person responsible for another's learning and general development while Philips-Jones (1982) viewed mentors as influential people who help others reach major life goals. Mathews (2003) identified two points of agreement among the nine authors: (1) the

mentor is typically a high-ranking, influential, senior member of the organization who has significant experience and knowledge; and (2) the mentor is interested in sharing knowledge with others.

An important distinction is to be made between informal and formal mentoring relationships. An informal mentoring relationship develops spontaneously on the basis of mutual preference whereas a formal mentoring relationship occurs through the matching or assignment of mentees to mentors in conjunction with an institutionally sponsored program (Chao et al., 1992; Noe, 1988; Ragins, 1999; Ragins & Cotton, 1999). Informal and formal mentoring relationships also tend to differ in length, and informal relationships last significantly longer than formal relationships (Ragins & Cotton, 1999). The goals of formal relationships are defined by the objectives of the institution's program while the goals of informal relationships evolve over time and mesh with the mentee's specific career needs (Ragins & Cotton, 1999). Thus, informal mentoring may be more advantageous than formal mentoring because of the increased likelihood of compatibility between the mentor and mentee, the length of the relationship, and the ability of the mentor to cater to the mentee's specific needs over the course of a career.

Kram's (1983) framework is the most frequently cited description of the process of mentoring, or what takes place in a mentoring relationship. He identified two broad functions of mentors: career and psychosocial. Career development functions are those that aid the mentee in professional advancement including sponsorship, nomination for important projects, coaching, protecting the mentee from risk, and increasing visibility (Kram, 1983; Noe, 1988). The psychosocial functions include role modeling, communicating acceptance, and offering counseling and friendship (Kram, 1983). The career or instrumental functions depend largely on the mentor's status and power in the organization while the psychosocial functions are more dependent on the quality of the relationship and emotional connection between the mentor and mentee. Ragins & Cotton (1999) found that faculty members with informal mentors reported receiving more career development and psychosocial assistance, greater satisfaction with their mentors, and more promotions than did those with formal mentors.

Noe's (1988) study involved participants of a formal mentoring program; and, while mentees reported helpful psychosocial assistance, the career development aspect was limited. Noe (1988) suggested that "organizations should not expect mentees to obtain the same type of benefits from an assigned mentoring relationship as they would receive from an informally established …mentoring relationship" (p. 473). These studies build a case for stronger outcomes from informal mentoring than formal mentoring, but they also illustrate positive benefits from mentoring as compared to no mentoring at all.

Noe (1988) investigated the influence of mentees' personal characteristics, job, and career attitudes on the extent of interaction with mentors and the outcomes of mentoring. He developed a Mentoring Functions Scale to assess the various types of mentoring provided. Noe's research and factor analysis confirmed Kram's (1983) two categories of mentoring functions (career and psychosocial). It is interesting to note that in this early research women reported obtaining more psychosocial benefit from the mentoring they received than did the men. No differences were found between men and women for the career development aspect (Noe, 1988).

Mentoring has traditionally involved a dyadic relationship between a senior and a junior member of the organization. An alternative form of mentoring, which has received some attention, is peer mentoring. It involves two or more persons of equal status and can range from a small group to a large network (Girves, et al., 2005; Sorcinelli & Yun, 2007). Peer mentoring can be used successfully alongside traditional mentoring, and faculty can benefit from multiple types of mentoring simultaneously (Cawyer et al., 2002; de Janasz & Sullivan, 2004; Mathews, 2003; Sorcinelli & Yun, 2007; Van Emmerik, 2004).

Peer mentoring often combines both informal and formal characteristics as programs may be officially offered within institutions, yet their content is determined by participants (Limbert, 1995). Research has shown that women benefit from directed or facilitated peer mentoring; this approach not only helps women leaders solve problems, but also builds a community that prevents feelings of isolation and burnout (Daniell, 2006). The advantages of peer mentoring relationships, for both women and men, include availability and access because an individual is likely to have more peers than supervisors/managers (Kram & Isabella, 1985). Another advantage to seeking support and guidance from peers is greater ease of information sharing in general, and specifically in discussing matters such as personal relationships and family responsibilities that extend beyond the boundaries of work (Angelique, Kyle & Taylor, 2002).

By not focusing on an individual mentee, peer mentoring can also involve several people who support and advise one another in a group or "circle" rather than in a one-to-one relationship (Darwin & Palmer, 2009; Limbert, 1995) or a larger network (Sorcinelli & Yun, 2011). Limbert (1995) suggested that peer group members can operate as intellectual guides, collaborators, and information sources for each other; yet there is little risk of becoming overly dependent on any one person as might occur in a one-to-one mentoring relationship. Kram & Isabella (1985) found that peer relationships can provide a variety of developmental benefits, many of which are similar to the career and psychosocial functions found in conventional mentoring.

