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Women Engineering Faculty: Expanding The Pipeline

Nadene Deiterman Greni

The purpose for this case study was to explore the features of undergraduate engineering departmental and college support that influenced the persistence of women students. Women engineering faculty members were among the participants at three Land Grant universities in the Midwest. The data revealed the theme, Expanding the Pipeline, and demonstrated how women engineering faculty perceived their role in helping to encourage women students to persist in engineering majors.

In 1997 women made up nearly half of the U.S. labor force, but only slightly more than one-fifth of the science and engineering labor force. Of those scientists and engineers, women were most present as social scientists (more than half) and as physical scientists (22%). Women engineers constituted 9% of the engineering workforce in 1997 (National Science Board, 1998). Approximately 2% of bachelor's degree-level graduates of engineering disciplines in the U.S. in 1975 were women. The number of women completing undergraduate engineering degrees rose to more than 10% by 1981, but by 1998 still less than 20% of undergraduate engineering degrees were obtained by women (National Science Board, 2002).

A 35 year study of trends of incoming freshman to higher education by Astin, Oseguera, Sax, and Korn (2002) found that career interests of men and women in traditionally male fields such as medicine, law, business, and engineering had converged. A modest increase in women's interest and a decline in men's interest were attributed to the case of engineering. A gender gap of 10.7% in student aspirations for engineering was the largest of any of the sex-stereotypical careers, with smaller gaps in elementary education, allied health, business, and nursing.

The rationale for a qualitative study was to explore the types of undergraduate engineering departmental support that influenced the persistence of women students. The perceptions of women undergraduate engineering students, women engineering faculty, and engineering department chairs were examined. Six female engineering faculty members

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Nadene Deiterman Greni received a bachelor's degree in industrial arts/technology from Black Hills State in 1987. She worked for and with a number of engineers, architects and technicians at a consulting engineering firm, a university physical plant, and a telephone utility.

Greni completed the civil engineering prerequisite courses in 1995 at South Dakota State University. She taught several sections of engineering graphics and construction management classes while working on the master's degree in industrial management at South Dakota State University in 1996 and 1997 and earned a M.S. degree in 1997. Greni taught from 1998 to 2002 in an associate's degree program in computer-aided drafting at Western Dakota Technical Institute. She served as a mentor to a group of women students from all of the gender non-traditional areas of Western Dakota Technical Institute. She interned with the multicultural affairs office at South Dakota School of Mines and Technology and studied the lack of retention of women undergraduate engineering students from 2002 to 2003. Greni taught construction management for two years at the University of Nebraska at Kearney while she completed her Ph.D. in Education-Administration, Curriculum and Instruction. Currently she is Girl Program/Special Projects Coordinator with Girls Scouts of the Black Hills Council. ngreni@girlscouts-blackhills.org

holding doctoral degrees in an engineering discipline were among the participants at three universities located in the Midwest established as Land Grant universities under the Morrill Act of 1862 (University A, 2003a; University B, n.d.; University C, n.d.). Each was classified as a Doctoral/Research University—Extensive by the Carnegie Foundation. University A enrolled nearly 3,000 undergraduate engineering students with an average of 13% female enrollment. Female participation in engineering disciplines ranged from nearly 34% in industrial engineering to 7% in mechanical engineering. Approximately 2,500 students were undergraduate engineering students at University B, which had an average female participation of 15%. Women student participation ranged from 43% of biological systems students to below 3% of agricultural engineering students. Engineering at University C consisted of 5,000 students, 16% women. Female engineering student participation ranged from nearly 39% in chemical engineering to below 7% in electrical engineering.

Interviews were conducted at the main campus of each university during the spring semester of 2004. The faculty members represented a variety of

engineering disciplines including agricultural engineering, chemical engineering, industrial engineering, materials engineering, and mechanical engineering. Two of the faculty had recently begun serving in administrative positions and another had worked for a time as an administrator.

The following descriptions include the use of pseudonyms for each participant. Dr. Andrea Allen seemed aware of her role model image and familiar with literature regarding increasing the numbers of women engineering students. She was fairly new to her department and appeared very open and energetic. Dr. Amy Arnold also gave the impression that she was cognizant of her role as a mentor to women students. Dr. Beth Brown explained her thoughts and experiences as a woman engineering faculty member very openly and related several accounts of her engineer father. Dr. Brenda Bailey stated that she did not have much to offer for some questions, but relayed information about role modeling the active learning approaches used in her classes. Dr. Cara Carlson described her enjoyment with the growth of the numbers of women students in her classes and had recently been appointed chair of her engineering department. Dr. Catherine Carter stated her concern that the drive for more women in engineering resulted in oppression rather than encouragement.

