INVOLVING STUDENTS THROUGH BUILDING COMMUNITY: CHALLENGES FOR WOMEN IN ENGINEERING PROGRAMS

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Rationale

The critical mass of female students in engineering decreases as women proceed through their undergraduate and graduate education. In addition, the "chilly climate" embedded in the culture and environment of engineering often leaves women students at-risk for feeling isolated and disconnected from the institution. Thus, establishing and maintaining a sense of community for female students in engineering is a major challenge facing women in engineering programs today. Within the context of student development theory, including student involvement (Astin, 1984) and marginality versus mattering (Schlossberg, 1989), this paper will examine barriers to building community and fostering involvement among female undergraduate and graduate students. Based on the SPAR Model (Jacoby & Girrell, 1981) of program implementation, a set of strategic initiatives that can be taken by women in engineering programs to build a sense of community and mutual support among women students will also be explored.

Introducing Theoretical Models

According to Alexander Astin's (1984) theory of student involvement, colleges and universities that involve their students in their educational experiences not only enhance student learning outcomes, but also increase student retention. Astin (1984) explains that student involvement refers to the "amount of physical and psychological energy that the student devotes to the academic experience" (p. 297). Based on a longitudinal study involving college students who left their institutions before attaining a degree, Astin (1984) found evidence for the existence of certain factors in college environments that tend to impact student persistence. According to Astin (1984), factors associated with increased levels of involvement include: residing on campus, holding a campus job, participating in intercollegiate sports, being involved in an honors program, engaging in research with faculty, and establishing a high level of identification and affiliation with the institution. It is also interesting to note that "frequent interaction with faculty is more strongly related to satisfaction with college than any other type of involvement or, indeed, any other student or institutional characteristic" (Astin, 1984, p. 304).

Schlossberg (1989) concurs with Astin's theory of student involvement through her theory of "marginality and mattering." Schlossberg (1989) explains:

> Involvement creates connections between students, faculty, and staff that allow individuals to believe in their own personal worth. This involvement also creates an awareness of our mutual relatedness and the fact that the condition of community is not only desirable but essential to human survival. Therefore, the concern over involving students, although expediently related to satisfaction and retention, is the very process that creates community (p. 6).

In essence, Schlossberg acknowledges that students will ask themselves, "Do I belong here?" A student, for example, who feels that she matters to the institution and to others has internalized the notion that others depend on her and are concerned with her fate. In contrast, a student who thinks that she does not matter will feel marginalized. As a result, she may be at-risk for isolation from her peers and a sense of disconnection from the institution, both of which could serve as barriers for her educational persistence. Thus, a female engineering student's level of mattering will ultimately shape her experiences and level of motivation to further pursue engineering. Within this context, students who feel a sense of identification with others and the institution -- a sense of community -- are more likely to become involved and persist. Therefore, the framework of community is perhaps one of the most powerful mediums through which to involve women engineering students, enhance their educational experiences, and increase their likelihood of completing an engineering degree.

Although theories of student development and involvement are integral in giving voice to the experiences of college students and assisting educators in fostering their development, a major limitation of many theories is that they were developed and based on the experiences of traditional-aged students, many of whom were white, middle-class males at four-year residential institutions (Jacoby, 1991). This brings to question the appropriateness of applying such theories for work with diverse student populations on college and university campuses today, including women engineering students. In exploring the degree of applicability of these theories to women students through the contexts of involvement, retention, and community, how can women in engineering programs ensure that female undergraduate and graduate students have the opportunity to become involved in their institutions and feel that they matter to others?

In attempting to answer this question, one conceptual model in the literature that can serve as a framework for structuring and implementing women in engineering programs that are sensitive to the diverse needs of students is the SPAR Model (Jacoby and Girrell, 1981). Within this conceptual framework, functions that enhance the educational and co-curricular experiences of students can be organized along the following four interrelated dimensions: (1) Services (functions that are performed for students), (2) Programs (functions that are performed with students), (3) Advocacy (functions that are performed on behalf of students), and (4) Research (the vital ingredient that determines the types of

services, programs, and advocacy best suited to meet the diverse needs of students). Including these four components in a women in engineering program can increase student involvement, intentionally foster a sense of community, and increase the overall quality of women's experiences at the institution.