Group peer mentoring may be a particularly viable alternative to traditional mentoring for female STEM faculty because they encounter more obstacles than their male counterparts when seeking traditional, higher-ranking mentors. STEM departments often have few or no available senior faculty who can serve as effective mentors to female and minority faculty (Bussey-Jones et al., 2006; Chandler, 1996; Files et al., 2008). Moreover, women may differ from men in how they benefit from mentoring relationships; and traditional mentoring structures may reproduce systems that do not address the needs of women (Bussey-Jones et al., 2006; Chandler, 1996; Chesler & Chesler, 2002; Dunham et al., 2012). Group peer mentoring can potentially resolve many problems inherent in traditional dyadic, hierarchical mentoring programs. Rockquemore (2012) argued for a shift from a "person-based to a needs-based framework" (p. 2) that allows faculty members to focus on identifying their concerns and determining strategies for getting their needs met. Thus the focus shifts from securing a senior mentor to finding sources of support that meet individual needs.

Peer mentoring may serve as a link between identifying and acknowledging the needs of female faculty members through group discussion and, in turn, can contribute to transforming departments and institutions by creating environments more supportive of female faculty (Angelique, et al., 2002; Darwin, 2000). Female mentors, in particular, can play a role in fostering resistance to male-created institutional structures (Stalker, 1994). While more traditional mentoring programs provide support to women as they are encouraged to adapt to their current departmental cultures and practices, women in peer mentoring groups may collaborate and develop ideas and policies that can be used to change these cultures to be responsive to women faculty needs.

## Peer Mentoring Circles for STEM Women Faculty at The Ohio State University

### Institutional Context

Peer mentoring circles were implemented at The Ohio State University (OSU), a large Research I university (56,000 students; 2,850 tenure-track/tenured and 2,670 adjunct faculty

members), with attendees from participating STEM colleges. In October 2009, participating STEM fields consisted of 27 departments in three colleges; together, they had 122 women and 548 men faculty members, with 84 women at associate and full professor levels. Women constituted 18% of the faculty in those departments. Information for the 2009-2010, 2010-2011 and 2011-2012 academic years is presented in the table below (Table 1).

OSU also has three other STEM colleges with 20 departments. There were approximately 100 women faculty (60 tenured) and 280 male faculty members (210 tenured) between 2009 and 2012 in these colleges.

Female faculty members in the participating STEM colleges have been less likely than male faculty members to feel welcome in these colleges and departments. Data obtained from a university survey designed to yield information on faculty satisfaction indicated that female faculty were more dissatisfied than male faculty with their professional relationships and reported more exclusion from informal networks (Herbers & Desai, 2012). Additionally, more female than male STEM associate professors reported having to work harder than their colleagues to be recognized as legitimate scholars and scientists.

## Project Description

Comprehensive Equity at Ohio State (CEOS) is a multi-faceted project funded by a five-year Institutional Transformation (IT) award from the National Science Foundation's ADVANCE (Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers) program. IT grants support projects addressing comprehensive, university-wide change. University, college, and especially departmental cultures (Gappa and Austin, 2010) strongly influence job satisfaction and the recruitment and retention of women faculty members (Fouad & Singh, 2011; National Academy of Sciences, 2007). While many OSU initiatives, programs, and policies aim to support women faculty and to contribute to work/life balance, organizational culture has remained a significant area in need of improvement. Departmental cultures often prevent effective implementation of existing policies. Taking advantage of the policies, for example, choosing a part-time tenure track appointment, or stopping the tenure clock for a major life event, is perceived as a sign of weakness or as an effort to seek preferential treatment (Camacho, 2013; Collay, 2002).

Figure 1 illustrates the Transformational Leadership model, which provides a conceptual framework that guided the work of CEOS. This model was drawn initially from the work on transformational leadership by Burns (1978) and Bass (1998). Our model also includes characteristics of leadership teams themselves (Foldy, Goldman & Ospina, 2008; Morley & Lugg, 2009) as well as processes those teams undergo and changes they produce in institutional culture (Morley & Lugg, 2009; Uhl-Bien & Ospina, 2012). As leaders work together, they develop a common vision by inclusive thinking (Ospina & Sorenson, 2006). The development of an inclusive vision and changes in underlying cultural assumptions and in daily practices need to occur interdependently for the successful transformation of academic cultures (Kezar, 2009).

According to this model, institutional transformation is brought about through change at both the organizational and individual levels. The driving force behind the transformation is a vision of support and inclusiveness, forming the basis of the policies that promote career flexibility at all levels of the institution. Change is brought about by challenging cultural assumptions about the negative relationship between excellence and diversity (Brown-Glaude, 2009), which leads to altered practices that ensure an appreciation of diversity.