Four themes emerged from the study, and faculty responses contributed to the development of those themes. The loss of women in engineering has been referred to in the current literature as a leak in the engineering pipeline, so the pipeline theme carried on this practice. The In the Pipeline theme emerged from information that was noted about the individual student that helped to create an encouraging or neutral environment. The Navigating the Pipeline theme developed from two sub-themes dealing with the individual student that was detrimental to an individual's progress in an engineering major. The Pipeline Tools theme discussed how students find classroom work, how faculty present learning material, and how classroom learning relates to the engineering workplace. The Expanding the Pipeline theme explained how engineering college personnel see their role in helping to encourage women students in engineering majors.

The Expanding the Pipeline theme emerged from sub-themes described as Beyond Classroom Learning, Building Community, Faculty Experience, No Special Treatment, Number of Women, and Role Modeling. Beyond Classroom Learning included plant trips, research, and methods employed to help students see where their professional engineering degree could lead. The Building Community sub-theme described the methods employed to make women students feel welcome in the major. Women faculty members related some of the events they recalled in their own backgrounds in Faculty Experience. No Special Treatment and Number of Women depicted the

observations made by participants with regard to women undergraduate engineering students. In the sub-theme of Role Modeling faculty participants described their perceptions of being role models for men and women students.

Faculty research, organizations of women in engineering, and discipline-specific professional organizations all helped students see their lives as engineers in Beyond Classroom Learning. Dr. Allen said, "It's been fun to try to find young women to work with, just to give them that opportunity to see what research is. How they can move that forward." She added, "It kinda gets back to that, not everyone likes to take things apart so if you have women in your class who don't like to take things apart." And she continued, "[You can s]how . . . how you are applying the engineering that you like to do." Dr. Arnold said,

[T]here are a number of industrial sponsors that provide financial resources and some guidance to try to help us to picture the successful women and underrepresented minorities. And I think some of those programs are fairly well designed. The challenge at this institution as I have seen it is getting those programs to migrate into the student body as a whole. The number of students that participate in those programs is relatively small. That means their impact is not so great. . . . Some of the women would consider these programs unnecessary and they don't want to be associated with them because they think they suggest that they need special help and so there's a bit of a problem to get the students to take advantage of them, some of them just don't want to. . . . [T]hey help the students that are involved with them. Students who choose to avail themselves of those programs, they get training, get to interact with people, get exposure to industrial sponsors that the rest of the students don't get. And that certainly is going to be helpful.

She continued,

[We] actually had a change in our curriculum, made it more effective for students to take the undergraduate research course and added [it] as a required component of the curriculum and so we've actually had a big increase in the number of students that are participating in undergraduate research. Some of those are women and I think those types of things can help them persevere as undergraduates because if they see that this means something. It might impact somebody in the world at some point [so] then they get much more excited and much more likely to do it. I've seen studies and I believe that women are much more concerned with societal impact of what they are doing than the men. And that certainly seems to be the case for the ones that I know. And so showing them that there is impact to what they are doing I think is really important. So we are actually pushing the undergraduate research option. I think it is going to be important for them

and I think it will open some of their eyes to the concepts that they can go to graduate school. They don't have to stop and get a job.

Dr. Brown said,

I think the bigger issue probably we have more female students involved in coops [cooperative learning] and so on. I think in general we're very sensitive to students that are in coops, making sure that they have the courses they need when they come back, that would disproportionately affect them, the female students. They are in high demand in the coops. Proportionately more of our female students are active in coops, working in the field during the summers.

Dr. Carson said,

I think it is working with these [student] organizations because that is where they find other students taking the same classes and also get exposure to industry. I think we have research experiences for undergraduates, which is where faculty have undergraduates working in their labs. That's great experience, the program for women in science and engineering has a summer program where they support students in faculty labs and all of those, I believe, are ways that students can get connected. That's really what it's all about.

Dr. Carter described a woman student she encouraged in an internship, "[S]he was talented and I knew she was, but I got a call from [an engineering firm] to say they wanted a [student intern]." She continued

[They said] pick one because they like to have them back several semesters and . . . [the student said] "I can't, I can't, I don't know anything," [I said] "[T]rust me this time." She finally gave in and did go and have a wonderful experience. They hired her back and she ended up . . . [a] very capable engineer. . . . [I]t's always fun, too, when I can help a woman recognize her own talents.

