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Panel Discussion on the History of the Women in Engineering Division: Reflections From Past Chairs of the Division

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Dr. Beena Sukumaran, Rowan University

Beena Sukumaran has been on the faculty at Rowan University since 1998 and is currently Professor and Chair of Civil and Environmental Engineering. Under her leadership, the Civil and Environmental Engineering Program has seen considerable growth in student and faculty numbers. Her area of expertise is in micro-geomechanics and has published over 100 peer reviewed conference and journal papers including several papers on engineering education and the unique undergraduate curriculum at Rowan University, especially the Engineering Clinics. She has been involved in various outreach activities to recruit more women and minorities into engineering and is Program Chair Elect of the Women in Engineering Division of ASEE. She is the recipient of the 2011 New Jersey Section of ASCE Educator of the Year award as well as the 2013 Distinguished Engineering Award from the New Jersey Alliance for Action.

Dr. Janet Callahan, Boise State University

Janet Callahan is Chair and Professor of the Micron School of Materials Science and Engineering at Boise State University. Dr. Callahan received her Ph.D. in Materials Science, M.S. in Metallurgy, and B.S. in Chemical Engineering from the University of Connecticut. Her research interests include leadership, mathematics and materials science teaching and learning, first-year programs, continuous improvement and faculty development.

Dr. Donna C. Llewellyn, Boise State University

Donna Crystal Llewellyn received her BA (major in Mathematics and minor in Economics) with High Honors from Swarthmore College in 1980. She went on to earn an MS in Operations Research from Stanford University in 1981 and a Ph.D. in Operations Research from Cornell University in 1984. After 30 years at Georgia Tech in a variety of roles, Donna became the Executive Director of the new Institute for STEM and Diversity Initiatives at Boise State University in January 2015. Donna's current interests center around education issues in general, and in particular on increasing access and success of those traditionally under-represented and/or under-served in STEM higher education.

Dr. Beth M Holloway, Purdue University, West Lafayette (College of Engineering)

Beth Holloway is the Assistant Dean for Diversity and Engagement and the Leah H. Jamieson Director of the Women in Engineering Program (WIEP) in the College of Engineering at Purdue University. She is the current past chair of the Women in Engineering Division of ASEE. Holloway received B.S. and M.S. degrees in Mechanical Engineering and a Ph.D. in Engineering Education, all from Purdue University.

Dr. Noel N. Schulz, Washington State University

Dr. Noel Schulz received her B.S. in Electrical Engineering and M.S. in Electrical Engineering degrees from Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Va. in 1988 and 1990, respectively. She received her Ph.D. in Electrical Engineering from the University of Minnesota in Minneapolis, Minnesota in 1995. Noel joined the Washington State University faculty in 2016 in the School of Electrical Engineering and Computer Science. She has a total of over twenty-three years of teaching experience including other schools such as Mississippi State University, Michigan Technological University, University of North Dakota, Virginia Tech and Kansas State University.

Noel is active in teaching, research and service. She enjoys teaching electrical engineering and power engineering topics to students. In research and graduate studies, she has been very active having graduated 40 MS and 13 PhD students; published 160 papers and 2 book chapters; and brought in over $40 M in external research through individual and collaborative projects including an U.S. National Science Foundation CAREER award. She is an ASEE and an IEEE Fellow.

She has been active in the IEEE Power & Energy Society serving on the PES Governing Board for 12 years and President for 2012-2013. Dr. Schulz is a member of Eta Kappa Nu (Electrical Engineering

Honorary Society), Tau Beta Pi (Engineering Honor Society), the American Society for Engineering Education (ASEE), the Society of Women Engineers and the National Society of Black Engineers.

Dr. Sarah A Rajala, Iowa State University

Sarah A. Rajala is professor and James L. and Katherine S. Melsa Dean of Engineering at Iowa State University. Previously, she served as professor, dean of engineering and department head at Mississippi State University, and associate dean and professor at North Carolina State University. She received her B.S. degree in electrical engineering from Michigan Technological University and MS and PhD degrees in electrical engineering from Rice University. Her research expertise is in the analysis and process of images and image sequences and on engineering educational assessment. Rajala is the Past President of ASEE, past Chair of the Engineering Accreditation Council of ABET, past Chair of the Global Engineering Deans Council (GEDC), and past Chair of the ASEE Public Policy Committee. She is a Fellow of AAAS, ABET, ASEE, and IEEE.