CEOS work has focused on two levels: the individual level work is with women faculty members and with chairs and deans from participating STEM colleges; at the university level

**Table 1** CEOS STEM colleges, departments, and faculty by gender in 2009-2010, 2010-2011, and 2011-2012

| Year | Number of CEOS STEM Colleges | Number of CEOS STEM departments | Number of women in CEOS STEM departments (%) | Number of tenured women in CEOS STEM departments (%) | Number of men in CEOS STEM departments (%) | Number of tenured men in CEOS STEM departments (%) |
|---|---|---|---|---|---|---|
| 2009-2010 | 3 | 27 | 122 (18%) | 84 (15%) | 548 (82%) | 466 (85%) |
| 2010-2011 | 3 | 22 | 122 (19%) | 86 (16%) | 515 (81%) | 442 (84%) |
| 2011-2012 | 3 | 22 | 123 (20%) | 87 (17%) | 503 (80%) | 435 (83%) |


**Figure 1** CEOS Transformational Leadership Model

the focus is on bringing about change in the cultures of these colleges and the institution as a whole. The five components of the model function at both levels with inclusiveness as a core value. The expectation is that, as individual needs are understood and cultural assumptions questioned, policies at the university and the departmental levels will change to meet those needs and will be implemented; and the desired cultural change will occur (Kezar and Lester, 2011). The main vehicle for this change is a transformed leadership that acts to make specific changes in the short term and works towards broad transformation as part of the institutional fabric over the longer term. Such institutional changes encompass practices that accommodate and promote diversity in all functions of the university.

In this model of transformational leadership, the purpose of the peer mentoring circles is to provide a forum for identifying and meeting individual needs and discussing strategies for change. These circles are also a part of the formal university support system and can therefore be used for conveying faculty needs to those in positions of authority who can attend to the broader task of initiating policy changes, enforcing existing policies, and ensuring their implementation at OSU.

## Research Methods

In summer of 2009 all 84 tenured STEM women faculty members in the participating colleges were sent invitations to participate in the peer mentoring circles, and 42 volunteered to do so in the first year. New invitations were sent each year to tenured women faculty so that they could participate, even if they had not participated in the previous year. Informed by participant concerns and comments, the CEOS research team designed a survey to gather feedback about the circles and to ascertain their effects. The survey consisted of statements related to the research questions with a 5 point Likert type scale (from strongly agree to strongly disagree) and an open-ended item. The first survey administration, six months after the circles began, contained fewer items than the next two because items assessing longer-term outcomes were not included initially. Response rates for the three administrations of the survey were 64% (27) in December 2009, 48% (15) in June 2010, and 68% (15) in June 2011.

In addition to the survey, circle participants were asked to submit a reflective essay at the end of each of the first two years. Despite repeated requests, only eight participants submitted an essay in 2010 and five in 2011. The women's essays were intended to answer the question: "What have you gained personally and professionally from the peer mentoring circles?" The essays were coded for themes (circle benefits and challenges) that were identified by at least two participants.

In December 2009 and again in June 2011, a member of the CEOS research team investigated through follow-up interviews why some women left the circles. In the majority of cases, as described below, the reasons involved lack of time and/or scheduling conflicts. Beyond the issue of time constraints was a concern about the loose structure of the circles that was expressed to the CEOS External Advisory Committee. This feedback resulted in a structure shift in the circles with the facilitator taking a more active role, which we discuss below.

We expected that the peer mentoring circles would lead to a greater sense of belonging, advance more women into leadership roles, and promote policies and practices that facilitate a supportive and inclusive culture. All three objectives are related to the goal of the ADVANCE program to retain more women in academic STEM fields. Thus, our research questions regarding women faculty in STEM fields asked whether the peer mentoring circles create a greater sense of belonging; whether they lead to an inclusive community, and whether they lead to increased retention.

## Description of Peer Mentoring Circles

Invitations to participate in the circles stated the purposes as offering a safe, confidential forum for dialogue, reflection, and the exchange of ideas; encouraging career and life goals; and supporting participants in taking focused and purposeful action in response to the challenges they faced.

Initially, twelve to fifteen women composed each of three circles with membership from Veterinary Medicine, Engineering, Architecture, and the Natural and Mathematical Sciences. In the first year (2009-2010), the circles met monthly for a two-hour period. Associate professors and full professors, as well as a few women in college leadership positions (i.e., department chair, associate dean), participated. To the extent possible, given the limited number of circles, care was taken to assign those in formal leadership positions to circles in which the other participating women were not from the chair's or dean's department or college.

Assignments were made based on three criteria: the participant's availability, her discipline, and her rank. Creating circles with multiple disciplines represented and with a combination of associate and full professors was the goal. However, availability to attend a circle became the overriding criterion for circle assignments as it was difficult to find a common meeting time for twelve or more busy scientists and engineers.

From the inception of the program a professionally trained, non-STEM facilitator was part of the design. The facilitator's role was to solicit current issues of importance to group participants and aid discussions to explore solutions. Ideally, the woman who brought forth an issue would be able to reflect on various options contributed by others, then select and enact one of the proposed solutions. This design allowed all circle participants to be mentees once they put forward an issue for discussion, and all participants were mentors once they contributed an idea for addressing the issue. Thus, everyone could learn as a result of interacting with everyone else. We anticipated that a sense of "I am not alone" would evolve as participants heard peers sharing challenges similar to their own and as they actively engaged in addressing the challenges. Building confidence and capability in tackling difficult situations could strengthen resiliency for career progression.

