CURRICULUM, METHODS, AND MALES: PROBLEMS AND SOLUTIONS TO LOW FEMALE ENROLLMENT IN COLLEGE AND PRE-COLLEGE TECHNOLOGICAL COURSES

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In an effort to attract more women into engineering and technological disciplines, there is a tendency to either select or change women so that they come to realize that engineering and technology may offer a viable occupation for them. One might ask, "Why don't many women choose engineering? Why do so many leave the field? What do women need to know about the field? And what support do women need to enter and to stay in the field?" While these questions are important, they represent an approach that centers on asking, "what's wrong with the women?" This approach assumes that the field is unbiased, and that the problem to be fixed is not with the field or education, but with the prospective female engineers and technologists.

Eventually, educators may look to their curriculum in an attempt to better meet the needs of all students, especially women and other under represented groups. Even more courage may be needed if faculty attempt an appraisal of their teaching methods, analyzing teaching behavior for bias and undesirable effects. However, often omitted from a reform plan is attention to male students. Ironically, male students have been charged by some as presenting one of the biggest obstacles to women, especially in pre-college technical courses.

This paper looks at three issues regarding program improvement to promote more equitable enrollment, retention, and care of female students in college and pre-college industrial technology: curriculum, teaching methodology, and barriers to women stemming from male students.

In middle schools and high schools in the US, engineering is not a typical curricular offering. Where it is included, it is often part of the school's Technology Education Program. Technology Education (TE) is the field that evolved from Industrial Arts. In many middle schools, TE classes are a requirement, whereas they are electives in most high schools. There are many high school TE course offerings, usually including Manufacturing, Communication, Drafting, and Principles of Technology. For many students, their middle school TE course is their introduction to technological and engineering materials, processes, and problems. Their experiences there can be critical to their later pursuits in high school TE and in engineering and technological studies and work after high school.

CURRICULUM

One way to modify the curriculum is to add equity as a curricular topic. This is appropriate at all levels of technical education, and may help students realize those special instances of inequity particular to the course topic. Patricia Yosha[1] developed a collection of lessons for pre-college students on gender equity. Some of those topics are appropriate for college students as well, such as the analysis of job opportunities and salaries. Sex equity can also be approached from a tangent. For example, in course on product engineering or construction design, the curriculum can include Universal Design, which is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design"[2]. For example, by asking students to design or modify products for the arthritic, or structures for those in a wheelchair, students are encouraged to look for inequities.

Yet, as Higginbotham[3] noted, this additive approach can serve to marginalize issues concerning previously underrepresented populations. A token lecture on a woman engineer may serve to merely complement an inherently biased curriculum core. It is important to appraise the (core) curriculum itself for sex bias. Respondents to a survey of women in TE[4] suggested major changes in the curriculum: "Change the curriculum offerings to be more representative of all aspects of technology in society;" "Offer courses of interest to females;" "A broader definition of technology and its link between the arts and sciences."

Shepherd[5] offered a new look at the field of science, without a male bias; the questions she raised help to redefine science and the scientific method from a new perspective. Could it be that the very definitions of technology and engineering are biased?

> The traditional conception of technology is heavily weighted against women. We tend to think about technology in terms of industrial machinery and cars, for example, ignoring other technologies that affect most aspects of everyday life. The very definition of technology, in other words, has a male bias. This emphasis on technologies dominated by men conspires in turn to diminish the significance of women's technologies.[6] (p.137)

If we begin with a biased definition of the field, then the delineation of the field will also be biased. When the field of Technology Education evolved from Industrial Arts, it was commonly apportioned into 4 sub-fields: manufacturing, construction, communication, and transportation. This was decided by the twenty men and the one woman involved in the Jackson's Mill Industrial Arts Curriculum Symposium[7]. Had that group consisted of twenty women and one man, the delineation may have had less bias toward technologies associated with occupations typically associated with men.

Student activities can be expression of sex-biased curriculum. In the past, Industrial Arts students built gun racks. After the switch to Technology Education, thousands of TE students build CO_2-powered drag racers. While gun racks and drag racers may have appeal to both males and females, they are both clearly male-stereotypical. A more

inclusive approach would be to offer a range of activities, including those that are stereotypically female, male, and neutral.

