Lessons learned from efforts to develop mentoring programs for early-career STEM faculty after an NSF ADVANCE PAID grant

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Abstract

Funded by an NSF ADVANCE Partnerships for Adaptation, Implementation, and Dissemination (PAID) grant between 2011 and 2016, the WISE@OU program at Oakland University set out to identify and implement strategies that would increase the recruitment, retention, promotion and job satisfaction of women and underrepresented faculty in Science, Technology, Engineering and Math (STEM) departments. After conducting a climate survey and several focus group meetings, it quickly became apparent that there were many needs across campus that needed to be addressed, not only within STEM and not only among women and underrepresented faculty. With no formal faculty mentoring programs in place or active in any of the STEM departments, it hence came as no surprise that a majority of female and male STEM faculty indicated the need for more mentoring, particularly in the area of research. Although the benefits of mentoring in the workplace have long been documented in the literature, early and mid-career STEM faculty at Oakland University were generally left to fend for themselves unless they were fortunate enough to identify helpful faculty in their departments on their own. This paper discusses WISE@OU's initial efforts to organize one-on-one, peer-to-peer and group mentoring activities across STEM departments, then goes on to describe a faculty mentoring model that was implemented within the School of Engineering and Computer Science.

Introduction

In recent years, many faculty, administrators, and staff in higher education have been wrestling with the challenges of creating and administering successful mentoring programs for both assistant and associate professors during their academic careers. These efforts reflect an often strong interest by both tenure-track and mid-career faculty for effective mentoring that addresses their associated needs[1,2], and also represent a growing awareness of some of the particular challenges that faculty on the tenure-track face. In a survey study by the American Association

for the Advancement of Science (AAAS), both male and female respondents cited the issue of *grants/funding* as the most significant career barrier and ranked the issue of *balancing of life and career* as the second and third most significant barrier for women and men, respectively[3]. When later asked to list resources to help them overcome these barriers, both men and women placed *grants/funding* as primary and cited *mentors* as the second most desired resource. Faculty mentoring programs are a critical tool in lowering many of the institutional and campus climate barriers facing all faculty[4,5,6]. Clarity in tenure and promotion expectations, as well as the availability of mentoring are key to the successful retention and promotion of all faculty, women and underrepresented minorities (URMs) in particular. The benefits of mentoring in academic and non-academic workplaces have been widely documented[7], yet finding peer-reviewed and practitioner research to aid in the process historically has proven difficult as much of the literature has traditionally focused on faculty-student mentoring as opposed to faculty-faculty mentoring.

Some of the most useful sources of information regarding faculty mentoring programs have originated from current and past recipients of the National Science Foundation (NSF) ADVANCE program. First established in 2001, the goal of the NSF ADVANCE program is to "increase the representation and advancement of women in academic science and engineering careers, thereby developing a more diverse science and engineering workforce[8]." With over 200 grants awarded since 2001, including one to Oakland University, institutional recipients of NSF ADVANCE awards have been focused on issues of retention, fairness, equity and policy and have made important contributions to the knowledge base on issues of faculty mentoring[9,21].

As the knowledge base has grown, considerations of best practices have evidenced the realization that there is no "one size fits all" model that will achieve all mentoring goals at each institution; after all, institutions of higher education vary widely in size and resource availability, let alone in stakeholder interest. Hence, the emerging literature speaks to "mentoring networks" or "mosaic mentoring" or "toolkits" or "design elements" that can be used in developing a program customized to a given institution rather than recommending a single model[10,11].

In this paper, we report on some of the past a\nd continuing efforts by the NSF-funded WISE@OU Program at Oakland University to address the mentoring needs of STEM faculty. These include peer-to-peer and group mentoring activities across STEM departments, as well as a faculty mentoring model that was implemented within the School of Engineering and Computer Science.

