Session 2630

Attitude about Engineering Survey, Fall 1995 and 1996: A Study of Confidence by Gender

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I. Introduction

One of the primary goals of the North Carolina State University College of Engineering (COE) is to enroll the best undergraduate students possible. One factor hampering the achievement of this goal is the lack of interest of many female high school students in the traditionally male-dominated field of engineering. With no special recruiting activities aimed at informing young women about the field of engineering and recruiting them to our campus, the results are not surprising: even though women represent forty percent of the undergraduate enrollment at the University, they represent just under twenty percent in the COE. In order to recruit and enroll the best students, the college must understand why women are generally not inclined towards engineering and, where this disinclination is a result of misperceptions or lack of understanding, provide correct information upon which a rational decision can be made. Moreover, the COE must strive to create an atmosphere that is supportive of the women who do choose to enroll.

The United States Department of Education conducts a study called the National Assessment of Educational Progress to determine periodically the levels of educational achievement of high school students across the country(1). Results show that in mathematics proficiency, girls tend to score slightly higher than boys at age nine; the sexes score about the same at thirteen; and males outscore the females at seventeen. In science, the males outscore the females at all three age levels, with the gap widening as they proceed through the secondary educational system. Given that the sexes are of equal intelligence and given that they have the same teachers and facilities, one must look elsewhere to understand the differences in these scores.

Stephen G. Brush (2) summarized some of the factors which might influence girls when they are in their middle and high school years, a time when they must select the course work which would lay the foundation for a career in science and engineering. Among these factors are:

- The “stereotypical scientist” who is too often negatively displayed in the popular media as a male “nerd” figure which is antithetical to femininity.
- The lack of pictures of women in science text books used in high schools.

- The after-effects of publicity in the 1970's and 80's which asserted that women are inferior to men in mathematical skills and spacial visualization, aptitudes important to engineering.
- The problem of certain key courses, such as physics, being offered in high school at a time when young women are preoccupied with adolescent socialization.

Sue Berryman (3) adds that girls generally choose the courses they take based at least in part on their expectations regarding child rearing in the future. The more likely they are to see themselves playing the major role in rearing children, the less likely they are to take the courses which will prepare them to enter college to study engineering or science. Conversely, those young women who expect to be in the labor force during most of their adult lives are more likely to undertake the more rigorous courses in mathematics and science in high school.

A report prepared by the Office of Technology Assessment (4) stated that if one were to follow a group of 2,000 boys and 2,000 girls through their middle and high school years, one would find that by age twelve about half in each group would be sufficiently prepared to undertake the courses in mathematics which would further prepare them to enroll in college to study in a quantitative field. However, by the end of high school, only 280 of the boys and 220 of the girls would have actually completed the necessary mathematics courses. Finally, the report states that of the original pools of 2,000, "only 140 of the boys and 45 of the girls will actually enter college with plans to major in science or engineering" (p. 115). As a result, and as has been the case for years, SAT mathematics scores for males and females reflect the difference in preparation, with about 29% of the 1996 college-bound male seniors scoring 600 or better, compared to only 18% of their female counterparts (5).

One might think that by the time this winnowing process is complete, the men and women who had completed all of the prerequisite course work in mathematics and science with grades high enough to be accepted into a college of engineering would be equally confident of their abilities to succeed. However, when women enter engineering classrooms on college campuses, they find themselves in a overwhelmingly male domain. It is in this environment that they will not only learn the subject matter of the discipline, but also be "enculturated" into the tradition of engineering (6,7). O'Neal even sees that enculutration as a sort of ritualistic ordeal which has its origin in the military traditions of engineering, where recruits were tested and prepared for battle (8).

In his longitudinal study of chemical engineering students, Felder (9) found that even though women enrolled in the discipline with at least equivalent credentials as their male classmates and even though they performed at an equivalent level in their first year on campus, women's subsequent grades in their major courses were lower than men and their confidence progressively eroded. Among the potential reasons he cited for lower grades and confidence were:

1. Uncertainties in students' minds about the suitability of women to be engineers.
2. Mismatches between characteristic instructional styles of engineering professors and characteristic learning styles of women students.

3. Discrimination by faculty instructors and advisors.
4. A tendency of women to be less active in cooperative learning groups.
5. Discounting by male classmates, including (and perhaps especially) in cooperative learning groups.
6. Lack of female role models in engineering schools.
7. Different relative priorities attached by men and women to personal relationships and schoolwork.

Clearly, confidence is an important ingredient of success in engineering education. In a study of female engineering and computer science alumni, Robinson (10) found that the graduates ranked "self-confidence as the most important element for professional success and advancement" (p. 81).