Gretchen Wilbur[8] saw sex-fair curriculum as being characterized by the following six attributes:

> It acknowledges and affirms *variation*, i.e., similarities and differences among and within groups of people. It is *inclusive*, allowing both females and males to find and identify positively with messages about themselves. It is *accurate*, presenting information that is data-based, verifiable, and able to withstand critical analysis. It is *affirmative*, acknowledging and valuing the worth of individuals and groups. It is *representative*, balancing multiple perspectives. And, finally, it is *integrated*, weaving together the experiences, needs, and interests of both males and females. (p.64)

Fortunately, in the past decade, numerous resources have been developed for those interested in sex-fair curriculum. (An online clearinghouse regarding women and curriculum is available at The National Center for Curriculum Transformation Resources on Women, located at http://www.towson.edu/ncctrw/). But curricula designed to promote equity should be executed with teaching methods (and teacher behaviors) that promote fairness.

TEACHING METHODOLOGY

During their training to become teachers, many are not well-introduced to the variety of methods that can be used to include equity in the curriculum. Campbell and Sanders[9] surveyed professors in methods courses. They found that "almost everyone doing gender equity uses classroom discussions (87%), with many (61%) also using lecture. About half (49%) said they used classroom observations; many fewer used student presentation (26%) or student projects (25%)" (p.71). It is critical that pre-service teachers be exposed to the variety of ways to promote equity, but it is also important for them to become aware of their teaching behaviors and ways to assess these behaviors.

Unlike K-12 teachers, most university professors do not have a degree in education that included a rigorous study of teaching methods, a practicum, and professional assessment of teaching. Yet, many licensed teachers have never been asked to study the bias of teaching methods, or ways to teach that can promote equity.

To help appraise one's teaching methods, a peer and a video camera may be useful. Sanders, Koch, and Urso[10] recommend a self-assessment of teaching for pre-service teachers, using a list of categories often showing sex-bias, including: language, eye contact, calling on students, and body position. However, self assessment may not be sufficient. Sadker and Sadker[11] noted a number of sexist teaching behaviors unnoticed by the teacher until later evaluation of a videotape with an outsider. For example, they saw teachers ask males different types of questions than they asked females. They heard jokes and remarks from teachers that were clearly sexist, even though the teacher had not

intended to offend. They saw teachers spend much more time and effort with male students. In general, they noticed a lack of awareness by teachers regarding the sexism of their behaviors.

There are also proactive teaching strategies for promoting equity. Flowers[12] noted strategies for grouping students to promote equity. In a manufacturing technology class, college students first worked in self-selected groups, with each member having a specific job. There was a tendency for the females to take on the jobs of group secretary or designer. In the next activity, a new group was made of all of the previous group leaders, another made of all the group secretaries, and so on. This forced students to self-select a variety of roles. A second strategy used a role-playing activity. Students were seemingly randomly assigned to groups, but the result was the creation of at least one all-female group. Each group then interviewed prospective employees from the remaining students in the class. Because of the power levels involved, when males were interviewed by an all-female panel, it "invariably a humbling experience for the males and an empowering experience for the females" (p.12). This one activity seemed to change how the females participated in the class.

Rosser[13] examined nineteen teaching techniques to promote sex-equity in science education, such as: "Use methods from a variety of fields or interdisciplinary approaches to problem solving" (p.369); and "Encourage development of theories and hypotheses that are relational, interdependent and multicausal rather than hierarchical, reductionistic, and dualistic" (p. 372).

Unfortunately, adapting new teaching techniques and diminishing one's own sexist behaviors probably represents the biggest obstacle for university and K-12 teachers. One reason is that habits are difficult to break, but a deeper reason is that teachers are not aware of a problem.

I suggest the following strategies for influencing teacher behaviors. First, teacher preparation should include practice in spotting and overcoming inequity. Second, the behavior of existing teachers should be evaluated by that teacher, by peers, by students, and by administrators, specifically for equity issues. A self-administered *gender equity audit*[14] can help a teacher to realize problems, but should be supplemented with objective observations and constructive criticism from others. To change the behaviors of existing teachers, mandatory in-service might be a better solution than voluntary in-service due to the denial involved.

MALE STUDENTS

One significant obstacle to female enrollment and participation, especially at the pre-college level, is the behavior of male students. "Girls complained that the boys were always trying to take over... The girls said that the boys make fun of girls trying to use the equipment, and the teacher sometimes lets them get away with it. They said the boys

would laugh at their ideas or give them a hard time for making small mistakes"[15] (p.5). Just as many teachers may be unaware of their sexist practices, "women are more aware [than men] of gender discrimination in the engineering classroom"[16] (p.178).