About the WISE@OU Program

In 2011, Oakland University was awarded a 4-year grant under the NSF ADVANCE Partnerships for Adaptation, Implementation, and Dissemination (PAID) program[12]. One of 15 state-supported 4-year institutions in Michigan, Oakland University (OU) is a relatively young, dynamically growing doctoral University with a High Research Activity (R2) classification according to the Carnegie Classification of Institutions of Higher Education. With about 20,000 students, the university is anchored by a large College of Arts and Sciences (CAS), as well as several professional schools including School of Engineering and Computer Science (SECS), School of Business Administration, School of Education and Human Services, School of Nursing, School of Health Sciences, as well as a medical school.

The WISE@OU program focused on creating a comprehensive recruitment, retention, and career development program for women and under-represented populations in STEM disciplines. This included, among other things[13-16],

- Anti-bias training for search committees and faculty review committees
- Development of resources for new faculty
- Advocacy for the needs of faculty, including the needs of women and under-represented populations in STEM
- STEM-focused workshops highlighting best practices in teaching and research
- Special events and workshops for mid-career faculty
- Development of family-friendly information for faculty and faculty candidates
- Resources to educate faculty about campus processes and policies and advocacy for needed changes in policies
- Regular workshops and a resource guide for department chairs
- Collaboration between professors and administrators across campus
- Proactive nomination for internal and external awards

Among other things, WISE@OU sought to develop effective mentoring initiatives with the potential for sustainability beyond the life of the grant. Upon completion of the NSF-grant, the program transitioned to the Research Office in Fall 2016 and became WISER (Women in Science, Engineering and Research).

Climate Study and Focus Group Sessions

One of the very first tasks undertaken by WISE@OU to determine the strengths and limitations of our campus climate, and identify the issues facing STEM faculty was to conduct an accelerated "institutional transformation" fact-finding endeavor, involving a climate survey, focus group meetings, and the analysis of other faculty-related data. A climate survey was distributed to all faculty in the College of Arts and Sciences (CAS) and School of Engineering and Computer Science (SECS), and this was followed up by focus group meetings with many STEM faculty and campus administrators. Main topics of the survey included hiring, tenure, career growth and satisfaction, grants and research, departmental environment, and work-life balance. Survey responses indicated that most STEM faculty (64%) were especially interested in more professional development opportunities and career management training. A majority of STEM faculty (81%) strongly indicated that they needed more support in the grant application process. Over half of STEM faculty (59%) indicated they did not receive assistance in the form of mentoring and career development, especially in research. In addition, we conducted focus group sessions with female STEM faculty of different ranks (assistant, associate, and full professors) as well as with STEM department chairs. The focus group sessions allowed faculty to more openly discuss their challenges. For example, although survey responses in general indicated that faculty members were more satisfied than dissatisfied with the campus climate, the focus group participants identified factors that detracted from career satisfaction, including workload issues, low salaries, and a gender-biased environment. Through discussions with STEM department chairs and faculty, we determined that, as in many other institutions, there were no formal faculty mentoring programs in place. The benefits of mentoring in the workplace

have long been documented in the literature, yet early and mid-career faculty at OU were generally left to fend for themselves unless they were fortunate enough to identify helpful faculty in their departments on their own. So, it was thus not surprising that most faculty members indicated that they were not receiving assistance from their colleagues or department in the forms of career advice and development opportunities and that more mentoring, particularly as it pertains to research, was needed, as echoed in comments such as the following from focus group meetings: *"I feel for everyone to grow in this academia… you need the person who has been there, done that, to give you advice, at least to avoid mistakes."*

Mentoring is needed, but how should it be structured?

As the WISE@OU leadership team set out to convince deans, associate deans and department chairs of the need for and value of setting up formalized faculty mentoring programs within their units, it initially anticipated developing a traditional mentoring model for STEM faculty with careful matching of mentor and mentee. Yet our review of the limited literature on best practices in STEM faculty mentoring quickly pointed us in a different direction.

