

# **Creating a collaborative cross-institutional culture to support STEM women of color and women with family responsibilities at four midwestern research institutions**

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Canan Bilen-Green is Vice Provost for Faculty Affairs and Equity at North Dakota State University. She is also Dale Hogoboom Professor of Industrial and Manufacturing Engineering. She received her Ph.D. from the University of Wyoming. She holds additional degrees from Middle East Technical University (B.S.), Bilkent University (M.S.), and University of Wyoming (M.S.). Dr. Bilen-Green's primary teaching and research interest is in quality engineering and management of people systems. She served as lead investigator and director of the National Science Foundation funded ADVANCE FORWARD Institutional Transformation program and the ADVOCATE FORWARD PLAN-D partnership project. Dr. Bilen-Green formed, led, and/or served on various institutional committees including Commission of the Status of Women Faculty, Women with Disabilities Task Force, Promotion to Professor Task Force, and the NDSU Childcare Center Committee.

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## **Adrienne Minerick (Director, The ADVANCE Initiative and Professor, Chemical Engineering)**

Adrienne R. Minerick is Director of ADVANCE at Michigan Tech and Professor of Chemical Engineering. She has served as Associate Dean for Research and Innovation in the College of Engineering, Assistant to the Provost for Faculty Development, Dean of the School of Technology, founded the College of Computing, and most recently served as Interim Dean of the Pavlis Honors College. She has received numerous honors and awards, including the distinction of Fellow of AAAS and ASEE, a National Science Foundation CAREER Award, the Raymond W. Fahien Award from the Chemical Engineering Division of ASEE, and Michigan Tech's Fredrick D. Williams Instructional Innovation Award. She and her students have published over 100 archival journal publications, book chapters, or proceedings articles and earned 23 best paper/presentation awards. Adrienne previously served as the President of the AES Electrophoresis Society and on the ASEE's Board of Directors as First Vice President and Professional Interest Council I Chair. She also chaired ASEE's National Diversity Committee. Her research and service interests regularly intersect and involve underserved individuals with an emphasis on research experiences to increase engagement and retention.

## **Ann Burnett (Director of Women and Gender Studies)**

Ann Burnett is Professor Emerita of Communication at North Dakota State University. Burnett holds a Ph.D. degree in Communication from the University of Utah and an M.A. degree in Communication from the University of Northern Colorado.

## **Roger A. Green (Associate Professor)**

Dr. Roger Green is an Associate Professor of Electrical and Computer Engineering at North Dakota State University, where he teaches, conducts signal processing research, and serves as Undergraduate Program Coordinator. Since its inception in 2008, Dr. Green has been a lead member of the NDSU Advance FORWARD Advocates, a group of male faculty dedicated to effecting departmental and institutional change in support of gender equality. As part of this group, he regularly trains men, at NDSU and other institutions, to better serve as gender equity allies. Dr. Green received his Ph.D. in Electrical Engineering from the University of Wyoming.

## **Carla Koretsky**

Carla M. Koretsky earned a B.A. degree in Earth and Planetary Sciences from Washington University in St. Louis in 1993, and M.A. and Ph.D. degrees in Earth and Planetary Sciences from Johns Hopkins University in 1995 and 1998, respectively. She currently serves as Dean of the College of Arts and Sciences at Western Michigan University and Professor of Geological and Environmental Sciences. She has previously served as Associate Dean and Dean of the Lee Honors College at Western Michigan. She has served as co-lead of the WMU Aspire Change Alliance and the WMU lead of the NSF ADVANCE Joining Forces Midwest Partnership grant. She has received numerous awards and honors including the Michigan ACE Network Distinguished Woman in Higher Education Leadership Award; the Geochemical Society Distinguished Service Award; the WMU Excellence in Diversity Rising Star Award; the WMU College of Arts and Sciences Faculty Achievement in Teaching Award; and the WMU Emerging Scholar Award. She was named a 2019 Crain's Notable Women in STEM, and is the recipient of numerous grants from state and federal agencies such as the Department of Energy, the Michigan Department of Environmental Quality, the Office of Naval Research, and the National Science Foundation, including an NSF CAREER award.

## **David W. Wahl**

David W. Wahl is a social psychologist currently working as a research associate with the ADVANCE Midwest Partnership at Iowa State University.

## **Lori Alicia Wingate**

## **D. Raj Raman (Morrill Professor)**

D. Raj Raman is Morrill Professor of Agricultural and Biosystems Engineering Department at Iowa State University. Raman holds a BS in Electrical Engineering (RIT, 1986) and doctorate in Agricultural and Biological Engineering (Cornell University, 1994); prior to coming to Iowa State University (ISU), he was assistant/associate professor at the University of Tennessee, Knoxville, from 1993 – 2005. Raman's research has encompassed waste management, insect detection, and technoeconomic modelling of bioprocessing and waste-treatment systems. He has developed new graduate and undergraduate degree programs, overseen accreditation of highly-ranked engineering degree programs at ISU, and taught courses across the curriculum, from first-year engineering problem solving & computing, to capstone design. Over 220 students have participated in summer research programs (e.g., NSF REU sites) that he has directed, with two of these sites associated with large externally-funded interdisciplinary research efforts led by ISU. He has contributed to the literature in areas of curriculum, student risk characterization, and mentoring, and has been recognized with teaching honors including the Farrall Young Educator Award and the Massey-Ferguson Gold Medal Teaching Award – both national teaching awards given by the ASABE. Since 2017, Raman has worked closely with Dr. Ken Moore (Distinguished Professor of Agronomy) on a transdisciplinary project focused on perennial groundcover. In fall 2021, that effort (RegenPGC) received \$10M in funding in the form of Agriculture and Food Research Initiative Competitive Grant program from the USDA National Institute of Food and Agriculture, and Raman now serves as Project Director for RegenPGC.