The facilitator requested at the beginning that participants agree to four principles. (1) What is said in circle stays in circle; confidentiality is critical. (2) We listen to each other with curiosity and compassion—we replace judgment with discernment and keep an open mind. (3) We ask for what we need and offer what we can. (4) When we are unsure how to proceed, we stop action, pause, and reflect. The format of the circles typically included calling the circle to

order, briefly checking-in, gathering of issues and time requests, exchanging ideas, and closing the circle.

By naming and seeking acceptance of the four principles and by utilizing a routine design, a loose structure was provided. The content of each meeting, however, emerged from the "gathering of issues" and arose from participants' experiences. Dialogue, reflection, and the exchange of ideas among the participants made up the substantive part of each circle gathering. Discussions centered on career and life transitions, responding to subtle—implicit and explicit—biases, understanding one's self as something greater than "a scientist," positively influencing younger women, and facilitating institutional change.

The peer mentoring circles were formal in the sense that they were part of an institutionally sponsored project with specific goals, and the women faculty members who expressed interest were assigned to a group. However, the circles had a strong sense of informality in that the agenda was set spontaneously in real-time by participants, not the facilitator. Members were not required to attend every circle; and, in keeping with the spirit of peer mentoring, there was an emphasis on everyone learning from one another, not just from the senior members of the group. However, over time, the circles became more formal in response to participants' requests for a tighter structure and a more active role on the part of the facilitator.

## Benefits of Participation

The circles began in the summer of 2009. All of the 84 tenured women faculty members from STEM disciplines in participating colleges were invited to join. Forty-two (50%) of those invited participated during academic year 2009-2010. In 2010-2011, 31(36%) took part in the circles, and 22 (25%) participated in 2011-2012.

As discussed above, the CEOS research team designed a survey to gather feedback about the circles. Table 2 presents five items that reflect circle benefits. The last two items are salient indicators of the impact of participation in the circles over time, pertaining to retention of women faculty in STEM fields. As Table 2 shows, those who responded in the last two administrations of the survey were increasingly likely to view the University as a supportive community and to be more likely over time to stay at OSU as a result of participating in the circles. These participants also reported that they had enlarged their professional and social networks at the University (80 % in 2010 and 2011) and were able to better navigate OSU (40 % in 2010 and 53 % in 2011) due to taking part in the circles.

Although the participant data are limited, we know that of the 2009-2010 participants four (of 42 or 9%) had resigned from their positions by January 2014; of those participating in 2011-2012 none had resigned as of January 2014.

**Table 2** Benefits of Peer Mentoring Circle Participation

| Survey Item | Dec. 2009 | June 2010 | June 2011 |
|---|---|---|---|
| | % Agree/Strongly Agree | | |
| I am personally benefitting from participating in a circle. | 78% | 100% | 80% |
| I am professionally benefitting from participating in a circle. | 50% | 60% | 74% |
| Participating in a circle is a valuable use of my time. | 75% | 80% | 94% |
| My sense of OSU as a supportive community has strengthened as a result of participating in a circle. | N/A | 47% | 53% |
| Participation in a circle has increased the likelihood that I will stay at OSU. | N/A | 28% | 40% |

As discussed above, eight circle participants submitted a reflective essay in 2010 and five in 2011. In these essays, the participants identified a number of benefits, which included networking with women in other departments and colleges; meeting others in similar career and life stages; hearing from department chairs; receiving valuable advice; realizing that others have similar problems, issues, and questions; gaining perspective on the situations that others have encountered; and gaining social experiences and opportunities. Each of these benefits was reported by at least two participants.

In December 2009 and June 2011, a member of the CEOS research team interviewed those women who had left the circles. One of 10 respondents in 2009 and eight of 12 respondents in 2011, reported being "uncomfortable" in the peer mentoring circles. They described their discomfort in these ways: "I was less interested in the peer 'support' aspect than the peer mentoring potential"; "the one I went to felt like it lacked a clear focus"; "… just too 'squishy' for me as an engineer"; "I felt uncomfortable sharing too many personal details"; and "I've realized my need for circles is not a professional facilitator and an anonymous group. Instead, I've formed circles with colleagues and friends around issues of interest to us." Some women reported that a few members dominated conversation at the sessions. Similar comments, including a desire for more member continuity at each session and requests for more structure in the circles, were made in the responses to open-ended survey items, in reflective essays, and in a conversation with members of the CEOS External Advisory Committee in July 2010.