II. The University of Pittsburgh "Attitude About Engineering" Questionnaire

Since 1993, researchers at the University of Pittsburgh have been studying freshman attitudes about engineering and how those attitudes change over the course of the students' first year (11). To that end, they developed and tested an "Attitude About Engineering" questionnaire. Using factor analysis, Besterfield-Sacre found that the fifty questions clustered into thirteen measures, two of which are of primary interest in this study. The first is "Confidence in Basic Engineering Knowledge and Skills," which Besterfield-Sacre says "looks specifically at the confidence someone has based on their previous experience and knowledge in the subject areas" of "math, physics, engineering and computer skills"(12). The second cluster of particular interest has to do with "Engineering Skills" (or "Engineering Abilities"), which Besterfield-Sacre says refer to self-assessed confidence in certain traits associated with success in engineering, including problem-solving, design, creative thinking, and mechanical and technical inclinations.

The Pittsburgh researchers initially administered the questionnaire to their freshman class in 1993. Among their initial findings was that women enter their school with considerably less confidence than men with regard to both their basic engineering knowledge and their engineering abilities and that those gaps endure over the course of the first semester. They found, however, that the gap in basic engineering knowledge closes by the end of the first year; however, the difference in perception about engineering abilities remains (13).

In collaboration with the University of Pittsburgh researchers, their counterparts at NC State decided to replicate partially their study (14). We administered the survey at the beginning and end of the fall semester but did not re-administer in the spring because we have no common engineering course in which to do so. The 1995 freshman class was the first to respond to the questionnaire, and preliminary results were presented at the Women in Engineering Program Advocates Network (WEPAN) annual conference in March, 1997(15). The questionnaire was also administered to the NC State freshman class of 1996, and the pre- and post-test results for both cohorts are included herein.

III. The NC State College of Engineering Freshman Class of 1995

The College of Engineering enrolled 960 new freshmen in the fall of 1995. During the second week in the semester and again at the end of the term, those students were given the Pittsburgh questionnaire in order to assess their initial attitudes about the study of engineering and to determine the changes in those attitudes over the semester.

Among the new first year students were 237 (25%) women and 723 (75%) men. The women's average high school GPA of 3.84 was slightly higher than the men's 3.75, but their average SAT of 1096 was considerably lower than the men's 1149. Most of the difference was in the SAT-Math scores, where the men scored an average of 635 compared to the women's mean score of 592. A regression equation (AI) predicting freshman year performance gave the women an average expected performance of 3.15, compared to the men's 3.04. In actuality, the 221 (93%) women who finished both semesters of their first year had an average GPA of 2.89, while the 689 (95%) men completing both terms did so with an average cumulative GPA of 2.83.

Of the entire cohort, 91 (38%) of the 237 women completed all of their mathematics and science requirements by the end of the spring semester, compared to 342 (47%) of the 723 men in the class. Eighty-two of those women either matriculated into an engineering curriculum or would have been eligible to enter the COE major of their choice. The corresponding figure for the men was 306. These groups will be referred to as "M"; students who were not eligible to matriculate will be annotated "NM."

A total of 67 of the female M responded to both of the questionnaires, as did 109 of the female NM. Of the men, 253 of the M responded to both questionnaires; and 280 of the NM responded to both. The remaining data presented will be based upon the responses of these students to the fifty questions which were common to both questionnaires.

IV. Analysis

The Wilcoxon rank-sum test was employed to determine significant differences between groups. Table 1 shows the average responses to key questions common to both the pre- and post-tests, and highlighted or bold cells reveal the statistically significant differences between the sexes. Wilcoxon tests were also run on the differences between the pre- and post-tests to measure change in attitudes for women and men.

Table 4 shows the mean responses for the same students, except each gender group has been divided into those who matriculated and those who did not. Here again, shaded cells or bold indicate significant differences between groups.

Students were included in the analysis of each individual question only if they responded to that question on both the pre- and post-tests. For most questions, the answer scale ranged from 1 = strongly disagree to 5 = strongly agree. For the questions dealing with

the students' confidence, the answers ranged from 1 = not strongly confident* to 5 = strongly confident.

V. 1995 Responses by Gender

As seen in Table 1, there were substantial differences between men and women with respect to their confidence in their abilities and skills related to engineering. In general, women were dramatically less confident than men.