## **Gul E. Okudan Kremer (Wilkinson Professor and Senior Director)**

Gül E. Kremer is Dean-elect of Engineering at University of Dayton. Kremer served as chair of the Department of Industrial and Manufacturing Systems Engineering (2016-2021) and Senior Director Presidential Projects (2021-2022), in addition to past leadership roles at Penn State. Dr. Kremer has degrees in industrial engineering from Yildiz Technical University, a masters in business from Istanbul University, and a PhD in Engineering Management from Missouri University of Science and Technology. She was a National Research Council-US AFRL Summer Faculty Fellow in the Human Effectiveness Directorate (2002-2004), a Fulbright Scholar (2010-2011), and Program Director in NSF's Division of Undergraduate Education (2013-2016). Dr. Kremer's research interests include applied decision analysis to improve complex products and systems, and engineering education. Her research has appeared in 3 books and over 360 refereed publications. She is a Fellow of the American Society for Mechanical Engineers and senior member of the Institute of Industrial Systems Engineers. In addition, she has significant contributions to research efforts that are directed toward improving engineering education.

## **Sonia Goltz (Professor of Organizational Behavior)**

Sonia Goltz is Mickus Endowed Faculty Fellow of Business Impact in the College of Business at Michigan Tech and teaches organizational behavior and organizational change. She received her Ph.D. in Industrial/Organizational Psychology from Purdue University. Her research examines topics such as organizational change, social power and coercion, and gender equity and has been published in business and applied social sciences journals including: Human Relations, Journal of Applied Social Psychology, Decision Sciences, Journal of Small Business Management, and Journal of Organizational Behavior Management. She is a co-PI on Michigan Tech's NSF ADVANCE Adaptation grant, a collaborator on the NSF ADVANCE Midwest Partnership grant led by Iowa State, and received Michigan Tech's diversity award in 2021.

## **Patricia Sotirin (Research Professor)**

Dr. Patricia Sotirin is a Research Professor in the Department of Humanities at Michigan Tech. She earned a Ph.D. in Communication from Purdue University and her research areas include interpretive qualitative methods, feminist theory, embodied gender in organizations, and kinship communication. She has co-authored or co-edited six books on such topics as poststructuralist qualitative research; feminist resilience; feminist vigilance; women on the homefront; aunts in popular culture and aunt/niece/nephew communication. Her published articles include analyses of dual career issues, embodiment in change management, DEI training, and organizational resistance. She has published in such journals as the Journal of Organizational Change Management; Qualitative Inquiry; Review of Higher Education; Organization Management Journal; Journal of Social and Personal Relationships; and Organization: The Critical Journal of Organization, Theory, and Society. She has been President of the Organization for the Study of Communication, Language, and Gender (OSCLG) and Editor of Women & Language. She has been on over fifty graduate committees and received an Outstanding Mentor Award from OSCLG. She is a Co-PI on an NSF ADVANCE Adaptation grant at Michigan Technological University.

# **Creating a collaborative cross-institutional culture to support STEM women of color and women with family responsibilities at four midwestern research institutions**

## **Abstract**

NSF ADVANCE has been instrumental in supporting institutional practices leading to the increased representation of women in STEM. However, research suggests institutional culture and practices evolve slowly, and much progress remains to create a collaborative and supportive work environment where women scientists, mathematicians, and engineers can thrive, particularly those with intersectional identities, including women of color and women with caregiving responsibilities. A partnership of four midwestern research universities joined together in late 2019 to adapt, design, implement, and assess the impact of a coordinated suite of programs intended to enhance the career success of women and underrepresented STEM faculty. The programs promote mentoring, male advocacy, and informed and intentional leadership as integral to campus culture, and foster community and cross-institutional data-based collaboration. This paper summarizes the programs designed and implemented to improve retention and job satisfaction of women in STEM fields with a focus on the intersectionalities of women of color and women with family responsibilities, including navigating the challenges presented by the COVID-19 pandemic, by creating support networks for these faculty.

## **Background**

Since 2001, NSF ADVANCE has been instrumental in supporting institutional practices leading to the increased representation of women in STEM. However, research suggests, and outcomes show, that institutional culture and practices have not evolved to create a collaborative and supportive work environment where women scientists, mathematicians, and engineers can thrive, particularly those with intersectional identities, including women of color and women with caregiving responsibilities. Joining together in October 2019, the ADVANCE Midwest Partnership has been adapting, developing, and offering cross-institutional programs for STEM women faculty with these two intersectional identities. The programs developed with funding from the ADVANCE Partnership program to four midwestern research institutions and are intended to address issues of retention, advancement, and work-life balance.

Three of the four institutions are prior recipients of institutional ADVANCE grants. The fourth one has a history of programs focused on women's success. Efforts to recruit more women faculty at these institutions are shown by increases at the assistant professor rank from 2008 to 2018. However, the increase in the percentage of STEM women faculty in the lower ranks has not been consistently reflected in the higher ranks, suggesting that retention remains an issue (Figure 1). This is noted also at other ADVANCE institutions [1]. Overall, the numbers of women faculty in STEM fields at the four partner institutions are significantly lower than the 34.5% national average of STEM women faculty at doctorate-granting research universities, particularly at the full professor rank [2].

Research indicates women and underrepresented (URWM) faculty often face intersectionality-based discrimination including stereotyping and implicit biases [3], [4], [5], [6], less acknowledgment for quality of their work [7], [8], and an accumulation of disadvantages [9]. These experiences likely lead to the difficulties in retention shown at the four partner institutions. Among the reasons contributing to STEM women faculty leaving the institutions, identified through climate surveys, are: departmental climate, lack of support for research, sexist climate for women, tension over work/life balance, and inequities in treatment [10].

This paper summarizes the programs designed and implemented to improve career success, job satisfaction, and thus retention of women in STEM fields with a focus on the intersectionalities of women of color and women with family responsibilities. We also discuss how the team navigated the challenges presented by the COVID-19 pandemic and attempted to create support networks for women faculty of color and/or with family responsibilities who were among those in academia most impacted by it.

### **Context and Intersectionalities**

This partnership project brought together four midwestern research-intensive, doctoral-level public universities. Their sizes range from 7,000 to 32,000 students; two are urban and two are in rural settings; all have strong reputations for STEM research. All four have university leadership committed to cultural change institutionalizing diversity and equity, and three were recipients of ADVANCE grants awarded between 2006 and 2018 prior to the funding of this Partnership grant in 2019. All showed gains in equity, diversity, and faculty retention and career advancement as a result of institutional efforts and commitment to increasing diversity, with a 2-15% growth of women in tenure-eligible positions in STEM fields between 2008 and 2018 efforts, especially at the assistant professor rank (Figure 1). However, women at the associate and full professor rank in STEM departments did not grow at a comparable level in this same time period.