This feedback resulted in a structure shift in the circles for the 2010-2011 academic year. The facilitator started providing more purposeful direction. She prepared material on specific topics and presented strategies for addressing them. Time was also allocated for reflecting and sharing personal experiences related to the introduced topics. In essays submitted (n=4) and open ended responses to a survey conducted (n=12) in June 2011, participants expressed appreciation for the new structure (9/16) *and* desired more time for social interactions (4/16). As one faculty member succinctly stated, "I do not think we give ourselves enough time to just have conversations."

The interviews with those who stopped coming to the circles also revealed that dropping out did not necessarily result in lack of benefits. An early participant, who had attended only one meeting and then never returned, nonetheless reported a positive experience. This scientist believed she had received an unfair pay increase relative to her peers. Her colleagues at the same rank and her department chair were all men. She brought to the circle her problem of unfair treatment and sought advice. The suggestions she received from members of the circle, as well as an empowered sense of confidence, were what she needed. She gathered evidence and presented it to her chair. He agreed to look into the matter, concluded that the faculty member had made a compelling case, and increased her pay. In sharing this story with the CEOS researcher, the scientist stated full support for the peer mentoring circles. "I got exactly what I needed!" was her assessment of the benefits of the circle. Once she received the help she sought, she saw no reason to return to the circle gatherings. This woman saw the circles as instrumental to solving a specific problem; support and further mentoring were not her desire.

In addition to meeting participants' needs at the individual level, a major benefit of the peer mentoring circles pertained to moving issues and solutions identified in the circles into established university structures with the goal of accomplishing positive change. The third set of survey responses and the second set of participant essays indicated that STEM women faculty were interested in finding effective methods for communicating the issues and concerns raised in the circles to department chairs and college administrators. For example, a participant wrote in her reflective essay that she felt frustrated; and she proposed that the peer mentoring circle members spend more time collaborating on what the University might do to improve the climate for women. In response to such suggestions, a workshop for deans and chairs and

mentoring circle participants was organized, thus creating a forum for the circle participants to discuss with administrators the concerns raised in their groups. The topics included creating a more supportive climate for women faculty, promotion to full professor, and faculty mentoring practices. Post-workshop evaluations suggested that both the administrators and the circle participants found the opportunity to exchange ideas valuable. Seven of 18 deans and department chairs indicated in subsequent interviews that the workshop series, in general, had made them more sensitive to issues regarding bullying and mistreatment in their departments. Moreover, 13 persons from this administrative group stated that they had either changed existing mentoring practices or implemented new ones.

In addition, CEOS college-wide teams, which worked to improve departmental and college cultures, took up problems identified by circle participants. For example, the Natural and Mathematical Sciences team identified a lack of effective mentoring for women faculty and proposed a multi-pronged program. Several of the women faculty who participated in the peer mentoring circles became members of these college-wide teams. A university-wide survey, administered first in 2008 and later in 2011, showed that dissatisfaction with faculty mentoring practices decreased in participating CEOS STEM colleges from 56.9 percent in 2008 to 52.8 percent in 2011, while it increased from 46.4 percent to 50.0 percent in all other university colleges.

## Discussion

Over time, what became clear were the different needs of STEM women faculty who responded to an invitation to join peer mentoring circles. Some greatly valued the social interaction; others were uncomfortable giving time to supporting one another. Some had their needs met with a loose and informal structure; others desired a more controlled agenda. The intent, and design, of our peer mentoring circles was primarily a focus on the psychosocial functions of mentoring. The invitations to participate used the phrases "offering a safe, confidential forum," "encouraging goals" and "supporting participants." While it was assumed that the career functions of mentoring would be addressed through the identification, discussion, and resolution of the women's challenges, this assumption was more subtle and relied on the women's willingness to bring forth career advancement concerns.

While several women faculty members criticized the circles for their lack of structure and a focus on socializing, others valued the circles because they discovered and shared real life problems with similarly positioned women. They found a community that had not existed for them in the past, which increased their desire to stay at the University. As indicated above, most of the participants in the circles stayed at OSU; and their overall satisfaction with the institution increased over time. Given these results which show the potential of improving the retention rate of women STEM faculty members, it is imperative to address female STEM scientists' needs to build a supportive community and to connect with their peers.

The response of STEM female faculty to the peer mentoring circles supports the conclusions found in the current peer mentoring literature. Many participants appreciated the community and networking opportunities that developed as a result of the initially informal structure of the circles. On the other hand, the experience of the participants in these circles was not always positive. Some women in the CEOS circles expressed frustration with the loose structure and lack of continuity in circle attendance, suggesting that informality may only be useful in certain situations and that the circles benefitted STEM women faculty in some ways through increased structure and formality.

Based upon some of their own experiences as African-American female faculty, Mccarther, Davis, & Caruthers (2012), described how they benefitted from informal mentoring relationships; but they also recommended scheduling formal meetings with faculty members. Their conclusions, as well as the requests for less personal and more structured CEOS peer mentoring circles, suggest that female faculty may benefit from more formal mentoring relationships in addition to the informal relationships that were already established.