Dr. Donna Reese, Mississippi State University

Donna Reese served as head of the Computer Science and Engineering Department at Mississippi State University from 2010 until 2017. Prior to that she served for six years as associate dean in the Bagley College of Engineering. Her research interests are in recruitment and retention of underrepresented groups in computing and engineering fields.

Reflections from Past Chairs of the Women in Engineering Division

Abstract

In celebration of 125 years of the American Society of Engineering Education, past Chairs of the Women in Engineering Division (WIED), Beth Holloway, Donna Llewellyn, Sarah Rajala, and Noel Schulz convened in a focused panel that looked back through the division's history. To help archive the historical perspective of these leaders, this paper was developed to help the former Chairs focus their perspectives with guiding questions. One additional chair, who could not attend the conference, Donna Reese participated in this paper. The guiding questions for chairs concerned: the influence of their leadership of the WIED on their career, their perspective on the climate for women, the main issues the division faced when they were chair, and what research questions people should be asking now.

Introduction

On the occasion of the 125th anniversary of the American Society for Engineering Education, a panel of past chairs of the Women in Engineering Division (WIED) were assembled to discuss key questions they faced as Chairs of WIED during their two years of leadership. The chairs were leaders of the division across twenty years, selected in approximately five-year increments. Dr. Donna Llewellyn was Chair of WIED from 1996 to 1998, Dr. Sarah Rajala was Chair from 2002 to 2004, Dr. Noel Schulz was Chair from 2006 to 2008, Dr. Donna Reese was Chair from 2010 to 2012, and most recently, Beth Holloway, was Chair from 2014 to 2016, see Table 1. A total of five past chairs were invited; one could not attend due to a conflict (Dr. Reese); four were able to attend the panel in person. All provided written perspectives.

Table 1: Past Chair, Chair, Chair Elect/Program Chair and Program Chair Elect for the Women in Engineering Division, 1998-2018

Year	Past Chair	Chair	Chair Elect & Program Chair	Program Chair Elect
1998-2000	**Llewellyn**	Cooney	Larkin	Rajala
2000-2002	Cooney	Larkin	Rajala	Piket-May
2002-2004	Larkin	**Rajala**	Richardson	Schulz
2004-2006	Rajala	Anderson-Rowland	Schulz	Watford
2006-2008	Anderson-Rowland	**Schulz**	Watford	Wasburn
2008-2010	Schulz	Watford	Wasburn	Reese
2010-2011	Watford	**Reese**	Reese	Constant
2011-2012	Watford	**Reese**	Constant	Holloway
2012-2014	Reese	Constant	Holloway	Sukumaran
2014-2016	Constant	**Holloway**	Sukumaran	Eksioglu
2016-2018	Holloway	Sukumaran	Eksioglu	Callahan

Background

The past twenty years has shown a significant transition relative to women in engineering academia and also relative to women in academic engineering leadership positions. For example, in 1997, women made up 6.5% of faculty in engineering (National Science Foundation, 1999). In 2015, there were 4143 female faculty, representing 15.7% of the engineering faculty (Yoder, 2015). Relative to leaders in engineering academia, in 2010, there were 38 female engineering

deans in the United States (Layne, 2011). By 2017, this had grown to 57 female deans representing 15% of all engineering deans in the United States (Layne, 2017). Clearly, much progress has been made in the past two decades relative to diversifying the faculty and the leadership in engineering education. This paper focuses on issues that the Women in Engineering Division concentrated on across this time frame.

The Women in Engineering Division (WIED) made a significant transition in the 1990s, as described by Dr. Llewellyn (see her response to Question #3). During that decade, the division, which had historically been a division for staff who had oversight for women in engineering programs, made a transition to include the professoriate. The aim was to create a community where women could focus on issues faced by women faculty. According to Dr. Llewellyn, following a WEPAN meeting, several women made a group decision to attend the ASEE and assume the leadership of WIED. Thus, in 1992, Dr. Llewellyn was elected to the lowest rung of the leadership ladder – newsletter editor. It was then a natural progression up to Chair and into Past Chair. All new officer positions in 1992 went to faculty and led to a new focus on the issues related to faculty life.