Table 1	**1995 Class Responses**					
	Pre Test		**Post Test**		**Change**	
Basic Engineering Knowledge & Skills	**F**	**M**	**F**	**M**	**F**	**M**
Confidence in physics.	**3.45**	**3.89**	**3.37**	**3.84**	-0.08	-0.05
Confidence in calculus.	3.84	3.91	3.76	3.92	-0.08	0.01
Confidence in engineering.	**3.44**	**3.83**	**3.50**	**3.88**	0.06	0.05
Confidence in computer skills.	**3.20**	**3.55**	**3.24**	**3.73**	0.04	0.17
Engineering Skills						
I feel I know what an engineer does.	**3.12**	**3.50**	**3.40**	**3.64**	0.28	0.15
Creative thinking is one of my strengths.	**3.34**	**3.78**	**3.45**	**3.79**	0.12	0.01
I have strong problem solving skills.	**3.47**	**3.86**	**3.50**	**3.87**	0.03	0.01
I feel confident in ability to succeed in E.	**3.98**	**4.21**	**3.64**	**3.94**	-0.34	-0.27
I am good at designing things.	**3.15**	**3.63**	**3.32**	**3.68**	0.18	0.05
I consider myself mechanically inclined.	**3.23**	**3.81**	**3.31**	**3.85**	0.08	0.04
I consider myself technically inclined.	**3.35**	**3.87**	**3.33**	**3.86**	-0.02	-0.01
I enjoy solving open-ended problems.	**3.49**	**3.69**	**3.39**	**3.65**	-0.11	-0.04
Enjoy probs that can be solved diff ways.	**3.79**	**4.00**	**3.63**	**3.84**	-0.16	-0.16

Bold scores indicate significant differences between groups at $p < .01$.

* "Not strongly confident" is the actual wording which appeared on the questionnaire. Even though the literal interpretation of that phrase would mean anything other than "strongly confident," including being merely "confident," we feel the students interpreted that response as meaning that they were very much lacking in confidence.

Confidence in Basic Engineering Knowledge and Skills

According to the researchers at the University of Pittsburgh who developed the questionnaire (6), the four questions dealing with confidence in basic engineering knowledge and skills were those asking about physics, calculus, engineering, and computer skills. On three of the four questions, calculus excepted, the women indicated significantly lower confidence than the men at both the beginning and the end of their first semester, even though both groups performed at essentially the same level in that term. Interestingly, both sexes lost confidence in physics even though they did not attempt the course in the fall, with women declining by an average of 0.08 and men by 0.05. In computer skills, both gained in confidence; but the women gained by only 0.04 compared to 0.17 for men.

Confidence in Engineering Skills

On all nine of the questions pertaining to confidence in engineering skills, women scored lower than men on both the pre- and post tests. On the question dealing with confidence about ability to succeed in engineering, both sexes showed a decline over the semester; but women showed a greater decline. As a result, women, who at the beginning of the term were significantly more inclined to think the future benefits of studying engineering were worth the effort, changed their minds about that statement at a much higher rate. Thus, women were more inclined to be thinking about changing majors by the end of the fall semester.

Table 2	**Pre Test**		**Post Test**		**Change**	
	F	**M**	**F**	**M**	**F**	**M**
Future benefits of studying E worth effort.	**4.54**	**4.41**	4.17	4.14	**-0.38**	**-0.27**
Can think of majors more rewarding than E.	2.44	2.46	2.74	2.58	**0.30**	**0.12**
Have no desire to change to another major.	**3.66**	**3.82**	**3.40**	**3.67**	-0.26	-0.15

Bold scores indicate significant differences between groups at $p < .05$.

VI. 1995 Results By Gender Within Matriculation Status

In order to matriculate into an engineering discipline, students must complete a rigorous set of courses during the freshman year, including the first two calculus courses, general chemistry, physics, and either a computer science or second chemistry course. Students must complete those courses with a grade of at least "C." Once students have met these requirements, they apply to enter the major field of their choice, and their acceptance depends upon the cumulative GPA. An overall average of 2.90 or better presently guarantees admission into the discipline of choice.

Sixty seven (38%) of the women and 253 (48%) of the men were matriculants (M) at the end of the year, and the remainder in each group were non-matriculants (NM). Their

mean GPA's at the end of the fall semester and at the end of the entire freshman year (for those who finished both terms during the year) were as follows:

Table 3		Mean Scores	
	N	Fall GPA	Frosh GPA
Female M	67	3.54	3.38
Female NM	109	2.70	2.66
Male M	253	3.44	3.32
Male NM	279	2.52	2.48

As predicted by the AI regression equation, the women had a slightly higher average freshman GPA than the men in both the M and NM categories.

Table 4 shows the results to the key engineering questions by matriculation status and gender.

Confidence in Basic Engineering Knowledge and Skills

Among the matriculants, women initially were significantly more inclined to say they enjoyed the subjects of mathematics and science most (4.54 vs. 4.28), yet they were less confident than the men in physics, computer skills, and engineering, all three of which are traditionally male-dominated fields. While the female M generally gained confidence in these subject areas over the term, they were nevertheless still less confident than the men at the end of the semester. By the end of the term, the significant difference on the question about enjoying math and science most had disappeared.