Classroom activities also helped students see their lives as practicing engineers. Dr. Allen said,

So getting the women to understand that there are a lot more applications and many applications, even if they aren't thinking engineering, if they are thinking science, that engineering still has a home for them. The biomedical type areas, where a lot of women tend to go. Engineering can still provide a good foundation for them and give them a career in engineering as opposed to just going into science, I think that is something that is probably not focused enough on young women.

Dr. Arnold remarked,

[T]he freshman engineering class is partly driven by what we thought was the need to show societal impact of the work we were doing very early so they can say I am not taking an engineering class this year but next year I am going to get to and then I am going to have an opportunity to do this really cool stuff. I think it works.

Dr. Allen relayed, “[T]he departments are trying to get the kids in and show them applications in the freshmen year, even though they don’t have the math skills or chemistry skills to pull off a design.” She added, “[A]t least they can see what kind of design they would potentially be looking at. Hopefully that will help.”

Academic engineering departments worked to build community and faculty discussed methods of Building Community used by themselves and their departments. They cited friendliness, a comfortable atmosphere, and attempts to get students working together as ways to build community. Dr. Allen described a national competition that took place,

. . . in the summer at our national meeting so it varies where they’ll go. There have been women on that team. I don’t think, [we] never had huge numbers except in the . . . competition where we have more women. I don’t think that the women feel they can’t play any of these games that our department does. . . . I would say that they would feel pretty welcome in this department.

Dr. Arnold discussed student organization activities designed to get students involved in the department.

I think they are all good, I think anything that gets them involved is good, I think it is actually quite good that the students are the initiators of the activities, because they have a much better understanding of what’s gonna be interesting than we do. Because they are willing to put the energy together to try to get it to happen, it means that at least there is going to be a group that shows up for sure which will act as the nucleus around which the rest of them will gravitate. So I am actually quite happy with the level of activities that the undergraduate student body is involved in right now. In some sense you have to balance, if you have too much social activity, then it starts to put a drain on all the other things that they are doing. So, the level they are at now is sufficient to provide a sense of community, a sense of individuals that care about me as a person and want to see me succeed and a sense of excitement that some things are happening here. I am hopeful that we will be able to maintain it.

Dr. Bailey said,

We have what we call FAC. Fridays After Class. In . . . E and that is sponsored by . . . [student professional organization]. So again that is an opportunity for them to get involved with things outside of class. They do plan trips to places, we have a picnic at the end of the year. We have a welcome back to school picnic. I think those are some of the social activities that I see them participating in. . . . I don't know that we have done anything in a while, I mean I don't think we have done anything real proactive in helping women students persist. I think, well, Dr. D. participates in, and I go from time to time to the women['s] . . . engineering day. . . . [H]e is committed to that. And he shows up at the event where a lot of departments don't show up. Also sends the message that . . . E is the place that [is] women-friendly.

Women faculty reported a broad range of experiences in engineering. Faculty related experiences that they had experienced as women engineering students and women engineering faculty that guided their understanding of women undergraduate engineering students. Examples of Faculty Experience were described by each faculty member. Dr. Allen described women friends she had as an undergraduate student,

[T]ypically in engineering it doesn't really matter what that woman is like, you tend to make friends because there aren't any other women. You just kind of hung together. There was no way I would have been friends with most of the women I graduated with if we'd have had much of a choice. But we were all friends because there were just three of us.

In another instance Dr. Allen said,

Originally I thought I would do more [specific engineering area]. . . . I remember wanting very badly to work on a . . . [specific area] for a summer. My mom's best friend's husband owned a . . . firm in town. I thought, man, I got it made. And he wouldn't hire me because I was a woman. "Women cry too easy, I can't put up with that crap on my jobsite." He had one woman that worked in his whole [business], and he had a very large . . . company. She answered the phones. [He d]idn't want me on a job. We [women] weren't reliable and we cry too easy.

Dr. Brown reported, "[W]hen I was a beginning professor, I really struggled with the first two children." And added, "I took a lot of flack from colleagues at technical meetings, people here were saying your kids shouldn't travel, they should be at home and so should you." Dr. Arnold

described an incident that happened while she was faculty at another university.