As seen in Table 1, there is a progression in leadership from Program Chair-Elect, to Chair Elect/Program Chair, to Chair and then to Past Chair. This helps ensure continuity in leadership. Two exceptions to this occurred, one in 2004-2006 when Dr. Anderson-Rowland became chair instead of Dr. Richardson. A second instance occurred in 2010, as a result of the passing of Dr. Wasburn, described further below. The leadership team of the division includes other roles, including Treasurer, Secretary, Director of Positions, Webmaster, Listserv Manager, and Directors at Large. The division leaders typically began in one of these roles before being elected as program chair elect. In total, across these two decades, a total of 58 individuals served WIED on the leadership team.

The division has had a longstanding tradition of supporting women embarking on their careers. An example of this is seen in the life of Mara H. Wasburn (1941-2011). Dr. Wasburn was a strong leader on behalf of women, and a professor in the Department of Organizational Leadership and Supervision at Purdue University. On track to become Chair of the division as Chair-Elect in 2008-2010, she passed away in 2011. In 2011, the Apprentice Educator Grant program, which provided a $2,000 travel grant to the conference, was renamed the Mara H. Wasburn Early Educator Grant (EEEG) in honor of Dr. Wasburn, whose passion for encouraging young female engineering educators was renowned. Dr. Wasburn's mentoring model, Strategic Collaboration, was copyrighted and has been applied internationally to both business and academic environments.

Procedure

The division has a history of division Chairs serving for two years, and for the two preceding years, serving as Program Chair, see Table 1. Thus, typical Chair experiences reflect four or more years of leadership and active participation in the division. With five chairs selected across 20 years, the aim was for historical perspective.

For brevity, the panelists are referred to as R1, R2, R3, R4 and R5, corresponding to Llewellyn, Rajala, Schulz, Reese and Holloway.

In preparation for the panel, four questions were posed in writing via email to the four panelists, who responded individually. This article contains these collected reflections. The four questions asked were:

> 1. In looking back, how has your participation and leadership in ASEE and particularly in the Women in Engineering Division influenced your career? Have you noticed any changes in the focus of ASEE or WIED over the years; if so, what have they been?
>
> 2. What is your perspective on how the climate for women in engineering may have changed over the years?
>
> 3. What were the main issues that the division faced during your Chairship of WIED? Also, what do you think that the Women in Engineering Division should be focusing on over the next decade?
>
> 4. What are some of the research questions we should be asking to better understand what really works in the recruitment and retention of women students, women faculty and in the development of academic women leaders?

Results

1. In looking back, how has your participation (and leadership) in ASEE and particularly in the Women in Engineering Division influenced your career? Have you noticed any changes in the focus of ASEE or WIED over the years; if so, what have they been?

R1 (1996-1998): My participation in ASEE opened the door to many connections, collaborations, and friendships. I am still in touch with people whom I first met through ASEE decades ago. I first joined ASEE at a time when engineering education was not a valued area for scholarship or even extended attention at my home institution. I immediately felt like I had "found my people." In WIED, this was even more pronounced. I was only the 5th woman hired into engineering at my home institution and so finding a community was critical to my not feeling isolated. Hearing that others faced the same issues and were willing to work on them together gave me a sense of hope.

My leadership gave me a chance to serve this organization that had given me a sense of belonging. It was a form of service that felt genuine, needed, and valued – and I think it made a difference. It also set the tone for my career path – I moved pretty much out of technical research and into the world of STEM education and dove into the issue of equity and inclusion – and have stayed there.

R2 (2002-2004): The Women in Engineering Division provided a venue for women to come together to share ideas, address concerns, and most importantly to get to know one another. WIED also provided me an opportunity to further develop my leadership skills. Although I had been active for many years in my technical societies, I was not active in ASEE until midcareer, when I assumed the role of Associate Dean for Academic Affairs at NC State. ASEE and WIED allowed me to connect with individuals whose passion and focus were on engineering education. It

provided me the opportunity to learn about best practices, issues and trends, and build a network of colleagues focused on improving engineering education for everyone. This was important to my success as associate dean and had a critical impact on my future research focus.