Examining Barriers to Involvement and Mattering

Both individual and institutional factors serve as barriers to fostering involvement and a feeling of mattering among female undergraduate and graduate students in engineering. First, in examining individual barriers, women experience multiple roles -- as learners, mothers, daughters, partners, and professionals -- that may serve as challenges to their involvement in their educational experience. Related to this, a phenomenon commonly cited in the research literature is that of "role conflict," which Stoltz-Loike (1993) explains "results when individuals must function simultaneously within multiple roles and the demands for optimal performance in each role cannot be simultaneously achieved. Role conflict can lead to stress, anxiety, or decreased levels of performance at work or at home" (p. 116).

Directly related to role conflict is the issue of lacking available resources, including time and finances. For example, a female student who is attempting to balance multiple caretaking responsibilities along with holding a job and the rigorous demands of the engineering curriculum will have less time to become involved -- such as living on campus, making friends in classes, participating in academic study groups, or taking part in engineering societies. In contrast, students who do not have these other roles and responsibilities have many more opportunities to become involved. In this respect, involvement in one's academic and co-curricular experience is a privilege that is not easily achievable for all women students.

On the institutional level, the "chilly climate" of the engineering discipline may serve as a hindrance to female students' involvement and feelings that they belong and matter. The emerging literature on engineering education suggests a link between the impersonal and competitive norms imbedded in the culture of engineering and the underrepresentation of women in engineering (Barber, 1995; Brush, 1991; Ginorio, 1995). Examining this phenomenon in the context of student development theory, it is clear that the engineering curriculum does not always foster a feeling of belonging for women students. Instead, students enter the discipline with the unspoken understanding that most introductory engineering courses are meant to "weed out" students (Ginorio, 1995; Tobias, 1990). Thus, students must earn the privilege to belong to the engineering community by successfully completing these tasks. For female students, however, this is even more complex since many of the factors that help to sustain students are not available, such as a critical mass of like-minded peers and female role models.

Relationships and connection are central components in women's psychological development (Gilligan, 1982; Jordan, Kaplan, Miller, Stiver, & Surrey, 1991). Jordan

and associates (1991) state that "for women at all life stages, relational needs are primary and healthy, dynamic relationships are the motivating force that propels psychological growth" (p. 37). They further explain that a woman's self-esteem and sense of self worth are directly related to the extent that mutuality is developed within her relationships. However, the devaluation of women's relational orientation is pervasive throughout society (Gilligan, 1982). This is particularly true within the culture of engineering, which is often characterized by a highly impersonal and competitive training process. Barber (1995) illuminates that boys are socialized to develop qualities (i.e., assertiveness, competitiveness, linear thinking) that are most often rewarded in the culture of science and engineering. In contrast, for girls becoming a scientist or engineer challenges the core of self, which is relational. This can communicate to female students that their way of relating to the world is not valued within the engineering community and therefore, they do not belong or must suppress a part of themselves in order to feel that they belong.

The devaluation of women's relational orientation is particularly prevalent in the engineering classroom, where often only a few learning styles are highly valued and rewarded. Research examining women's cognitive development has shown that while male students prefer to argue and debate in class, women students are often reluctant to share their views, express their opinions, or provide answers for fear of alienating others (Belenky, Clinchy, Goldberger, & Tarule, 1986). In an environment perceived as competitive and hostile, women may become even less inclined to speak out. In addition, the lack of examples that include women clearly communicates to female students that their presence in the classroom is insignificant. Furthermore, marginalization impacts women outside the classroom, where opportunities to establish mentoring relationships with faculty, receive research funding, and other educational experiences are rewarded to students who fit the non-relational cultural norms and criteria for success.