A student had come in [to a faculty colleague] to ask a technical problem and he correctly identified me as the faculty member who would be most likely to help in this situation. So my faculty colleague said, “[Y]ou could go talk to Mrs. C. about that because she understands that area, she is pretty good. She can help you.” And the student walked two doors down and knocked on my door and said “Mrs. C. can I ask you a question?” And I didn’t look up, and he knocked again and I looked up and he said, “Mrs. C. can I ask you a question?” And I looked at him and I said, “Mrs. C., that’s my Mom, she’s not here. There is no Mrs. C. here,” I felt bad for him, and he stopped for a second and very quickly proceeded, “Dr. C., can I ask you a question?” “Sure. What can I help you with?” And so the student never did it again and I talked to my faculty colleague and said, “You know, it’s not really my name and Dr. C. is better.” “Oh sure,” he said. He didn’t really mean anything by it, but it was a little insult in essence, because he was undermining my professional working with the students. Stuff like that happens. I don’t think they overtly mean to be problematic, but they are.

Dr. Brown relayed another instance of her experience as a female engineering faculty member,

I don’t understand the dynamic of what happens in my class when I’m the only woman, there’s sometimes . . . a very different environment when I have an all male class. I don’t think that the men in there intentionally do it or they’re even aware of it, but I think sometimes we get set up when I’m the only woman there, I’ll get a student who’s going to work at challenging me, where I think they are almost embarrassed to do that if there is a female colleague in the room. Or they don’t do it, I don’t think, I don’t know what the dynamic is or why it doesn’t happen, but it doesn’t happen. The only time I have ever had a student that would just, would try and nail you to the wall is in an all male class. I don’t know why that is, but I can usually say, “[I]t’s a very interesting question, you can come to my office and you talk about it and I can try and get you the right reading material. You can go learn about it and I’ll show you how to do that,” but I’ve had students in all male classes, sometimes . . . [ask a very specific question and] I’ll say you know, this is a general . . . course and . . . I’d have to go look it up, I can show you how to do that, and they just won’t let go. I’ve had students dig and dig and dig and feel that they had some need to sort of embarrass me, but I don’t think that when there is another woman present that they do that. That’s probably the strangest phenomena that has happened. Probably three of four different times, so a pretty good correlation with that.

Dr. Carter said,

I do know that there have been a couple of times when I mentioned to faculty that, "[T]hat's probably not a comfortable thing for you to say in front of women," and they'll look at me kind of puzzled and go, "Oh, I guess you are right." Within my limited reach try to help the other people be a little more sensitive to some issues.

Faculty noted no instances of special treatment for women students. Dr. Brown related, "I don't think there's any thought there [to addressing women specifically] and maybe that's good, maybe it means they just assume they're teaching students and they aren't worried about what they're doing."

Dr. Allen said, "I definitely don't do anything to purposefully hurt women in the classroom, but I haven't spent a lot of time thinking specifically about examples that I do and whether or not they are gender friendly." She added,

[S]o is there something I've done in particular, no. Is there something I know the University is spending a lot of time thinking about, yes, I think the nation, the ABET community is spending a lot of time thinking about that.

Dr. Arnold said,

I think actually if you look at the undergraduate student body and ask are there any, would I expect that a female student would feel any level of discrimination or special treatment from any of her colleagues, I think the answer is no. There probably are expectations. . . . [S]o I don't think the students see any special treatment.

Dr. Brown related an instance where she described requiring female students to do lab work,

I can think of a few times where sometimes the most important thing I need to say to a female student is, "[Y]ou are not out of it because you are female, I know you can do it, get back in there. Pick up the tools and particularly in the lab, pick up the tools, and just do it, you can wire that circuit, you'll be fine, try and do it." Being female and looking at a female across the table and saying, "[N]ope, if I can do it . . . you can do it." That puts to rest some of the, oh, I have to find somebody to carry it for me or wire it for me, or do it for me and I think that is where we help them develop. If you felt somehow limited before, there are no excuses in my group.

Dr. Arnold summed up her idea of No Special Treatment by relaying,

I think the faculty really tries to support the undergraduate student and provide a curriculum and an environment that allows the students to be successful, but I don't think there is any particular emphasis on what makes the women different and what we need to do to resolve their issues, or assist them in their transition . . . from student to professional.

Participants reflected on the Numbers of Women in their engineering programs. Faculty reported current numbers of women students varied with discipline, and that a 50/50 gender mix was a goal for the department. Dr. Allen said,

We are low [in numbers of women students] right now. Why that is, I don't know . . . I think our numbers are down overall . . . Our department probably doesn't face some of the issues a lot of the other departments on campus do because we do have a fairly high amount of women.