Many of the tools or design elements of faculty mentoring programs in the literature reflect what has been learned from studying two of the most common models used in higher education for faculty-faculty mentoring: hierarchical one-on-on mentoring and peer-mentoring (either one-on-one or as a group). The traditional model, hierarchical/one-on-one is structured so that a faculty member of higher seniority is either assigned or has volunteered to mentor a newly hired individual. It assumes the mentor has the time, interest, communication skills, and ability to tune in to a given mentee's needs effectively despite a reality that may not reflect this[17]. Though it can be successful in aiding mentees, if the mentor/mentee relationship is not strong, this model can actually hinder or even harm, potentially creating a sense of isolation in the mentee[9]. A factor contributing to possible dysfunction involves the dynamics experienced by mentees who are members of underrepresented groups, such as women, in a field that is dominated by men[18]

Peer mentoring can take many forms. A group of newly-hired junior faculty members may meet regularly with supervision of a senior faculty member[19]. Alternatively, a junior or mid-career faculty member or members may meet with other similarly situated faculty members, either singularly or as a group without hierarchical senior faculty oversight or facilitation[20]. Peer mentoring can be particularly beneficial as mentees mature and develop into independent scientists in that the associated relationships not only help them in furthering their own problem-solving skills and career self-efficacy but also their confidence and skills as mentors[9].

As previously mentioned, emerging research reflects the need for mentoring programs to be flexible to the institutional structures and people within. Hence, we find concepts such as network or mosaic mentoring and toolkits or design elements important to be considered when developing a customized program. Key to all of these is the finding that the one-on-one /hierarchical model has limitations and that programs need to be driven by the diverse needs of the mentees as well as unique factors associated with individual institutions.

For example, "mosaic mentoring" might involve a newly-hired female faculty member being placed with a mentor to help set up a laboratory and give feedback on early articles while also being placed with another faculty member who will introduce her to leaders and others in

national organizations and help her get on the right committees. This individual may also later help her get to a leadership position within the school or university[11].

A mentoring network helps correct for the weaknesses of the tradition one-on-one/hierarchical model termed the Guru Model by leading mentoring researcher Rockquemore[17] who states, "Our center teaches (and represents) a completely different model that is the opposite of the guru-mentor model. Specifically, we place the faculty member (not the guru) at the center and help individuals create a broad and deep mentoring network to meet the common needs that new faculty members have. Instead of fantasizing about a guru-mentor, we encourage faculty members to develop the skill of continually asking 'what do I need and where is the best place to get it?'" In this model, a facilitating senior faculty member initiates a conversation with the mentee regarding questions and concerns, validates needs, helps brainstorm solutions, make connections, and confirms next step[17]. Solutions to the various questions and concerns involve myriad others such as other faculty, staff, peers, external connections, and/or administrators.

In terms of toolkit development, many National Science Foundation's Institutional ADVANCE grant recipients have created toolkits that guide unit-level stakeholders in formulating mentoring programs that not only reflect institution-wide policies supporting mentoring but also best practices research[21]. The information provided helps stakeholders to make informed decisions at every phase on mentoring.

Lastly, drawing on mentoring research, Phillip Dawson[10] has identified sixteen (16) design elements that represent key points of consideration in the development of an institution's mentoring model. "A design element of mentoring represents a variable or an opportunity for a choice in the design of a mentoring model, for example: the choice of one-to-one rather than group mentoring (the cardinality element); the criteria that are used to choose mentors (the selection element); or the triggers for and consequences of ending a mentoring relationship (the termination element)"[10]. Dawson's identification of these elements provides a research-informed framework for program developers to use. These include considerations such as *Matching*: "how mentoring relationships are composed"; *Activities*: "actions that mentors and mentees can perform during their relationship"; *Role of technology*; *Training*: "how necessary understandings and skills for mentoring will be developed in participants"; and *Monitoring*: "what oversight will be performed, what actions will be taken under what circumstances, and by whom."