Institutional data show that two key intersectionalities are particularly affected by these low retention rates: underrepresented women minorities (URWM) and women with familial care responsibilities (WFC), and that regional factors impact these intersectionalities more than other faculty groups.

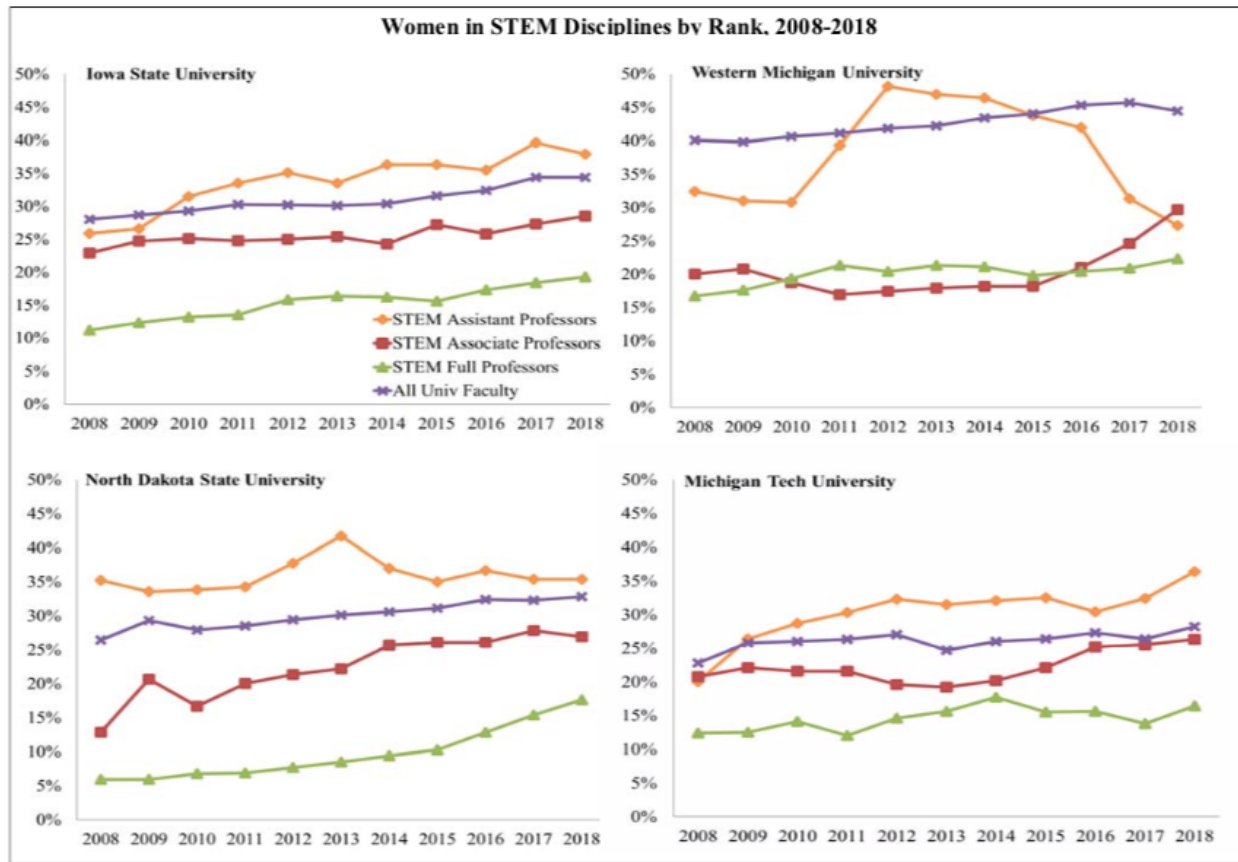


Figure 1: Percentages of women in STEM disciplines by rank and overall at four partner institutions (2008-2018). The national average of STEM women faculty at doctorate-granting institutions is 34.5% [2].

Women faculty at these institutions are less likely to be married and have children than men faculty. For example, results from the 2013-14 Collaboratives on Academic Careers in Higher Education (COACHE) survey showed that at one of the institutions only about  $\frac{1}{3}$  of the 210 STEM women in tenured or tenure-track positions had children. Women faculty members at a second institution were more likely than men to be single (2010 Work-Life Survey). This presents barriers to recruiting and providing mentorship and support to women with caregiving responsibilities, because there may be few mentors who have had similar experiences. Department cultures that assume faculty have few if any caregiving responsibilities can present a significant obstacle in recruiting women faculty. Retention of these faculty has shown to be low: retention data at the first institution for a recent ten-year period indicated that almost half of the

resignations came from assistant professors, of which 37% were women and 39% were faculty of color, citing department climate and the chair as the main reasons for leaving the institution. Retention data at a third institution from 2009-2019 illustrate that women leave at a 50% higher rate than men.

In 2019, 44% of women in STEM with the highest degrees awarded were nonwhite [11]; however, percentages in academia typically hover near zero (for example, see [12]), and unfortunately, proportions at the four partner institutions follow national trends. For example, 2020 data from one of the institutions indicated that Asian, Hispanic, and African-American women made up only 9% of the total faculty. Similarly, at a second institution in 2018 4.8% of STEM faculty were both female and domestic underrepresented minorities, and 1.2% were international women. Other data indicate likely reasons for the low numbers. A 2017 climate study at this institution indicated that higher percentages of people of color (26%) and multiracial respondents (21%) as compared with white respondents (16%) reported experiencing exclusionary or offensive conduct [10]. At a third institution, faculty of color (23%) and international faculty (36%) were less likely to respond that the campus climate was extremely or moderately good as compared with faculty overall (52%).

Although low rates of retention of underrepresented individuals are experienced across the country, regional issues associated with the upper Midwest aggravate the problem, including history, geography, entrenched biases, a lack of community resources for diversity in religious and ethnic traditions, and limited availability of family care services. One study found a “chilly climate” for ethnic and racial minority faculty in Midwest universities [13], [14] given biased perceptions of incompetence (see the stories in *Presumed Incompetent*, edited by Gutiérrez y Muhs et al. [15]).