Building Community Among Women Engineering Students

In linking the barriers associated with involvement and mattering to building community among women engineering students, it is first important to provide an operational definition of community. According to Hillery (1955) as cited in Johnson (1991), a community is "a group of individuals engaged in social interaction, possessing common interests and goals, who show concern for and are sensitive to the needs of other members, and are primarily interested in furthering the group goals over all others" (p. 3). In a similar vein, Schlossberg (1989) highlights that "those working to build a sense of community through activities are challenged not only to understand why certain individuals get involved, thereby creating community among themselves, but also why others seem unable to establish connections or meaningful level of involvement."
The aforementioned barriers to involvement and mattering for female engineering students can make community-building among women a particularly difficult challenge.

In exploring the interrelated concepts of involvement, mattering, and community, it is apparent that one of the strategic goals of women in engineering initiatives should be to

dismantle barriers that hinder women students. In reintroducing the SPAR (Services, Programs, Advocacy, Research) Model (Jacoby & Girrell, 1981) for program implementation, women in engineering programs can organize their initiatives and refine their focus in dismantling such barriers as a primary tenet of their structure, functioning, and mission. As cited in the 1995 WEPAN Data Book, there exist numerous initiatives on college and university campuses that actively foster community among women students in engineering. In conclusion, the following four facets of the SPAR Model provide a holistic approach to implementing community-enhancing initiatives for women engineering students.

Services: Services are functions that are performed for students, and it is integral that they are both appropriate for and accessible to students (Jacoby, 1991). Within the context of women in engineering programs, services provided may include job and scholarship listings; workshops on career development and graduate school; personal, academic, and career counseling; and opportunities for student employment. In this respect, fostering collaboration with campus resources such as the counseling center, career center, and the financial aid office is extremely important. At the same time, one of the most important yet often overlooked facets of providing services is disseminating information about them, as students are often unaware of the institutional resources available. Distributing newsletters, compiling e-mail aliases of women students in various engineering departments, informing faculty of services, and collaborating with engineering student societies can be effective measures to achieve this end. Thus, women students see that the institution is responsive to their needs and that they actually "matter" to others.

Programs: Programs are functions that are performed with students (Jacoby, 1991). Programs responding to the needs and interests of women engineering students may include: mentoring with professional engineers; teaching and research fellowship opportunities; collaboration with community colleges; tutoring programs; and engineering outreach programs with high school, middle school, and elementary school students. Through their participation, women become actively involved with other students, faculty, and staff, and have the opportunity to develop connections and significant relationships that are central to their psychosocial and cognitive development. These programs not only provide women engineering students with valuable personal and professional experiences, but they also enhance their sense of self-efficacy, help them gain valuable interpersonal skills in working with others, and foster their leadership potential.

Advocacy: Advocacy occurs on behalf of students to ensure that their needs and interests are being recognized and incorporated into the policies, practices, and culture of the institution (Jacoby, 1991). In terms of advocacy, women in engineering programs play a vital role on campus in raising awareness surrounding women's issues, particularly with respect to male-dominated academic disciplines and professions. Women in engineering programs can sponsor curriculum transformation initiatives, facilitate workshops on

sexual harassment, and conduct research about women in the sciences and the barriers they often face. In this capacity, they ultimately serve as advocates not only for women in engineering, but also for creating a gender-equitable climate for all students on campus.

Research: Finally, research serves as the vital link between the key components of services, programs, and advocacy (Jacoby, 1991). Through research, women in engineering advocates can assess the needs of women students, design programs and services accordingly, and evaluate their initiatives in terms of their quality and effectiveness. Research, evaluation, and assessment ultimately inform and justify the existence of programs and services as well as determine priorities, directions, and future initiatives. Research can take on both quantitative and qualitative forms, including surveys, focus groups, and informal discussions that bring together diverse groups of undergraduate and graduate women. The focus group model, in particular, extends beyond the goals of research and evaluation by fostering community among female engineering students and creating a forum through which they can share their experiences with each other.

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