

**WOMEN IN ENGINEERING/TECHNOLOGY
AT COMMUNITY COLLEGES IN NEW JERSEY**

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Background:

Women In Engineering, Science and Technology (W.E.S.T.)

In response to the well documented lack of women in engineering pipeline, New Jersey Institute of Technology (NJIT) was funded by the National Science Foundation to establish the Women In Engineering, Science and Technology Program (W.E.S.T.) in 1991. W.E.S.T.'s goal is to increase the number of women who transfer to baccalaureate programs in Engineering, science and technology after receiving their AS degree from New Jersey community colleges.

We discovered that investing in faculty mentors of math-able women is one long term solution to the gender pipeline problem. We work closely with faculty members to encourage and support their women students to consider an Engineering/Technology career. We run Career Days for Women every semester.

A three-credit course - Principles of Engineering - was developed and offered via cable TV to targeted women students. The course introduces students to the applications to science and engineering drawing from the theories of Mathematics and Physics.

In the Spring of 1993, W.E.S.T. videotaped a Career Day for Women as well as the New Jersey State Conference on Women in Engineering, Science and Technology for community college women students/faculty for an educational TV program titled "She Wants To Be An Engineer" to be broadcast in 1994 on CTN in New Jersey which has a subscriber base of 1.8 million households and nationally over the Community College Satellite Network.

We also are co-producing a new telecourse for mathphobic women - with NJIT Distance Learning to help mathphobic women visually explore the math of art and the art of math in quilts and architecture. Distance Learning

will offer this telecourse in 1994. W.E.S.T. has obtained rights to edit portions of it into our program, "She Wants to Be An Engineer."

Almost every community college we have visited in New Jersey has requested a W.E.S.T. program. Some important factors to consider when selecting ideal community college sites to startup female mentoring projects are: an enthusiastic and supportive math/science faculty/administration at the community colleges; a number of women faculty in engineering/math/science at community colleges who already were "women pioneers" before your project arrives; strong articulation agreements with four year colleges; time to form a stable relationship between two and four year colleges. It takes at least one semester, under the best conditions, and a year under average conditions; a high rate of male transfer students already moving from the two to the four year college. Community college faculty are overloaded and need release time to mentor women students.

Thirty eight percent of post-secondary students in the U.S. are enrolled in the 1,458 community/junior colleges. Women and minority community college transfers to baccalaureate engineering programs generally take longer to graduate because of weak articulation agreements between two and four year colleges. Articulation agreements need to be strengthened between two and four year colleges.

Articulation Agreement Lessons

The W.E.S.T. grant at NJIT has taught us that transferring community college women to four year colleges on a case by case basis is a time consuming process. Without intervention women students often fall between the cracks at the point of transition between two and four year schools. Women technology students trickle in by the dozens each year when we could unblock the pipeline flow to bring in hundreds of women by changing the system itself.

W.E.S.T.'s recruitment of women needs to be brought inside the Admissions apparatus, and not operate outside the system, always on the institutional margins where women's programs often find themselves.

Articulation agreements generally exist between two and four year colleges, but many are outdated, stale documents of which students are unaware.

Often, students are told to take one curriculum by the community college, which the university later finds problematic, resulting in loss of transfer credit,

*W*OMEN IN ENGINEERING CONFERENCE: INCREASING ENROLLMENT AND RETENTION

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sometimes delaying graduation by years. Some students get discouraged and drop out; others fail to thrive. Women are most often casualties of this bureaucracy. The remedy is to assign a transfer specialist to create joint admissions agreements between two and four new community colleges.

This will make it easier for women students to be taking the right courses all along. This is a particular problem for women: not getting the right advice at the right juncture in high school and community colleges to take engineering curriculum prerequisites.

This transfer specialist must work with faculty at both two and four year colleges. By creating agreements that will make it easier for community college women to access Joint Admissions programs it also helps community college men gain access to higher levels of the pipeline. This proves that the progress of women is beneficial for men as well. It would be insightful for engineering Faculty and Deans to see that general curriculum reform, which helps all students, can be driven by a women's program and to learn that what is good for women is good for men too!