WIED provided an opportunity for me to take on leadership roles, eventually serving as Chair. This led to an opportunity to serve as PIC IV chair and service on the ASEE Board of Directors. Eventually, I had the opportunity to serve as President of ASEE. Each of these leadership roles provided me the opportunity to serve ASEE, find opportunities to improve the services provided to our membership and influence the future direction of ASEE.

One of the biggest changes has been the increased focus on diversity and inclusion. Although the importance of diversity was acknowledged, it is time to establish a meaningful dialogue about what it takes to create an inclusive environment. Another important change is the leadership role ASEE is taking in engineering education. This includes an increased focus on the scholarship of engineering education and improving teaching and learning through NETI.

R3 (2006-2008) My participation in WIED activities and leadership as well at ASEE were very important for two particular areas – networking and confidence.

For Networking: As an early career faculty member, it was awesome to network with other senior women who had been successful and have a chance to hear their stories and talk with them. They were often a resource not only at the conference but during the year with questions or suggestions. Because of my ASEE connections, I was able to have Karan Watson visit Michigan Tech early in my career. We didn't have many senior women in engineering; so having her visit and her suggestions and perspectives were very helpful to individual faculty such as me as well as other engineering leaders. I also reconnected with Sue Kemnitzer who recently retired from NSF at ASEE and she was a strong advocate for women in engineering and participated in several networking events I had for women in IEEE over the years. It has also been a great place for me to introduce other early career faculty and several of them have eventually been in WIED leadership.

Regarding confidence: For ASEE in general and also from the WIED and New Engineering Educators Divisions, I gained confidence in being able to submit and present papers, review papers, serve as a session moderator, program chair and in leadership as chair of the division as well as a member of the ASEE BOD representing WIE and other divisions. This confidence helped me in my technical society, IEEE. I had the confidence to step forward where there were few or no women and do activities. It gave me the strength and confidence to step up and run for IEEE Power & Energy Society (PES) Secretary in 2003 and other offices within PES. I was on the PES Governing Board from 2004-2015 serving as PES President 2012-13, only the second woman to be in that role ever.

R4 (2010-2012): When I joined ASEE, and WIED, I was serving in the role of Associate Dean and had several diversity programs (for students and faculty) under my responsibility. This was my first administrative position and at that time I had mainly been working in a faculty role and worrying about my own tenure and promotion. WIED provided a great place for me to get up to

speed pretty quickly on the issues facing women faculty in engineering and to learn from some great role models and leaders in this area. I followed folks like Bev Watford and Noel Schulz who had been dealing with these issues for much longer than I had and this really helped me in planning and implementing programs to help the women faculty at my own institution.

R5 (2014-2016): My initial participation in the Women in Engineering Division was at the invitation of a past chair. I worked on a small committee that created the initial structure of the Mara H Wasburn Early Engineering Educator travel grant award. From there, I was asked to be the division representative to ASEE's new Diversity Committee and then I was encouraged to take a role on the Board. At each step, someone from the division reached out to me and pulled me in. That form of mentorship and sponsorship within the division led to opportunities for additional involvement in ASEE at large. All of these roles have allowed me to meet new colleagues, who have influenced my thinking, and given me new experiences to leverage in my career. I see ASEE and the Women in Engineering Division as a place for me to continue to learn and grow, to meet new and interesting colleagues, and to stay connected with people and ideas. As a society, ASEE has been a major influence in my career development.

2. What is your perspective on how the climate for women in engineering may have changed over the years?

R1 (1996-1998): Climate is hard to comment on in such a general way – it is so dependent on your local context. Overall, it has improved – you walk around engineering conferences and you are no longer the only woman in a session, there are lines in the women's room, and there are female plenary speakers. Locally, for many the climate is now much warmer – many places have policies and procedures that make being a woman engineering professor more livable (tenure extension, maternity, etc.). However, there are still issues of harassment (just read the news on any given day…), places that don't have family friendly policies, and lots of implicit bias in hiring and other practices.