Combining family and academic work is known to be difficult [16], and this is exacerbated in the STEM fields. Less than one-third of U.S. scientists perceived their institution to be family-friendly [17], and dual-career is a key contributor to attrition of women in STEM [18], [19], [20], [21]. Furthermore, ‘Sandwich Generation’ adults have the added pressure of caring for elderly relatives [22], [23], [24], [25], [26]. Several studies have shown that this pinch can



have an adverse impact on work performance [27]. Although men also feel the stress of work-life balancing [28], [29], STEM women faculty tend to have fewer children than their male counterparts and have fewer children than they desire [30], [29], [31], [32], [33]. Additionally, national research indicates women with children in tenure-track jobs in the sciences are 27% less likely than male counterparts to achieve tenure [34]. Leaving full-time work after becoming a parent is nearly twice as likely for STEM women as compared with STEM men (43% vs. 23%); this difference is attributed to a sexist culture that does not support caregiving responsibilities [28].

Regional issues are relevant. Family characteristics in the Midwest are striking. Iowa is first in the country in the percentage of both parents with children six and younger in the workforce – 75.2% compared to a national average of 65.2% [35]. Michigan and North Dakota also rank high, with 71.5% and 70.7% respectively. The need for a systemic shift in how issues of caregiving are addressed is illustrated by the current daycare crisis. For example, a survey of social work program deans documented the most salient negative effects of not having reliable, affordable childcare as missed obligations (70%), chronic stress (80%), and handling specific caregiving-related issues such as illness or death, divorce, caring for elderly relatives (74%) [36]. These effects were somewhat buffered by the availability of on-site daycare and larger faculty size. However, even establishing on campus daycare may not be sufficient to provide reliable and affordable childcare for STEM faculty. Although three of the partner universities have on-campus daycare facilities, these facilities typically run at capacity and have extensive waiting lists, particularly for 0-3 year olds. Like most other midwestern research institutions, the childcare capacity to student enrollment ratio of these facilities is less than 1%, as compared with eastern research universities, which typically have a capacity from 1-4% [37]. Unfortunately, as public institutions of higher education, in particular, are increasingly struggling with decreased revenue due to enrollment declines and diminished state support, scarce resources are diverted away from campus child care centers. As a result, the percentage of public colleges with campus child care centers declined from 60% in 2004 to 45% in 2019 [38].

## **Cross-Institutional Partnership Solutions**

Instead of widely tried approaches such as working to increase the number of women in STEM fields, especially at the assistant professor level, and attempting to establish more family-friendly policies to hire faculty who are members of underrepresented groups in STEM, the partner institutions adopted a retention- and support-focused agenda. Specifically, attention was put into retaining women in STEM, and supporting professional development of key individuals in departments that continue to experience difficulties attracting and retaining ethnically diverse women faculty, and those with caregiving responsibilities. This project was designed to provide dynamically responsive support mechanisms that address issues of faculty workplace bias, tensions of family responsibility/career demands, a lack of regional resources for caregivers and minority faculty, and a need for department level connectivity and sense of belonging. This synergy is achieved through integrated cross-institutional programming adapted from well-established programs implemented at each partner institution. The cross-institutional efforts were refined with these specific intersectionalities in mind, designed to be portable to other universities, and crafted to enhance cross-institutional connections and resources for addressing conditions impacting underrepresented women minority women (URWM) and women with family caregiving responsibilities (WFC) on Midwest university campuses.

Five overarching goals drive partnership efforts: (1) to increase retention of URWM and WFC; (2) to support career progress for URWM and WFC; (3) to increase satisfaction and success of URWM and WFC; (4) to stimulate advocacy for systemic change based on awareness of gender equity issues emerging from the programs implemented; (5) to create an integrated set of cross-institutional programs that will be exportable to other regional universities that aim to support, retain, and advance the careers of URWM and WFC.

## **COVID-19 Impact**

The global COVID-19 pandemic became a serious concern in the United States in March 2020, less than six months after the Partnership project's official start date. Thus, the pandemic had a serious impact on the original implementation plans of the project components. It quickly became apparent that the pandemic, with its forced closures of campuses, schools, and daycare centers, and sudden transition to distance learning, was having a disproportionate impact on women with family responsibilities and women faculty of color. In addition, faculty of color faced the trauma and stress of the George Floyd murder and the resulting demonstrations and difficult conversations on campuses across the country, as well as the ensuing trauma experienced by students of color who often turned to women faculty of color for support [39].

The pandemic impacted the original timeline and modality of the implementation of the Partnership programs, such as delaying it by one year, but also offered several opportunities. First, it offered the opportunity to rethink our initial integration model, which could now occur synchronously by launching programs virtually across all institutions, rather than the originally envisioned sequential approach on individual campuses and then adapting them to different institutional contexts. Face-to-face programs like the Advocates & Allies offering at one of the institutions were initially delayed and then offered in a virtual format. Campus-specific training for department chairs became cross-institutional and virtual, giving chairs the opportunity to compare experiences across institutions and learn best practices. (Details on each program, and how they were implemented in a pandemic environment, are given below.) Second, it provided an opportunity to offer resources to assist women faculty navigating these unprecedented challenges, such as mentoring on remote teaching via the cross-institutional mentoring groups. Third, it provided an opportunity to study how the pandemic impacted women faculty with the two intersectional identities that have been the focus of this project.

## **Cross-Institutional Mentoring Communities (CIMC)**

CIMCs are designed to create mentoring networks as a robust support and feedback mechanism for assistant and associate professors. The networks emphasize problem-solving for career obstacles as well as enhancing a sense of belonging. Thus, the program is intended to reduce the isolation, exclusion, and silencing of WFC and URWM faculty particularly regarding caregiving issues and tokenism. The CIMCs are also designed to facilitate inter-institutional exchanges and reflexive learning among committee members about similarities and differences in climate and opportunities on different campuses, thus seeding fresh ideas across institutions. This program fosters a culture of listening, awareness, and responsiveness to the concerns of women faculty; collectively, this camaraderie supports WFC and URWM in career progression and their own advocacy for change. The first year involved 58 faculty in ten CIMC that met biweekly or monthly via virtual meetings with a mentor and multiple mentees. In addition, the Partnership hosted four cohort-wide virtual meetings for CIMC members to build additional camaraderie, assess progress, and celebrate accomplishments. The second year implementation involved 32 participants in eight groups. The larger number of groups to participants was a balance between continuing groups with attrition of some members and available mentors to start additional groups. The drop in participation is attributed to COVID burnout and what was termed “faculty disengagement” after nearly two years of pandemic fatigue [40]. Feedback from participants in year 1 (2020-2021, 35% response rate) indicated 79% agreed or strongly agreed they were better able to navigate or manage career challenges due to their participation in the CIMCs. The COVID-19 pandemic exposed the range of needs and challenges that made these communities a sought-after source of support and guidance across institutions and ranks [41].