The effect of male students is significant. On a survey of women in TE, twenty five different groups of people (e.g., friends, spouse, professors) were identified as providing a negative or positive influence on the respondents choice to become a technology teacher[4]. Of those, the average influence of twenty three groups was positive; the only two groups that had a negative influence were guidance counselors and male high school students.

Tannen[17] stated that "boys and girls grow up in what are essentially different cultures" (p.18). Teachers who are aware of these (cultural) differences may be better prepared to promote respect between these cultures. But should sexism a tolerable part of these cultures? "Tolerated under the assumption that 'boys will be boys' and hormone levels are high in high school, sexual harassment is a way of life in America's schools"[11] (p.8).

One guide for prospective teachers in this field includes activities for pre-service teacher[10]. The following deals with ways to handle rude student behavior:

> You are teaching your class and have just called on Junie to answer a question. She looks confused. Before Junie has a chance to say anything, mark mutters loudly enough for everyone to hear, "She'll never get it - she's an airhead." You could:
>
> - Ignore the comment.
> - disagree, saying that Junie isn't stupid at all.
> - Agree, saying that after all, Junie is trying hard.
> - Reprimand Mark mildly.
> - Reprimand Mark harshly.
> - Tell mark to leave your class and return only when he can be civil.
> - Hold a class discussion on insulting behavior.
>
> Consider the consequences for Junie, Mark, and the rest of the class of various courses of action open to you. What is the best thing you can do? (pp. 88-89)

Other solutions to problems with male students may include disciplinary actions, proximity of the teacher, student seating, student group assignment, and activities designed to improve the classes social climate. The teacher can also teach equity through: gender atypical references, modeling, restating inappropriate student comments, grading, adding content on equity, and by carefully assigning tasks and groups.

CONCLUSIONS

Teachers of college and pre-college technological courses are directly responsible for their curriculum, their teaching methods and habits, and the behavior of the students in their class. These three areas can be used to promote equity, even in all-male classes.

REFERENCES

1. VERTEC. (1993). Gender equity teaching guide. Hartford, CT: Vocational Equity Research, Training and Evaluation Center.
2. Center for Universal Design. (1998.) Universal Design. Retrieved on May 20, 1998, from the World Wide Web: http://www2.ncsu.edu/ncsu/design/cud/ud/ud.html
3. Higginbotham, E. (1990). Designing an inclusive curriculum: Bringing all women into the core. Women's Studies Quarterly, 1 & 2, 7-31.
4. Flowers, J. (1995). Overcoming the barriers: Technology education as a career choice for women. J of Women and Minorities in Science and Engineering, 2, (1&2), 17-32.
5. Shepherd, L. (1993). Lifting the veil: The feminine face of science. Boston: Shambhala.
6. Wajcman, J. (1991). Feminism confronts technology. University Park, PA: Pennsylvania State University Press.
7. Wright, R. (1995). Technology education curriculum development efforts. In G. Martin (Ed.), Foundations of technology education. 44th Yearbook, Council on Technology Teacher Education. Peoria, IL: Glencoe.
8. AAUW. (1992). How schools shortchange girls. Annapolis Junction, MD: American Association of University Women.
9. Campbell, P. and Sanders, J. (1997). Uninformed by interested: Findings of a national survey on gender equity in preservice teacher education. J of Teacher Education, 48(1), 69-75.
10. Sanders, J., Koch, J., and Urso, J. (1997). Gender equity right form the start. Mahway, NJ: Lawrence Erlbaum Associates.
11. Sadker, M. and Sadker, D. (1994). Failing at fairness: How America's schools cheat girls. New York: Charles Scribner's Sons.
12. Flowers, J. (1996-1997). Tips for grouping students. Technology Education Report, 9, (2), 11-12.
13. Rosser, S. (1989). Teaching techniques to attract women to science: Applications of feminist theories and methodologies. Women's Studies Int. Forum, 12(3), 363-377.
14. Horgan, D. (1995). Achieving gender equity: Strategies for the classroom. Boston: Allyn and Bacon.
15. Silverman, S. & Pritchard, A. (1993). Building their future: Girls in technology education in Connecticut. Hartford, CN: The Vocational Equity Research, Training and Evaluation Center.
16. Paulson, K. (1995). Female and male engineering student perceptions of and preferences for the classroom environment. WEPAN 1995 Conference Proceedings: Women in Engineering Conference, June 4-6, 1995, Wash., DC.
17. Tannen, D. (1990). You just don't understand: Women and men in conversation. New York: Murrow.