R2 (2002-2004): Much has changed since I started as a faculty member in 1979. I was the first and only female tenure-track faculty member at NC State when I started. There were very few women students and only a couple of other women in non-tenure track teaching positions. There were no maternity or family leave policies. Although there were women faculty members in disciplines outside of engineering, we were still few in number at the land-grant institutions. Women were certainly a novelty in the engineering profession. Campuses across the U.S. were struggling with developing strategies to increase the participation of women in engineering, addressing ways to make the work environment more family friendly, and providing women professional development opportunities. The good news is that these efforts have created environments that are more inclusive for everyone, enhanced professional development opportunities for all young faculty, and created more family friendly environments for all faculty.

There is still much work to be done, but we have achieved much along the way. WIED continues to provide a venue to discuss issues of common concern, share ideas, and providd a venue for publishing best practices.

R3 (2006-2008): We have many more women in senior administrative and faculty positions than we had when I started over 25 years ago attending ASEE. I remember when Denice Denton became the first woman or person of color to be engineering dean at an AAU university. We now have more women deans, university presidents, provosts, vice presidents for research, endowed positions and center directors. I think these examples are very important for women early in their careers to see these women role models.

I think we have made some progress on the integration of family and work for women in engineering. I remember Sarah Rajala talking about her department head calling each of her daughters her "heart-attack" as it was easier to frame pregnancies as heart attacks for leave purposes early in her career. We have made some progress with parental leave policies and tenure clock stoppage to help in these areas. I do think we continue to struggle as women trying to figure out the best time to start their families if they want children. I have known several women who waited until after tenure and then had medical issues because of their age. I think some of these balance issue improvements also help our male colleagues who have professional spouses/partners and are trying to integrate family and work.

I do think we continue to struggle with overloading women faculty with service and outreach activities more than their male counterparts. This often hurts their evaluations related to advancement

R4 (2010-2012): I think that the climate overall has improved over the years. However, I am constantly amazed at how the attitudes of a few faculty in a single department can set progress back just when you thought progress had been made! It takes constant vigilance to make sure that progress doesn't get undone because of the attitudes of a few. Overall, I am seeing more equal sharing of family responsibilities, more recognition of the importance of work/life balance which I think is so important to the success of all faculty, particularly women.

R5 (2014-2016): I think the climate for women in engineering continues to slowly improve. Given that the culture of an organization/profession are the shared values/belief systems/behaviors, and that the climate is the way we experience the culture, this tells me that culture is slowly evolving to be more inclusive of women in engineering. I see more of a national emphasis on pre-college STEM education, more initiatives that are directed towards diverse and underserved populations both in academia and industry, and more awareness of the importance of STEM education. With the recent preponderance of stories of sexual harassment in the workplace, I think that will also affect workplace climate for women in engineering – though it's not clear to me how that will play out.

3. What were the main issues that the division faced during your Chairship of WIED? Also, what do you think that WIED should be focusing on over the next decade?

R1 (1996-1998): When I joined WIED, it was part of an academic "coup." I had gone to WEPAN for the first time the previous year and learned about WIED. However, it had historically been a division for staff who ran women in engineering programs (nothing against those programs or those staff!). The women faculty who met at WEPAN decried the lack of a community for us – where we could discuss the issues that were pressing on our professional lives (tenure policies, the

lack of maternity leave, issues of biased course evaluations, lack of colleagues who understood our lives, etc.). We made a group decision to go to ASEE and try to get elected into positions of leadership in WIED. That was 1992 and I got elected to the lowest rung of the leadership ladder – newsletter editor. At that time, it was then a natural progression (for 6 years!) up to and including the Chair position (not counting two more years as Past Chair…). All new officer positions that year went to faculty and for some time, our sessions really concentrated on the issues related to faculty life.

At some point, outreach programs again became pretty much the norm. This led to the Pre-College Division being founded to serve those needs more thoroughly.

Perhaps I am old-fashioned…well, definitely old… and think that WIED should focus on the issues related to women in engineering – concentrating on our current students (undergrad and graduate) and faculty.

R2 (2002-2004): At the time I served as chair, WIED was a relatively young division and still struggling with growing its membership. Our focus was primarily on developing strategies to grow the membership, identifying topics of interest and relevance for conference sessions, encouraging ASEE members to conduct research related to women in engineering and sharing results and best practices. We were focused on ensuring women in engineering education had a voice.