## **Cross-Institutional Advocates & Allies (CI-A&A)**

The Advocates and Allies (A&A) program emphasizes men working with other men to create awareness of gender and inequities while maintaining accountability to women [42]. It provides structured pathways to effectively engage men to promote gender equity and has been introduced at over 30 campuses nationwide. The cross-institutional A&A enlists male faculty in

on-the-ground forms of support to promote equity for women faculty, including WFC and URWM, by engaging men advocate leaders from the partner campuses in changing the locus of responsibility from lone actors to networks that listen, learn, and act in response to identified issues. Both the CIMC and CI-A&A programs create proactive processes for recognizing how local conditions—such as regional factors—impact lived experiences and for championing initiatives toward more innovative campus policies, practices, and resources around race/ethnicity and caregiving support. The A&A program Ally workshop evaluations show that approximately 90% of participants state that their knowledge of unconscious gender bias and its impact on university climate has increased; a similar 90% indicate that they would be able to implement new strategies to promote a more equitable climate for women faculty on their campuses. These results indicate that the program encourages both awareness and advocacy for transformative changes in faculty processes and relations.

These data and success indicators are based on the traditional face-to-face model of implementation that was derailed by COVID-19 in 2020-2021, when the program was to be implemented at the third institution (the program was already in place at two of the institutions at the start of the project). Virtual Ally workshops offered at this institution in spring 2021, as well as similar virtual workshops offered elsewhere, had participation in the single digits (9), possibly because of both Zoom and COVID-19 burnout. In-person offerings at this third institution in fall 2021 were attended by 21 men faculty, more than doubling the spring participation.

### **Cross-Institutional Department Chair Professional Development (CI-DCPD)**

CI-DCPD focuses on professional development for department chairs. Although originally planned as a series of on-campus workshops to be adapted from workshops that had been offered at one of the partner institutions for several years and subsequently implemented at other campuses, the delay caused by the pandemic allowed the team to rethink the original plan and pivot to collaboratively develop workshops that transcend institutional culture and policies and focus on a cross-institutional context facilitated by a virtual environment.

The CI-DCPD is an important program given the leadership role of chairs and their central importance in modeling and promoting departmental culture. This program is intended to address reports by URWM and WFC that their decision to leave institutions were in part due to a perceived lack of support from department chairs. These professional development workshops are intended not only to increase chairs' knowledge and awareness for pathways and practices to retain and support URWM and WFC, but also to inspire them to become change agents within their own departments and across their own campuses, by leveraging their network across multiple universities.

The program consists of four 1.5 hour-long workshops offered at least twice at different days and times and that cover topics such as performance evaluation with a focus on COVID impact and caregiving penalties and tokenism, departmental climate and implicit biases, challenges in implementing flexible faculty practices, and bullying. The first workshop (Managing Faculty Performance in a Time of Change), offered in spring 2021, was attended by 89 chairs and administrators. The second one (Come Together: Building an Equitable Department Where Faculty Want to Work and Stay) attracted 69 participants in Fall 2021. The third one (Flexible Faculty Policies) was attended by 54 chairs in Spring 2022, and the fourth one on workplace bullying will take place in Fall 2022.

### **Cross-Institutional Women's Caucus**

The Regional Women's Caucus virtually disseminates experiences, research findings, best practices and success stories of women in STEM fields through film events, panel discussions, interactive workshops, and presentations. Approximately two presentations or workshops are offered each semester; the virtual format allows for broad participation extending even beyond the four partner institutions with participants invited via advertising on social media and through personal and professional networks.

In the 2020-2021 academic year, Regional Women's Caucus events included two viewings of the *Picture a Scientist* documentary followed by a panel discussion, a viewing and discussion of *the Bearded Lady Project*, and a discussion of the silencing and scrutiny of women in STEM with

Donna Riley. Overall, Caucus events were attended by a total of 1,066 faculty, staff, and students from 45 academic institutions and 15 other agencies. Eight institutions included nine or more attendees, with the highest representation coming from the four partner institutions, University of California-Davis, Des Moines Area Community College, and University of Minnesota-Duluth, each with more than 50 attendees. The attendees included university and college administrators (117), department chairs and heads (184), faculty (270), graduate students (103) and undergraduate students (299).

Caucus events support other Partnership programs, CIMC, CI-A&A and CI-DCPD, by offering programs that address issues and concerns raised by participants like implicit and explicit gender and racial bias as well as bystander intervention. Although we have no pre-pandemic comparison, the virtual format of these events, facilitated by the experience in virtual conferencing tools acquired during the pandemic emergency, is making them accessible to a broad audience. To accommodate faculty schedules in Partner institutions, the events have been offered later in the evening. In spring 2022, we will be experimenting with daytime offerings.

### **Program Evaluation**

Quantitative and qualitative assessment of each program and event, with a focus on integration and collaboration, provides feedback and guides further implementation phases. Assessment of each component of the project assists in describing the ways in which this cross-institutional synergy may reduce isolation for women faculty with these intersectional identities, encourage women faculty to be more optimistic about their futures in academia, and transform academic cultures and practices to enable and grow awareness, advocacy, and systemic change.

Assessment instruments and data sources include institutional data, participant demographics, online surveys tailored to each event and program, interview protocols, and analysis of comments, notes, and questions posted by workshop participants in shared online documents (e.g., Google Doc, Google Jamboard, Google Forms).