Dr. Carter described her department by saying, "We don't have very many women." Dr. Arnold relayed information about numbers of women in her department and described the numbers of women in the college of engineering at University A,

[O]ur [engineering major] student body is almost 40% women and that means that there is nothing particularly special about the fact that they're there. . . . I've looked at that number and can find the absolute number of women in the college is not dropping. The absolute number of women is actually going up just a little bit. But the average number of men is going up faster so our percentages are dropping. But I think it's just a residence time issue.

Faculty discussed the desire for more women students. Dr. Allen remarked,

The department is definitely interested in increasing the numbers of women and have been involved in numerous grants and discussions to try to figure out how to do all this gender equity work, how to recruit young women, how to focus in on what, listen to what young women are saying that they want to do and figure out how that pulls things together.

Dr. Bailey said, "I know our department wants to have more [women]." And Dr. Arnold said, "[T]here really has been a significant effort to increase the number of women in the college." Dr. Brown

spoke in terms of the college of engineering at University B rather than her department and said,

My opinion is we'll get the right number, I don't know if we'll ever get to 50%, but when my grade distribution for my female students looks like my grade distribution for my male students maybe we'll be teaching at least all of the women who want to be here. I'm not sure I would aim for 50%, but all of the women are grouped at the very top, or the very bottom. The whole mid-range is missing. . . . [W]e had a new student coordinator working at the college who said, okay, we're going to double the number of students, female students in engineering and science. . . . I would love to see that happened, but you have to realize that there has never been more than 17% female students the whole time I've been here. And so coming in and putting numbers out and saying we're going to double the number of female students without a pretty proactive plan just doesn't make sense. . . . We seem to have a retention problem, we know that we have about 17% women in the incoming class. And by the time they graduate it's about 10% of the college of engineering.

Two faculty members described numbers of women students at both ends of the spectrum. Dr. Bailey described having more women than men in her classes,

I tend to have more women in my classes, well, at times I've had more women in my classes than I've had guys and I think that has something to do with just the nature of . . . engineering. In that it is more, tends to be one of the fields that women are more likely to go in to than men.

Dr. Carlson described her delight when, "I taught a senior elective in . . . [a specific area] and I had five women in a class which was unbelievable, I had never had five women before." She added, "Three has been the max and by that time I knew all of them pretty well and it was just a really neat experience."

Faculty reported an awareness of their image as a female engineering role model that was important for male students as well as female students. Faculty discussed an awareness of their responsibility as role models. Dr. Allen said,

I've had the opportunity to work very closely with two young women honor students and I've really enjoyed that, one woman is now getting her Ph.D. . . . Hopefully I've had some influence on her wanting to stay in the research area. The other young woman is just a junior and she worked for me her sophomore year and will work for me till she graduates. And I . . .

will be very disappointed if D. doesn't go for her Ph.D. . . . Being a good role model, I think that—or I think [that means] also bringing your research into the classroom to show the students what you do.

Dr. Arnold explained,

I think being there helps them. Especially in an institution like this that is relatively small, if they only see men teaching then I think they start to think that this is something that men do even though the men are to their credit come out and say a lot of women are doing this, look around you. There are a lot of women in this class. A visual role model, I think helps them. . . . So being there is good. Understanding, having some appreciation of what they might be thinking is good. It's really trivial but I actually had my course video taped and evaluated by a neutral person in a class a long time ago and the person that was doing the evaluation said, you know, you always refer to the hypothetical person on the job as he, I probably do. So now I really, really try. Every time I force myself to think about it, I refer to the person as SHE. . . . What I find in terms of the role model thing, having women faculty teaching predominantly male courses, I have found has probably had a bigger impact on the male students than it has had on the women.

Dr. Brown related, "I didn't realize that I have, just sometimes just being female and lecturing in a different style, that is, softer voice, more comfortable." She continued,

I had a teaching evaluation for the first time and I've been teaching more than a decade, that said, it was really nice to realize that you can be feminine and still be effective and I thought that was a really great compliment to me. I really felt good about that, I've had evaluations in the past that said I didn't like your purple dress, okay, obviously they noticed what I was wearing, that was less positive. But I felt that that was a really nice compliment. It obviously was a person who was making a decision for herself, I think, about. "[D]o I have to look like a guy to be able to do this traditionally male field?"