Going forward, it is important to encourage women faculty interested in pursuing research in engineering education by providing venues for publishing their research in high-impact scholarly venues. WIED should also continue to provide a voice for women engineering faculty and graduate students, and find new ways to recognize the contributions of women faculty and graduate students.

R3 (2006-2008): Two of the challenges when I was Chair were communications and making progress between our annual physical meetings. We were working to advance our listserve and website to help promote WIED but also figure out the best way to disseminate information to division members. We also worked to get more involvement of non-tenure track and graduate students in the division.

The second item related to making progress between annual meetings. I set up regular conference calls with WIED leaders so we could work on items between our meetings besides just the annual program paper reviews and program. This helped with updating bylaws and other projects between the annual meeting.

In the next 10 years I believe the WIED division should work on three items – equality of opportunity, successful work/life integration, and promotion of women locally.

There is a lot of buzz about equal pay for women right now and I agree with this but we also need equal opportunities. Differential startups and service/outreach activities can be detrimental to the success and advancement of women faculty. We need to help women members develop strategies

related to these issues as well as reach out to department heads and deans to discuss benchmarking opportunities to make sure women faculty have a level playing field.

The second item relates to quality of life for women engineering faculty. My mom tried to be a supermom as an elementary teacher and it really wore her out. I am very concerned with burn out for our women faculty as they try to do it all. I have learned a lot recently from reading "Lean In" (Sandberg, 2013) and "Thrive" (Huffington, 2015) and discussing some of the challenges and opportunities. I especially like "Thrive" and its discussions on health, sleep, exercise, meditation and reflection. As I grow older and it is harder to be productive on less sleep and as my children grew older and now have left, I am finding it even more important to take care of myself and my family relationships. We need to discuss strategies and let faculty know that they don't have to choose but can find the integration that works for them.

The third item relates to encouraging women to recognize other women on their campuses and within their technical societies. The University of Wisconsin "Implicit Bias" survey showed that women promoting themselves is a negative but women promoting each other is a positive. If we can develop more promotion partners with our women colleagues we can help advance women through awards, Fellow and NAE nominations, nominations for leadership positions and more.

R4 (2010-2012): One thing that WIED was struggling with during the time that I was chair was what its main focus should be and now to differentiate itself from other organizations promoting women in engineering. We wanted to make sure that WIED was making a contribution and not overlapping with other organizations. We talked a lot about WEPAN and SWE in particular. In the end we solidified the position that WIED should focus on women *faculty* and provided programs that helped to support the recruitment and retention of women faculty. WEPAN supports some faculty but primarily in the role of leaders of Women in Engineering programs and SWE does more to support and promote women students. I think this allowed WIED to focus on providing opportunities for research that addressed issues that were important to faculty throughout their academic careers.

R5 (2014-2016): When I was chair of the Division, I thought a lot about how to address member involvement in the division, beyond the Board of Directors. What opportunities are there for involvement; how do we identify future leaders of the division, how do we indicate that we are an inclusive community when the work of our Division is really only seen at the annual conference? I'm not sure that we found optimized solutions, and those are still some questions that I think about as the immediate past chair. As a Board, we also tried to ensure women faculty had a venue to discuss issues and create community. We tried to have a panel each year at the annual conference that presented an issue and panelists who had some experience with that topic that they were willing to share.

In the next decade, I see a need for WIED to focus on how to use the progress made to date with regard to women in engineering, and leverage that to accelerate progress. While it will continue to be important for women to have a group in which they can share their experiences and mentor each other, it is increasingly clear to me that the culture of engineering won't become truly inclusive unless we involve men in the change we'd like to see. We may need to employ different

strategies than our current modes of operation to do this, and it will likely be something that WIED needs to do in partnership with others.

I also see a need for WIED to be more connected to divisions/organizations that focus on other underrepresented groups. The first CoNECD (Collaborative Network for Engineering and Computing Diversity) conference, held in April-May, 2018, is a great next step in our engagement with others.

4. What are some of the research questions we should be asking to better understand what really works in the recruitment and retention of women students, women faculty and in the development of academic women leaders?