There are two novel characteristics of the evaluation of this project. First, in an attempt to “measure” intersectionality, one demographic question in each of the instruments includes an open-ended question asking respondents to “fill in the blank” regarding their identities that may impact their experience with (in)equities [43]. Although intersectionality is not prone to measurement or quantification [44], this survey item is the first attempt (as best we can determine) to tap into that variable. However, the challenge is having sufficient numbers of individuals with common intersectional identities to report on these intersections. Second, evaluation follows the same cross-institutional partnership with the evaluation group working as a cross-institutional team, rather than individuals being responsible solely for surveying the programs that stem from one’s institution or events at one’s own institution. As a result, surveys are more planned and uniform, thereby allowing cross-comparisons, than if each evaluator operated in a silo.

### **Integrated Equity Support (IES)**

IES focuses on the integration of these programs in such a way as to ensure they support each other. In other words, the component programs of the Partnership should be seen as a holistic package of diversity, equity, and inclusion (DEI) efforts that capitalizes on synergies, or alignments among different functions, resources, or participants. A specific example of a Partnership synergy is an interactive theater event that was hosted by the Caucus and included CIMC mentors, chairs and administrators, and male advocates and allies. Thus, this program served as a resource across the programs and contributed to the Partnership package as a whole. IES also looks at capitalizing on synergies across institutional efforts. This includes sharing knowledge across the Partnership based on individual institutional experiences, and engaging in joint problem-solving to adapt individual programs to each campus. For example, the cross-institutional DCPD workshops raised the possibility of ongoing peer mentoring sessions among chairs at different institutions, thus realizing synergistic value by adapting the CIMC model to the DCPD. In this way, the process of adapting to problems and opportunities together can provoke synergistic adaptations that may not have emerged otherwise.



Importantly, such adaptations require awareness of contextual elements that impact programming, particularly the needs and resources that frame DEI action at Midwest universities. For example, childcare needs and facilities, while critical to parenting faculty everywhere, are framed by local practices and histories. The IES addresses potential synergies arising from regionally based assumptions about parenting and institutional responsiveness to faculty childcare needs that differ significantly from universities in other areas of the U.S.

## **Discussion**

The Partnership draws on a cross-institutional, regional lens to provide materials and assessment tools that are transferable, adaptable, and customizable across initially the current four institutions and expanding to other institutions. The cross-institutional approach allows for a more responsive transfer of practical knowledge across institutions to facilitate long-term changes in attitude and practice. The organizational structure adopted by the team has created multiple levels of synergy across institutions; further, this approach has enabled reinforcement of concepts between program elements. Cross-institutional participation is one of the main strengths of the project.

NSF ADVANCE is focused on women faculty in STEM fields in tenure-eligible positions. However, women represent the majority in non-tenure eligible positions at the partner institutions. While we acknowledge cultural differences within STEM fields and between STEM and non-STEM disciplines, the Partnership's approach is based on inclusivity and programs have been intentionally advertised as open to all faculty, regardless of rank, tenure status, or discipline. Assessments have shown that participation has predominantly come from the target audiences.

Prior ADVANCE funding and institutional commitment to equity had put in place some foundational policies designed to support women faculty, e.g. Family Medical Leave of Absence, dual career programs, extension of the tenure clock for arrival of child, and increased clarity in promotion and tenure guidelines. However, trends in percentage of women faculty (Figure 1) and the institutional context described above shows that these improvements were not sufficient to effectively address systemic issues that led to low retention of women faculty. Original plans

were to compare retention pre, during, and post implementation of the cross institutional partnership programs; however, the confounding effects of COVID on this very population continue to be documented (e.g., [45]) and may overshadow partnership's influence on retention.

The assessments conducted to date reveal short-term positive impacts from the programs. Determining the impact of these programs on URWF and WFC is more elusive. While self-reported identities are collected when programming is offered, the challenge is having sufficient numbers of individuals with common identity intersections to report on those intersections. Thus, there are a few notable limitations to the project's evaluation, especially in characterizing its impact on faculty with varying levels of caregiving responsibilities (e.g., single parents, elder care, geographic isolation from family of origin) beyond what participants self-report in surveys. While focused research on specific intersectionalities has the benefit of being able to seek out individuals with specific identities and then ask them to respond to a survey, with a project that offers broad, inclusive education, we are in the position of having to do the opposite, which makes achieving sufficient numbers challenging. Further, this level of detailed demographic information is not consistently tracked at the institutional level, and if tracked, privacy concerns are an important barrier.

## **Recommendations**

As we navigate the third year of the project, there are a few recommendations that we learned from two years of programming during a pandemic. We group these recommendations under three foci: 1) benefits from cross-institutional collaborations, 2) implementation platforms, and 3) program evaluation.

Benefits from Cross-institutional Collaborations:

- Policies and culture can differ greatly from institution to institution, and can make it challenging to transfer programs implemented at specific campuses. A collaborative approach that focuses on commonalities and challenges enables individuals to fully explore the pros/cons of new practices instead of defaulting to a mindset that changes cannot be implemented because of one governing body or another's past practice at an

institution. For example, using case studies embedded in small group interactions has proven effective for department chairs to proactively engage in strategies that benefit their faculty.

- Finding commonalities across institutions is key in developing mentoring communities and supportive programs to address issues affecting WFC and URWM. A regional focus allowed the Partnership to identify common issues affecting women in STEM departments at research institutions, and develop programs around them.
- Cross-institutional events, training, and mentoring work well when goals and benefits for attendees are clearly stated ahead of time. For sessions involving discussions, pre-reading assignments in the 15-20 minute range are completed at a sufficiently high rate by attendees.
- Synergistic and collaborative approaches work best when the programs are modified and implemented, allowing broad ownership and contributions from the four institutions.

#### Program Implementation Platforms:

- Making documentaries accessible over multiple days and recording panels or presentations provides additional flexibility to those who might have teaching or work conflicts and/or personal commitments at an event's scheduled time, although it precludes participation in Q&A or panel discussions.
- Attendance over time at the CIMC sessions has declined, a trend in keeping with reports of increased faculty exhaustion in the face of ongoing pandemic adjustments and increased task demands, especially for faculty mothers [45] as well as Zoom fatigue, which impacts women more than men [46]. A&A sessions had considerably less attendance than pre-pandemic sessions; however, the in-person sessions were better attended than the online sessions and although we did not conduct a comparative study to prove it, male faculty seem more engaged in in-person advocacy programs rather than online. Thus, despite the impact of the pandemic, participants indicate that the benefits of CIMC and A&A motivate their ongoing engagement.
- Online registration streamlines workload associated with monitoring and tracking attendance, and allows collection of basic demographic information from participants.