Participants also used the peer mentoring circles as an avenue to develop and suggest to deans and chairs policies and practices that were more supportive of female faculty. Their requests highlighted a need for discussion of how peer mentoring can contribute directly to institutional change—by not only addressing the individual career and psychosocial needs of female faculty, but also by creating departmental cultures that are more responsive to the needs of female faculty. Group peer mentoring may simultaneously be used to help women adapt to their environment and also to create an environment that adapts to the needs of women. Peer mentoring may thus provide a participatory, grassroots mechanism for institutional transformation by allowing women to discuss their individual concerns and to collaborate in order to develop solutions that address these concerns.

## Conclusion and Recommendations

We have focused on a peer mentoring program for STEM women faculty that successfully met the needs of many of the participating female faculty members, helped to contribute to their retention and advancement, and played a significant role in a larger institutional transformation effort. A distinguishing feature of this peer mentoring program is its focus on the collective as well as the individual as recipient of mentoring. Peer mentoring circles function as groups with a fluctuating membership. These circles can evolve into groups where individuals mentor one another, offer guidance and advice, and provide other forms of mutual support for success in a university setting.

A key struggle experienced by the planners of the CEOS mentoring circles was how best to organize the sessions to accommodate the diverse needs of the participants. Steps must be taken to ensure that a few members do not dominate conversation, and consensus must be reached about the discussions that occur inside the circles. What to discuss may depend on the mentees' departments, their academic positions, experiences, and whether or not they have families. One suggestion could be to focus discussion on specific topics; however, this could break the natural flow of the discussions, making participation irregular and discontinuous. Some of these issues could disappear over time as participants become better acquainted and learn to anticipate each other's needs. Nonetheless, at the outset, there is the need for an experienced facilitator who can help provide structure without necessarily dictating the topic or the nature of the discussions. Maintaining continuity in a group where attendance is optional and therefore varied from one meeting to the next is not easy. Moreover, faculty needs change and may shift over time.

Mentoring has been a common strategy for retaining women scientists because many express a need for it and suggest that it is unavailable or missing. As mentioned above, Rockquemore (2012) suggested shifting to a needs-based framework; exploring what is behind a request for mentoring can unearth varying strategies to meet varying needs. We would add that such assessment is continuous as new mentoring needs are likely to surface after previous ones have been met. Universities seeking to invest in a mentoring program might be well served to adopt the shift suggested by Rockquemore (2012). The more robust the needs assessment, the more likely a mentoring program will be effective.

Faculty members often express the need for mentoring in the context of tenure and promotion. Peer mentoring circles, however, provide a much larger context in which the discussions can encompass a broad range of topics related to the local culture and working environment. These circles, as an institutional arrangement, also provide a platform for bringing the collective needs of the participants to the attention of university administrators. Through attending workshops focused on working with a diverse workforce, deans and department heads gain insights into the types of cultural and institutional changes they need to bring about. However, it is not always obvious what the content of the specific changes ought to be. Periodic meetings of mentoring circle participants with university administrators can be mutually beneficial; administrators can learn firsthand about the cultural issues that need to be addressed and the specific changes that might be necessary while allowing circle participants to recognize that what appeared to be personal issues are in fact part of a cultural context.

Typically, mentoring programs for faculty in higher education focus on how to get faculty members oriented and conforming to the expectations of their departments and colleges so that they can be successful in the existing system. Seldom, if ever, do such programs question the norms to which faculty members are subjected and the practices that exist within departments and institutions. The peer mentoring program under CEOS was developed within a framework of institutional transformation. It was part of an overall culture change initiative aimed at improving working conditions for women STEM faculty and ultimately increasing retention of women in academic STEM fields. While the structured CEOS peer mentoring initiative has not continued in its original form, it was critical to inspiring a number of other mentoring initiatives, including peer networking happy hours and mentoring initiatives throughout the participating and other colleges.

As our research from this project demonstrates, problems and issues identified by mentoring circle participants can be vetted and responded to effectively by those in positions to change policies and practices. The findings reported here are of importance for those who wish to design peer mentoring programs that contribute to meaningful transformation at their academic institutions.

**Acknowledgments** We want to thank Anne Massaro, a co-principal investigator on this project, for helping to organize the peer mentoring circles, collecting some of the data, following up with the participants, and helping with data analysis. This research was supported in part by funding from the National Science Foundation ADVANCE Grant 0811123. The opinions expressed here are solely those of the authors and do not represent the official position of the NSF.

## References

Angelique, H., Kyle, K., & Taylor, E. (2002). Mentors and muses: New strategies for academic success. *Innovative Higher Education, 26*, 195–209.

Baldwin, R., DeZure, D., Shaw, A., & Moretto, K. (2008). Mapping the terrain of mid-career faculty at a research university: Implications for faculty and academic leaders. *Change* (September/October), 47-55.

Bass, B. M. (1998). *Transformational leadership: Industrial, military, and educational impact*. Mahwah, NJ: Erlbaum.