R1 (1996-1998): I would be interested in hearing more about what people do without external funding – we hear a lot of talks from folks who have grants (they need to disseminate their results as part of the grants, so I get that) – but what are folks doing who just work quietly behind the scenes on their campuses?

- What lessons can those of us with limited funding and personnel resources do to improve the situations on our campuses?

R2 (2002-2004):

- What factors influence the creation of an inclusive environment in an academic department, college of engineering, or university? What evidence is there of the impact of best practices?
- How important is good mentoring on the success of young faculty, especially those from underrepresented groups?
- What is the impact of increased diversity among student and faculty populations on the success of women or other underrepresented populations?

R3 (2006-2008):

- I think there should be metrics around resources and service/outreach activities. Besides salaries, how are women faculty doing with start-up, lab space, getting the best graduate students, partnering with senior faculty on grants, etc? Also what "invisible" workload are women burdened with in the areas of service and outreach and how is it recognized compared to other responsibilities?
- What are best practices related to imposter syndrome that can help women and under-represented minority faculty?
- How do we move away from the traditional "ladder" to a successful advancement model (like jungle gym in "Lean In") where women can do various academic positions and still be appreciated for their contributions and activities without being judged as less ambitious or successful?
- How do we continue to take the lessons learned from NSF ADVANCE programs and other research to make sure we are reviewing faculty candidates, award nominees, administrative candidates and tenure/promotion cases without unconscious bias and understand our own unconscious biases and how to counteract them.

R4 (2010-2012):

- We will need to see much more research on the issues that women of color in particular face as they progress in their careers. This needs to be understood if we are going to continue to make progress as the population of the United States becomes majority minority in the coming years.

R5 (2014-2016):

- I think we need to be asking questions around effective methods for mitigating unconscious bias and identifying effective training/awareness of how unconscious bias works (and that it's real).
- I think some research programs that study how organizations can become more inclusive would be very helpful, so that there's a roadmap to follow. We have lots of best practices to share around inclusivity, but have we really studied how those best practices can influence a culture change? What pieces really must be in place and which are just helpful, perhaps to accelerate the timeline? Are there any necessary and sufficient conditions?

Discussion

There is scant literature to be found to put these reflections into further perspective; this article may be the first example of a society with a women-focused division, reflecting in a historical fashion on key questions their division faced, and what they should be looking toward examining in the future. In 2011, Beddoes and Borrego reviewed the literature (88 different articles that had women or gender as a central part of their studies between 1995 and 2008) on engineering education research with the aim of examining the use of feminist theory in these works. While their examination did not include ASEE conference proceeding articles, their conclusions also provide insight into where we might focus our efforts as a division.

Because women remain underrepresented despite decades of effort, the authors suggest that feminist theory may provide insight on how some well-intentioned efforts might actually reinforce the very conditions they seek to change. Their analysis shows that feminist theory is not widely engaged or systematically developed in the scholarship. Their work identifies several ways in which deeper engagement with a wider range of feminist theories can benefit engineering education scholarship. The authors state, "the time has come to thoroughly examine and deconstruct how cultures of engineering education both reinforce masculine biases and (re)produce gendered identities" (Beddoes and Borrego, 2011, p. 297). Among other ideas, they pose the following question: How can we leverage the branches of feminist theory (liberal, standpoint, intersectional, interactional, Masculinity studies) to examine and deconstruct how cultures of engineering education both reinforce masculine biases and (re)produce gendered identities?

Panel Summary and Recommendations

Following the collection of thoughts from the panelists, panelists were asked to review the paper, and to select one to two research questions they felt were the highest priority to investigate.

In summary, former WIED chairs proposed that future scholarship examine these questions:

- How can we effectively mitigate unconscious bias to influence culture change (ensuring that we are reviewing faculty candidates, award nominees, administrative candidates and tenure/promotion cases without implicit bias)?
- What strategies can universities and colleges with limited funding and personnel resources implement to effectively improve the situations on our campuses?
- What factors influence the creation of an inclusive environment in an academic department, college of engineering, or university? What evidence is there of the impact of best practices?
- How important is good mentoring on the success of young faculty, especially those from underrepresented groups?
- What is the impact of increased diversity among student and faculty populations on the success of women or other underrepresented populations?

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