### Program Evaluation & Assessments:

- The collaborative approach to assessment instrument development are enabling opportunities for comparisons of impact across institutions.
- Response rates are increased by administering online surveys immediately at the end of presentations through links posted in chats or QR codes included in slides.
- Communication of the importance of assessment cannot be overemphasized to participants. We have found that participants find it compelling to know that the responses function both as a development tool to inform future offerings and as a way to document impact.

### **Conclusions**

The cross-institutional collaboration approach has strengthened the quality of the programs focused for women (WFC and URWM) in tenure-eligible faculty positions, for men advocates and allies, and for department chairs. The Partnership has enabled content to reach institutions even with inconsistent leadership. Assessments have allowed for improvements to the virtual interactions such that feedback on the content have illustrated positive gains in learning and advocacy.

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## References

- [1] J. Stepan-Norris and J. Kerrissey, "Enhancing gender equity in academia: lessons from the ADVANCE program," *Sociological Perspectives*, vol. 59, pp. 225-245, 2015.
- [2] National Science Foundation, *National Center for Science and Engineering Statistics, Survey of Doctorate Recipients*.  
<https://nces.nsf.gov/pubs/nsf19304/digest/occupation#academic-careers>, 2017.
- [3] A.G. Greenwald, E.L. Uhlmann, T.A. Poehlmann, and M/R/ Banaji, "Understanding and using the implicit association test: III. Meta-analysis of predictive validity," *Journal of Personality and Social Psychology*, vol. 97 (1), pp. 17-41, 2009.
- [4] J.T. Jost, L.A. Rudman, I.V. Blair, D.R. Carney, N. Dasgupta, J. Glaser, and C.D. Hardin, "The existence of implicit bias is beyond reasonable doubt: A refutation of ideological and methodological objections and an executive summary of ten studies that no manager should ignore," *Research in Organizational Behavior*, vol. 29, pp. 39-69, 2009.
- [5] C. Logel, G.M. Walton, S.J. Spencer, E.C. Iserman, W. von Hippel, and A. Bell, A., "Interacting with sexist men triggers social identity threat among female engineers." *Journal of Personality and Social Psychology*, vol. 96 , pp. 1089-1103, 2009.
- [6] M.C. Murphy, C.M. Steele, and J.J. Gross, "Signaling threat: How situational cues affect women in math, science and engineering settings," *Psychological Science*, vol. 18, 879–885, 2007.
- [7] V. Larivière, C. Ni, Y. Gingras, B. Cronin, and C.R. Sugimoto, "Bibliometrics: Global gender disparities in science," *Nature*, vol. 504 (7479), 2013. Available:  
<http://www.nature.com/news/bibliometrics-global-gender-disparities-in-science-1.14321>.  
[Accessed Jan 8, 2022]
- [8] D. Maliniak, R. Powers, and B.F. Walter, "The gender citation gap in international relations," *International Organization*, vol. 67 (4), pp. 889-922, 2013.
- [9] V. Valian, "Beyond gender schemas: Improving the advancement of women in academia," *Hypatia*, vol. 20(3), pp. 198-213, 2005.
- [10] Michigan Technological University, 2018. Assessment of Working, Living, and Learning.  
<https://www.mtu.edu/worklivelearn/>

[11] National Science Board, National Science Foundation, “The STEM Labor Force of Today: Scientists, Engineers and Skilled Technical Workers. *Science and Engineering Indicators 2022*.” NSB-2021-2. Alexandria, VA, 2021. Available <https://nces.nsf.gov/pubs/nsb20212>. [Accessed January 18, 2022].

[12] D. Nelson and C. Brammer, “A national analysis of minorities and women in science and engineering faculties at research universities,” Norman, OK: Diversity in Science Association and University of Oklahoma, 2010.  
[http://faculty-staff.ou.edu/N/Donna.J.Nelson-1/diversity/Faculty\\_Tables\\_FY07/07Report.pdf](http://faculty-staff.ou.edu/N/Donna.J.Nelson-1/diversity/Faculty_Tables_FY07/07Report.pdf) [Accessed January 3, 2017].

[13] C.S.V. Turner, S.L. Jr. Myers, and J.W. Creswell, “Exploring Underrepresentation,” *The Journal of Higher Education*, vol. 70:1, pp. 27-59, 1999.

[14] C.S.V. Turner, J.C. González, and J.L. Wood, “Faculty of color in academe: What 20 years of literature tells us,” *Journal of Diversity in Higher Education*, vol. 1(3), pp. 139–168, 2008.

[15] G. Gutiérrez y Muhs, Y. Flores Niemann, C.G. González, and A.P. Harris, (eds.). *Presumed incompetent, the intersections of race and class for women in academia*. Utah State University Press, Logan, UT, 2012, 588 pp.

[16] K. Ward and L. Wolf-Wendel, “Academic motherhood: Managing complex roles in research universities,” *The Review of Higher Education*, vol. 27, pp. 233-287, 2004.

[17] D.J. Dean and J.B. Koster, *Equitable solutions for retaining a robust workforce: Beyond best practices*. London: Academic Press, 2014.

[18] S.L. Laursen and A.E. Austin, “Strategic intervention brief #10: Support for dual-career couples,” in *StratEGIC toolkit: Strategies for effecting gender equity and institutional change*, S. L. Laursen & A. E. Austin, Ed. Boulder, CO, and East Lansing, MI  
<http://www.strategic toolkit.org/>, 2014.

[19] L. Schiebinger, A.D. Henderson, and S.K. Gilmartin, *Dual career academic couples: What universities need to know*, Stanford, CA: Michelle R. Clayman Institute for Gender Research, Stanford University, 2008.

[20] University of California, San Diego Academic Affairs, (n.d.). *Partner Opportunities Program*. San Diego, CA: UCSD. <https://academicaffairs.ucsd.edu/aps/partneropp>

[21] L. Wolf-Wendel, S.B. Twombly and S. Rice, S., *The two-body problem: Dual-career-couple hiring practices in higher education*, Johns Hopkins University Press, 2004.