Dr. Bailey remarked about being a role model,

[I] just think it is a lot of intangible things that are happening that might do that. I think also, I am really available to my students. I think, different dimensions of students take advantage of that, but I have probably had for the most part, better connections with some of my women students just because it is a woman professor so they have a chance to talk about things that they wouldn't normally get a chance to talk about with a male faculty.

Dr. Carlson explained,

[I] think as a whole being technically sound and being able to stand up in front of a class and talk, to speak technically about our area, just to be professional, a professional woman in front of a class is the biggest thing you can do to show them that we have those capabilities to do that.

Dr. Carter said, “[It is] probably helpful to women which see me in my position.” And added, “[V]ery few of them will become faculty, although I’ve had a few women say what is it you want, [and] they say I want to be you. I’ll still be me.”

Women faculty in engineering departments communicated their unique experiences as undergraduate engineering students, practicing engineering, and engineering faculty. Study of their leadership is important to understanding the culture and climate experienced by undergraduate students in engineering programs. Women engineering faculty spoke of their persistence to continue study in their engineering discipline from the time they entered as undergraduate engineering students. They reported that they were often isolated in their departments and were vigilant in speaking out on behalf of fair practices for themselves and women students. Women engineering faculty stated their perceptions of themselves as role models and mentors for all students, and especially for women undergraduate engineering students.

Faculty members saw themselves as role models for both female and male students, especially in balancing work/life issues. They stated that women students found them more accessible on a personal basis than other faculty members. They recognized that their teaching methods and delivery were sometimes different from other faculty members in the department. Female faculty members recalled experiences they had faced in the engineering workplace and as faculty members where they themselves were recipients of gender bias. They attempted remedies in their departments by pointing out examples of bias to their male faculty colleagues when disrespectful remarks or actions were made towards themselves or students.

Women engineering faculty were often isolated across departments with little opportunity to connect with other female engineers. Women faculty took opportunities to work as supporters for women students by pointing out blatant and subtle sexist behavior or remarks made by faculty colleagues (Frehill, 1997). She continued, “[W]omen in engineering reported that students appeared to ‘test’ them more often than their male colleagues” (p. 130). Women engineering faculty described workplace issues and experiences as faculty that at times corresponded with the National Research

Council's (1994) description of "a culture of industry that is hostile." Frehill (1997) noted,

[M]any women still experience gender inequality in engineering workplaces and in higher education. Whether the gender inequality is blatant or subtle, intentional or unintentional, such discrimination reinforces our cultural stereotypes about women and men in the classroom and on the job. (p. 132)

Participants described a climate that showed No Special Treatment toward women students. Frehill's (1997) review of women in engineering shows that academic engineers were the most likely to be conscious of gender inequity and that women students were more likely to be the recipients of sexist attitudes from male peers than faculty. However, Frehill (1997) found that male faculty were not always aware that they were treating women students differently from men.

Participants reported a wide variety of the percentages of women students in the undergraduate classes, depending upon the engineering major. In data collected from 2900 undergraduate engineering programs by the American Society for Engineering Education (2003), the numbers of women receiving bachelor's degrees in engineering in 2002-2003 continued to hover around 20%. Biomedical engineering, chemical engineering, and environmental engineering had the highest female graduation of approximately 40%. Electrical engineering, computer engineering, and mechanical engineering had the lowest reported graduation rate for women at 14.8%, 13.2%, and 12.8% respectively. "Small numbers make women very visible; visibility draws attention to successful performance, but it also spotlights errors" (Rosser, 2004, p. 64). In 1997 Frehill wrote,

[F]emale engineers experience sexism in the classroom and the workplace because of two related characteristics. First, because there are so few women in engineering, they encounter problems associated with being a token. Second, engineering is a gendered profession. (p. 118)

Participants described the persistence of women students in terms of individual skills while the three universities—A, B, and C—were in various phases of implementing institutional changes to provide a more supportive atmosphere for women engineering students. The concept of replacing individual women's coping skills with institutional change was described by Rosser (2004).

[M]ore women than men are lost from science at every level of the pipeline. . . . Failure to change the percentage of women significantly by applying individual solutions suggests the need for systemic institutional

changes to facilitate the careers of individual women scientists and engineers. (p. 52)

The experiences of women engineering faculty and their influence on students should be considered for further study. Additional areas for exploration include: (a) how women engineering faculty relate their own experiences to teaching; (b) how women engineering faculty relate their own experiences to faculty advising; and (c) how students perceive women engineering faculty.

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