Informed by the literature and the experiences of other ADVANCE programs, our own unique institutional context, limited resources, as well as a healthy dose of serendipity, WISE@OU's faculty mentoring efforts took on many forms, including group mentoring, mentoring networks, and peer-to-peer mentoring. In the next sections we describe some of our group mentoring experiences, as well as an example of a mentoring initiative undertaken by the School of Engineering and Computer Science.

Group Mentoring / Cohort Activities

One of our most successful, yet simple, initiatives centered around group/cohort mentoring of assistant professors from various STEM departments. We realized early on that while individual STEM departments may have a relatively small number of untenured faculty members, new faculty across these departments share many of the same challenges and concerns as they work to establish their research programs, develop new courses, and learn how to navigate university services and policies. We thus set out to provide opportunities for these newly hired assistant

professors (male and female) from math, science and engineering to meet each other and get to know key senior faculty members, staff, and administrators throughout campus. How did we structure this? By organizing a series of luncheons hosted by members of the WISE@OU leadership team who would facilitate or initiate discussions, allowing the new/junior faculty to ask questions about a variety of topics in a supportive environment. These luncheons were one of the few opportunities for faculty from different units to interact. Each event presented information on a topic (such as career planning, seeking funding, or meeting with campus leaders and administrators), as well as time for networking to help establish collegial support and collaboration. If we noticed that some important questions were not being asked by the new faculty, members of the WISE@OU leadership team made it a point to ask some of those questions as a way of prompting further discussion and reflection. The cohort luncheons proved to be successful, as attendees found peer mentors as well as guidance from the senior STEM faculty who were part of the our leadership team. Over time, "more seasoned" assistant professors started to provide assistance to newer faculty as well, and several research collaborations across disciplines resulted from interactions between faculty from different departments. More importantly, these luncheons introduced the newer faculty to experienced, senior STEM faculty that they could (and did) call upon for individual advice and counsel on a variety of issues, including research, teaching, service, departmental politics, tenure and promotion, work-life balance, etc. The diverse disciplines and experience of the senior STEM faculty involved with our program further allowed for many questions to be answered quickly and completely.

Throughout the duration of our grant, the leadership team worked incessantly to advocate for and highlight the need to the university administration for mentoring, faculty workshops, grant-writing resources, family-friendly policies, etc. We demonstrated our success through increased faculty promotion and award achievements, high attendance at our events, and positive feedback from faculty who attended our workshops. In addition, WISE@OU collaborated with well-established offices and centers on campus such as the Center for Excellence in Teaching and Learning, to leverage resources and to create long-lasting programs and partnerships. As the grant funding wound down, WISE@OU worked towards institutionalizing some of its services and programs, and has now become WISER within the OU research office. By highlighting many of the needs of faculty, WISER was able to work with the research office and others to successfully hire two Research Development Officers who can now provide more assistance to STEM faculty with grant writing and funding opportunities. New faculty can now enroll in the PI Academy, which "provides professional development in research and engagement to a cohort of 30 non-tenured, tenure-track faculty members from across campus. The program includes training sessions, workshops, and other activities. Academy participants are also matched with an external mentor to further develop their skill set and career network."[22] Other initiatives such as Chair and anti-bias training are continuing through collaborations with Academic Human Resources and the Center for Excellence in Teaching and Learning. More importantly, several units across campus are now looking at ways to provide mentoring and support to their faculty. Below we describe some initial efforts within the School of Engineering and Computer Science.

An Example from Engineering

One important goal for the WISE@OU Leadership Team was to help encourage a culture of mentorship within the STEM departments so that more senior faculty would get involved and the value of mentorship both to the mentee and to the mentor would be recognized. This message

was reiterated through several meetings over the duration of the grant with administrators, deans, and department chairs. The dean of the School of Engineering and Computer Science was particularly receptive to this message and appointed a faculty member, one of the co-authors and a co-PI on the ADVANCE grant, to serve as a coordinator for a school-wide faculty mentoring program. The SECS currently has four departments and about 70 faculty members. One distinguishing feature of the School is that all of its faculty are governed by the same tenure and promotion criteria, hence minimizing differences between disciplines. While the faculty mentoring program in the School is still evolving, below are some key features of the program:

- The program has a Faculty Development coordinator (FDC) who serves as a point person for untenured faculty within the School. It is important that the coordinator be perceived as approachable, available, knowledgeable and willing to help.
- The FDC reaches out to all newly hired faculty as soon as she is provided with their contact information by department Chairs. A warm email welcoming the new faculty to OU, providing contact information, offering to answer questions/provide assistance and meeting with the new faculty over the summer if they come to visit the area goes a long way towards setting a positive tone.
- The FDC meets individually with new faculty and provides them with information that they may need when they first arrive at OU. This generally entails school-specific information as faculty also receive a lot of information during their university-wide new faculty orientation.
- The FDC organizes several group get-togethers for untenured faculty throughout the year. These include informal coffee/chat gatherings to socialize and discuss issues that may be on their minds, as well as more formal meetings (similar to the cohort luncheons but specific to SECS faculty) focused on topics such as tenure and promotion, teaching issues, etc.
- The FDC also meets with individual faculty one-on-one; such meetings may be at the request of the faculty member or may be initiated by the FDC who may have observed the faculty member struggling with an issue. One area that the FDC highly encourages faculty to come discuss with her is promotion and tenure reviews.
- The FDC offers to review grant proposal drafts or to help identify other faculty willing to do so. This activity can be very time consuming, but with the hiring of Research Development Officers and the inception of the PI academy, is now becoming less needed.
- More importantly, the FDC follows a "mentor network" model, serving as a facilitator who can connect faculty with others who may be better able to help with a specific issue. For example, if a faculty member has questions about securing industrial funding, she may share her own experiences with the process, but will then connect the faculty member with Professor Z who has extensive experience in that area. Professor X on the other hand may serve as a good resource for teaching concerns and Professor Y can help with childcare issues.
- The FDC does not have all the answers and is not expected to. Rather, the FDC identifies faculty within the school and the university who can serve as great resources in specific areas and works on connecting faculty to them. The FDC knows to advise faculty dealing with medical issues, requiring a leave or wondering about maternity leave to contact Academic Human Resources.
- The FDC receives some summer compensation and one course release (usually in the Fall) to undertake this service activity.

Is this a perfect model? No. It requires a person who is dedicated to this service activity and who is also aware of the need for confidentiality in conversations with faculty. When several faculty are undergoing reviews, the workload can get quite high if one wants to provide detailed feedback to each one. It is hence critical to recruit other faculty to help, for example, faculty who have just successfully been promoted to associate or full professor. One needs to be mindful of not increasing the service burden on faculty members who already carry a high service load, not calling upon senior faculty who may be overly negative or not willing to invest the needed amount of time.

Although anecdotal, the response by junior faculty to the FDC has been very positive so far and most are very comfortable approaching her for assistance. Having a point person that they know they can go to for assistance is very helpful. In fact, mid-career faculty solicit the FDC's advice as well and department Chairs relay concerns to her as well.

Summary

As the literature shows, there are many mentoring models available and no single model is the magic bullet. When developing a mentoring program, the institutional culture and context must be taken into account. Yet, we believe that there are benefits to the WISE@OU cohort model including: ease of operation as it only requires a few committed mentors; interdisciplinary appeal (by bringing together faculty from different disciplines); and, minimal cost (we have learned that providing food is important, but does not need to be costly). Leveraging existing campus resources (such as centers) helps spread the workload and cost as well. The engineering FDC model is still evolving, but has the benefit of ensuring that faculty are provided with mentoring even in departments that may not have a strong mentoring culture; ensures that new faculty feel supported and know who to go to with questions; and ensures that some of the problems that have been reported in the literature with one-on-one mentoring are minimized. Ultimately, given the large investment of time and money in faculty recruitment and startup funds, academic institutions should behoove themselves to support efforts to nurture and retain faculty.

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