Berk, R. A., Berg, J., Mortimer, R., Walton-Moss, B., & Yeo, T. P. (2005). Measuring the effectiveness of faculty mentoring relationships. *Academic Medicine, 80*, 66–71.

Brown-Glaude, W. R. (Ed.). (2009). *Doing diversity in higher education: Faculty leaders share challenges and strategies*. New Brunswick, NJ: Rutgers University Press.

Burns, J. M. (1978). *Leadership*. New York, NY: Harper and Row.
Bussey-Jones, J., Bernstein, L., Higgins, S., Malebranche, D., Paranjape, A., Genao, I., Lee, B., & Branch, W. (2006). Repaving the road to academic success: The IMeRGE approach to peer mentoring. *Academic Medicine, 81*, 674–679.
Bystydzienski, J. M., & Bird, S. R. (Eds.). (2006). *Removing barriers: Women in academic science, technology, engineering and mathematics*. Bloomington, IN: Indiana University Press.
Camacho, M. M. (2013). *Bearing children on the tenure track: Survival strategies from the trenches*. In D. Mack, E.D. Watson, & M. M. Camacho, *Mentoring faculty of color: Essays on professional development and advancement in colleges and universities*. Jefferson, NC: McFarland.
Cawyer, C. S., Simonds, C., & Davis, S. (2002). Mentoring to facilitate socialization: The case of the new faculty member. *International Journal of Qualitative Studies in Education, 15*, 225–242.
Chandler, C. (1996). Mentoring and women in academia: Reevaluating the traditional model. *NWSA Journal, 8*(3), 79–100.
Chao, G. T., Walz, P. M., & Gardner, P. D. (1992). Formal and informal mentorships: A comparison on mentoring functions and contrast with non-mentored counterparts. *Personnel Psychology, 45*, 619–636.
Chesler, N. C., & Chesler, M. A. (2002). Gender-informed mentoring strategies for women engineering scholars: On establishing a caring community. *Journal of Engineering Education, 91*, 49–55.
Collay, M. (2002). Balancing work and family. In J. E. Cooper & D. D. Stevens (Eds.), *Tenure in the sacred grove* (pp. 89–106). Albany, NY: SUNY Press.
Cunningham, S. (1999). The nature of workplace mentoring relationships among faculty members in Christian higher education. *Journal of Higher Education, 70*, 441–463.
Daniell, E. (2006). *Every other Thursday*. New Haven, CT: Yale University Press.
Darwin, A., & Palmer, E. (2009). Mentoring circles in higher education. *Higher Education Research and Development, 28*, 125–136.
Darwin, A. (2000). Critical reflections on mentoring in work settings. *Adult Education Quarterly, 50*, 197–211.
de Janasz, S. C., & Sullivan, S. E. (2004). Multiple mentoring in academe: Developing the professional network. *Journal of Vocational Behavior, 64*, 263–283.
Dunham, C. C., Weathers, L. H., Hoo, K., & Heintz, C. (2012). "I just need someone who knows the ropes": Mentoring and female faculty in science and engineering. *Journal of Women and Minorities in Science and Engineering, 18*, 79–96.
Files, J.A., Blair, J.E., Mayer, A.P., & Ko, M.G. (2008). Facilitated peer mentorship: A pilot program for academic advancement of female medical Faculty. *Journal of Women's Health, 17*, 1009–1015
Foldy, E., Goldman, L., & Ospina, S. (2008). Sensegiving and the role of cognitive shifts in the work of leadership. *The Leadership Quarterly, 19*, 514–529.
Fouad, N.A., & Singh, R. (2011). *Stemming the tide: Why women leave engineering*. Center for the Study of the Workplace, University of Wisconsin-Milwaukee, Retrieved from http://studyofwork.com/files/2011/03/NSF_Women-Full-Report-0314.pdf
Gappa, J.M., & Austin, A.E. (2010) Rethinking academic traditions for twenty-first-century faculty. *Journal of Academic Freedom, 1*. Retrieved from http://www.aaup.org/sites/default/files/files/JAF/2010%20JAF/Gappa.pdf
Garrick, J., & Alexander, C. (1994). Using mentors: Critical issues for TAFE. *Training Agenda, 2*(4), 7–8.
Girves, J. E., Zepeda, Y., & Gwathmey, J. K. (2005). Mentoring in a post-affirmative action world. *Journal of Social Issues, 61*, 449–479.
Herbers, J.M., & Desai, A. (2012, June). *Women STEM faculty at Ohio State: Resource allocation and department climate*. Paper presented at the Annual WEPAN Conference, Columbus, Ohio.
Jones, R., & Corner, J. (2012). Seeing the forest *and* the trees: A complex adaptive systems lens for mentoring. *Human Relations, 65*, 391–411.
Kezar, A. (2009). Unexplored terrain: Is too much change happening in higher education? *Change* November/December, 35-45.
Kezar, A., & Lester, J. (2011). *Enhancing campus capacity for leadership: An examination of grassroots leaders*. Stanford, CA: Stanford Press.
Kram, K. E. (1983). Phases of the mentor relationship. *Academy of Management Journal, 26*, 608–625.
Kram, K. E., & Isabella, L. A. (1985). Mentoring alternatives: The role of peer relationships in career development. *Academy of Management Journal, 28*, 110–132.
Limbert, C. (1995). Chrysalis, a peer mentoring program for faculty and staff women. *National Women's Studies Association Journal, 7*(2), 86–98.
Mathews, P. (2003). Academic monitoring: Enhancing the use of scarce resources. *Educational Management and Administration, 31*, 313–334.
McCarther, S. M., Davis, D. M., & Caruthers, L. (2012). Traveling the tenure track: Mentoring and collaborative research among African American female faculty in a midwestern university. In S. D. Myers & C. W. Anderson (Eds.), *Dimensions in mentoring: A continuum of practice from beginning teachers to teacher leaders* (pp. 229–242). Boston, MA: Sense Publishers.