- [22] J.E. Dobson and R.L. Dobson, "The sandwich generation: Dealing with aging parents," *Journal of Counseling and Development*, vol. 63, pp. 572-574, 1985.
- [23] S.B. Hamill, "Parent-adolescent communication in sandwich generation families," *Journal of Adolescent Research*, vol. 9, pp. 458-482, 1994.
- [24] J.H. Schiele, "Disparities between African-American women and men on social work faculty," *Affilia*, vol. 7, pp. 44-56, 1992.
- [25] M.D. Wilcox, "Welcome to Generation S," *Kiplinger's Personal Finance Magazine*, vol. 49, pp. 59-63, 1995.
- [26] J.A. Jacobs and S.E. Winslow, S.E., "Overworked faculty: Jobs, stresses, and family divides," *Annals of the American Academy of Political and Social Science*, vol. 596, pp. 104-129, 2004.
- [27] R. Azarnoff and A.E. Scharlach, "Eldercare: the Sandwich Generation's coming of age," *Workforce*, vol. 67, pp. 60, 1988.
- [28] E.A. Cech and M. Blair-Loy, "The changing career trajectories of new parents in STEM," *Proceedings of the National Academy of Sciences*, vol. 116 (10), pp. 4182-4187, 2019.
- [29] E.H. Ecklund and A.E. Lincoln, A., *Failing Families, Failing Science: Work-Family Conflict in Academic Science*. New York: NYU Press, 224 pp., 2016. Retrieved from <http://www.jstor.org/stable/j.ctt1803zmg>
- [30] E.H. Ecklund and A.E. Lincoln, "Scientists want more children," *PLoS ONE*, vol. 6, e22590, 2011.
- [31] M.A. Mason and M. Goulden, M., "Do babies matter? The effect of family formation on the lifelong careers of academic men and women," *Academe*, vol. 88(6), pp. 21-27, 2002.
- [32] M.A. Mason and M. Goulden, "Marriage and baby blues: Redefining gender equity and the academy," *Annals of the American Political and Social Sciences*, vol. 596, pp. 86-103, 2004.
- [33] M.A. Mason, A. Stacy, and M. Goulden, *University of California Work and Family Survey*. Berkeley: University of California, Berkeley, 2002-2003.
- [34] M. Goulden, K. Frasch, and M.A. Mason, 2009. *Staying Competitive*. Center for American Progress, 48 pp., 2009. [https://www.law.berkeley.edu/files/Women\\_Sciences\\_Final\\_Copy.pdf](https://www.law.berkeley.edu/files/Women_Sciences_Final_Copy.pdf) [Accessed January 3, 2022].

- [35] U.S. Census (2017). *American Community Survey Data*. <https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2017/> 2017. [Accessed April 5, 2021].
- [36] T.L. Singer, B.L. Yegidis, M.M. Robinson, A.P. Barbee, and J. Funk, “Faculty in the middle, The effects of family caregiving on organizational effectiveness,” *Journal of Social Work Education*, vol.17 (2), pp. 295-307, 2001.
- [37] Michigan Technological University Childcare Study, 2015.
- [38] L.R. Cruse, L. Richburg-Hayes, A. Hare, and S. Contreras-Mendez, “Evaluating the role of campus child care in student parent success,” Institute for Women’s Policy Research, IWPR #C506, 25 pp., 2021.  
[https://iwpr.org/wp-content/uploads/2021/10/Evaluating-the-Role-of-Campus-Child-Care\\_FINAL.pdf](https://iwpr.org/wp-content/uploads/2021/10/Evaluating-the-Role-of-Campus-Child-Care_FINAL.pdf) [Accessed January 16, 2022].
- [39] K.A. O’Meara, “Leveraging, Checking, and Structuring Faculty Discretion to Advance Full Participation,” *The Reviews in Higher Education*, vol. 44, pp. 555-585, 2021.
- [40] K. McClure and A. Hicklin Fryar, “The Great Faculty Disengagement,” *The Chronicle of Higher Education*, January 19, 2022.  
[https://www.chronicle.com/article/the-great-faculty-disengagement?utm\\_source=Iterable&utm\\_medium=email&utm\\_campaign=campaign\\_3566436\\_nl\\_Academe-Today\\_date\\_20220121&cid=at&source=&sourceid=](https://www.chronicle.com/article/the-great-faculty-disengagement?utm_source=Iterable&utm_medium=email&utm_campaign=campaign_3566436_nl_Academe-Today_date_20220121&cid=at&source=&sourceid=) [Accessed January 19, 2022].
- [41] A. Minerick, C. Cervato, S. Goltz, C. Bilen-Green, M. Rouleau, D. Wahl, and P. Sotirin, “Cross-Institutional Mentoring Communities Program,” Women in Engineering Division of American Society for Engineering Education Proceedings, 2022.
- [42] C. Bilen-Green, C., J. Carpenter, S. Doore, R. Green, K. Horton, K. Jellison, M. Latimer, M. Levine, and P. O’Neal, P., “Implementation of Advocates and Allies Programs to Support and Promote Gender Equity in Academia,” 2015 ASEE Annual Conference and Exposition, Seattle, Washington, June 2015.
- [43] A. Burnett, D. Wahl, L. Wingate and C. Wojick, “I Am: More Than a Checkbox,” *EvaluATE, ATE Evaluation Resource Hub*, December 1, 2021,  
<https://evalu-ate.org/blog/wingate-dec21/>.
- [44] G.R. Bauer, S.M. Churchill, M. Mahendran, C. Walwyn, D. Lizotte, and A.A. Villa-Rueda, “Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods,” *SSM - Population Health*, vol. 14, 100798, 2021.



[45] S. Kasymova, J.M.S. Place, D.L. Billings, and J.L. Aldape, “Impacts of the COVID-19 pandemic on the productivity of academics who mother,” *Gender, Work, & Organization*, vol. 28(S2), pp. 419-433, 2021.

[46] G. Fauville, M. Luo, A.C.M. Queiroz, J.N. Bailenson, and J. Hancock, “Nonverbal Mechanisms Predict Zoom Fatigue and Explain Why Women Experience Higher Levels than Men,” *SSRN*, April 5, 2021. <http://dx.doi.org/10.2139/ssrn.3820035>