The negotiation process for a typical articulation agreement normally takes three months. The process begins and ends with a meeting between the Vice President for Academic Affairs/Provost from both institutions. These meetings signal the go-ahead and final approval for the agreement. The articulation negotiator from each institution meets ten to twelve times over the three-month period to discuss the details of the agreement and arrange three meetings between faculty departments from each institution. The faculty departments must discuss the transfer of credit. Once the agreement has been finalized and approved, each institution's President will meet to formally sign the document. Only four articulation agreements could be expected to be signed in a one-year period.

Long term articulation agreements between two and four year colleges are needed to increase the number of community college women transfer students in technology. By taking the proper engineering curriculum prerequisites before they arrive, we speed their journey toward higher degrees.

Now, let's look at who these women technology students are sociologically. Dean Judy Valyo, the Co-Principal Investigator on the W.E.S.T. grant and Dean of Freshman Studies at NJIT, first pointed out to me from her doctoral research at Columbia University in 1985 that half of women engineering students she studied at NJIT and Columbia came from families with a male engineer relative.

My research on women Engineering/Technology students at 15 New Jersey community colleges over the period 1991-93 confirms Dr. Valyo's data. At the W.E.S.T.-New Jersey State Conference on April 23, 1993, I found 45% of the women technology students came from engineering families.

The racial/ethnic breakdown was: half white Americans; half women of color. (23% are African American; 9% Hispanic; 9% Indian; 9% Middle Eastern.) See Table 1 below:

Total: 32 Technology Student Questionnaires (although 92 people attended from 15 New Jersey colleges)

TABLE 1: RACE/ETHNICITY:

11 White Americans	(50%)
5 African Americans	(23%)
2 Hispanic	(09%)
2 Indian	(09%)
2 Middle-Eastern	(09%)
22 TOTAL	(100%)

TABLE 2: GENDER:

Female	27	(93%)
Male	2	(07%)
TOTAL	29	(100%)

TABLE 3: ENGINEERING RELATIVE:

Yes	-	14	(45%)
No	-	17	(55%)
TOTAL		31	(100%)

TABLE 4: GENDER OF ENGINEER RELATIVE

MALE	17	(77%)
<u>FEMALE</u>	<u>5</u>	<u>(23%)</u>
TOTAL	22	(100%)

TABLE 5: TYPE OF ENGINEER RELATIVE

Brother	4
Father	0
Husband	3
Uncle	3
Cousin	3
Sister	1
Mother	1
Grandmother	1
Daughters	2
Father-In Law	1
Almost Everybody	2
<u>Son</u>	<u>1</u>
TOTAL	22

TABLE 6: MULTIPLE ENGINEER RELATIVES:

	(# of Students)	(%)
1 Relative -	6	(43%)
2 Relatives -	5	(36%)
<u>Many (9 or more)</u>	<u>3</u>	<u>(21%)</u>
TOTAL	14	(100%)

TABLE 7: ENGINEER RELATIVE BY RACE/ETHNICITY:

	<u>RESPONDENT'S RELATIVE IS AN ENGINEER</u>	
	YES	NO
Third World/People of Color	6 (75%)	4 (31%)
People of Color		
<u>White Americans</u>	<u>2 (25%)</u>	<u>9 (69%)</u>
TOTAL 21	8 (100%)	13 (100%)

See Table 4 for The Gender of the Engineering Relative, which is predominantly male (77%) like the Valyo data showed in 1985. But my data shows 23% are female, a higher figure than Valyo, which reflects that the number of women engineers have increased from 1985 to 1993; hopefully this trend will continue.

However, the most interesting find is located in Table 7. Although more research is needed to confirm this find, there does appear to be a correlation between Race/Ethnicity and women technology students having engineers in their families. About 70% of women who do not come from engineering families are American whites, and 30% are American Blacks. In contrast 75% of the women who come from engineering families are Third World (Indian, Hispanic, Middle Eastern) with English as a second language.

The majority of these women not only have one engineering relative - (43%); but over a third have 2 engineering relatives and a fifth of them have 9 or more engineering relatives!

This suggests to me two new strategies for industry and academia to recruit women:

- 1) Go DIRECTLY TO ENGINEERS and create support programs for their female relatives to go to engineering school then come into the company. Instead of a scattershot program aimed at all women - have some programs just for engineering families.
- 2) Try to get White and Black American engineering families to follow the third world example of encouraging women in these engineering families to be engineers. Set-up programs for white and Black employees and academics in engineering to learn to be more collective and supportive of female family members based on the third world family models.

In conclusion, I think we are on to something!