Morley, L., & Lugg, R. (2009). Mapping meritocracy: Intersecting gender, poverty and higher educational opportunity structures. *Higher Education Policy, 22*, 37–60.
National Academy of Sciences. (2007). *Beyond bias and barriers: Fulfilling the potential of women in academic science and engineering*. Washington, DC: The National Academies.
Noe, R. A. (1988). Women and mentoring: A review and research agenda. *The Academy of Management Review, 13*, 65–78.
Ospina, S., & Sorenson, G. (2006). A constructionist lens on leadership: Charting new territory. In G. R. Goethals & G. L. J. Sorenson (Eds.), *The quest for a general theory of leadership* (pp. 188–204). Northampton, MA: Edward Elgar Publishing.
Philips-Jones, L. (1982). *Mentors and protégés*. New York, NY: Arbour House.
Ragins, B. R. (1999). Gender and mentoring relationships: A review and research agenda for the next decade. In G. N. Powell (Ed.), *Handbook of gender and work* (pp. 347–370). Thousand Oaks, CA: Sage.
Ragins, B. R., & Cotton, J. L. (1999). Mentor functions and outcomes: A comparison of men and women in formal and informal mentoring relationships. *Journal of Applied Psychology, 84*, 529–550.
Rockquemore, K.A. (2012). *Don't talk about mentoring*. National Center for Faculty Development and Diversity. Retrieved from www.insidehighered.com/advice/mentoring/debut_of_new_column_on_mentoring_in_higher_education_careers#sthash.en1yvYTN.dpbs
Rosser, S. V. (2012). *Breaking into the lab: Engineering progress for women in science*. New York, NY: New York University Press.
Sambunjak, D., Straus, S. E., & Marusic, A. (2006). Mentoring in academic medicine: A systematic review. *Journal of the American Medical Association, 296*, 1103–1115.
Schrodt, P., Cawyer, C. S., & Sanders, R. (2003). An examination of academic mentoring behaviors and new faculty members' satisfaction with socialization and tenure and promotion processes. *Communication Education, 52*, 17–29.
Sorcinelli, M. D., & Yun, J. Y. (2007). From mentoring to mentoring networks: Mentoring in the new academy. *Change, 39*, 58–61.
Sorcinelli, M. D., & Yun, J. Y. (2011). *Mutual mentoring guide*. Amherst, MA: Office of Faculty Development. Retrieved from https://www.umass.edu/ctfd/mentoring/downloads/Mutual%20Mentoring%20Guide%20Final%2011_20.pdf
Stalker, J. (1994). Athene in academe: Women mentoring in the academy. *International Journal of Lifelong Education, 13*, 361–372.
Stockard, J., Greene, J., Lewis, P., & Richmond, G. (2010). Promoting mentoring among and for women in chemistry: The experiences of COACh. In K. K. Karukstis, B. L. Gourley, M. Rossi, & L. Wright (Eds.), *Mentoring strategies to facilitate the advancement of women faculty* (pp. 153–166). Washington, DC: American Chemical Society.
Uhl-Bien, M., & Ospina, S. (2012). *Advancing relational leadership research: A dialogue among perspectives. Leadership Horizon Series*. Greenwich, CT: Information Age.
Van Emmerik, I. J. H. (2004). The more you can get the better: Mentoring constellations and intrinsic career success. *Career Development International, 9*, 578.
Yen, J. W., Quinn, K., Carrigan, C., Litzler, E., & Riskin, E. A. (2007). The ADVANCE mentoring-for-leadership lunch series for women faculty in STEM at the University of Washington. *Journal of Women and Minorities in Science and Engineering, 13*, 191–206.
Zellers, D. F., Howard, V. M., & Barcic, M. A. (2008). Faculty mentoring programs: Reenvisioning rather than reinventing the wheel. *Review of Educational Research, 78*, 552–588.