The women who did not matriculate were also less confident than their male counterparts in the areas of physics and engineering from the beginning; and over the semester, that confidence generally eroded. Moreover, during the term the women also lost confidence in their computer skills, while the men gained in that area. Even though the men also generally lost confidence, they were significantly less likely than the women to indicate a desire to change majors.

Confidence in Engineering Skills

The women in both the M and NM groups were clearly less confident than the male students with regard to attributes associated with successful engineers. For example, the women began the semester less sure about their creative thinking abilities, their problem solving skills, their mechanical and technical inclinations, and their capabilities in the area of design. Even though the female M and NM generally gained confidence in these areas, they were nevertheless still less confident than the men in engineering skills by the end of the fall.

All of the students, on average, felt they gained insight into what an engineer does, and for the female matriculants, the gain was significantly greater than for their male counterparts.

Table 4	1995 Freshmen											
	Matriculants						Non-Matriculants					
	Pre Test		Post Test		Change		Pre Test		Post Test		Change	
Basic Engineering Knowledge and Skills	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Confidence in physics.	**3.62**	**3.94**	**3.60**	**3.98**	-0.02	0.03	**3.33**	**3.84**	**3.22**	**3.71**	-0.11	-0.12
Confidence in calculus.	4.03	4.08	4.00	4.17	-0.03	0.09	3.71	3.75	3.59	3.67	-0.11	-0.08
Confidence in engineering.	**3.42**	**3.85**	**3.53**	**3.92**	0.11	0.07	**3.45**	**3.81**	**3.48**	**3.84**	0.03	0.03
Confidence in computer skills.	**2.99**	**3.53**	**3.24**	**3.77**	0.25	0.24	3.34	3.57	**3.25**	**3.69**	-0.09	0.12
Engineering Skills												
I feel I know what an engineer does.	**3.07**	**3.52**	3.57	3.64	**0.49**	**0.11**	**3.15**	**3.47**	**3.30**	**3.65**	0.16	0.18
Creative thinking is one of my strengths.	**3.16**	**3.70**	**3.34**	**3.77**	0.18	0.07	**3.44**	**3.86**	**3.52**	**3.81**	0.08	-0.05
I have strong problem solving skills.	**3.46**	**3.93**	**3.58**	**3.89**	0.12	-0.04	**3.48**	**3.79**	**3.45**	**3.85**	-0.03	0.06
I feel confident in ability to succeed in E.	4.06	4.26	3.94	4.08	-0.12	-0.17	3.94	4.17	**3.46**	**3.81**	-0.48	-0.36
I am good at designing things.	**3.12**	**3.58**	**3.18**	**3.63**	0.06	0.05	**3.17**	**3.68**	**3.41**	**3.73**	0.25	0.05
Am confident about current study habits/routine.	3.61	3.32	3.40	3.23	-0.21	-0.09	3.12	3.04	2.87	2.74	-0.25	-0.30
I consider myself mechanically inclined.	**3.28**	**3.80**	**3.37**	**3.85**	0.09	0.05	**3.19**	**3.82**	**3.27**	**3.85**	0.07	0.04
I consider myself technically inclined.	**3.30**	**3.93**	**3.36**	**3.90**	0.06	-0.04	**3.38**	**3.82**	**3.31**	**3.84**	-0.06	0.01
I enjoy solving open-ended problems.	3.54	3.76	3.52	3.68	-0.01	-0.08	3.47	3.63	**3.30**	**3.63**	-0.17	0.00
Enjoy solving probs that can be solved diff ways.	3.87	4.03	3.72	3.88	-0.15	-0.15	3.74	3.97	**3.57**	**3.81**	-0.17	-0.16

Highlighted scores indicate significant differences between groups at $p < .05$.
Bold scores indicate significant differences at $p < .01$.

VII. The NC State University College of Engineering Class of 1996

In the fall of 1996, the NC State College of Engineering enrolled a freshman class of 946, including 210 (21.2%) women and 745 (78.8%) men. As was the case in 1995, the women had a slightly higher high school average, 3.96 to 3.90, but they had a lower average SAT at 1180 versus 1222. Again, the men scored substantially higher on the mathematics portion of the SAT, 637 to 601. The regression equation predicting freshman year performance estimated the women's average at 3.11, compared to 2.92 for the men. In the fall semester, the women posted an average GPA of 3.05, and the men scored a 3.02 average. All of the women and all but three of the men completed the fall term.

Following the pattern from 1995, the Attitude About Engineering questionnaire was administered to these students in the orientation courses during the second week of classes and again in the final week. With regard to the questions having to do with engineering knowledge and skills, the results were remarkably similar to those from the 1995 cohort, as seen in Table 5.

In looking at these data, one can see that even though they enter with academic credentials quite similar to their male counterparts -- with the exception of SAT-math scores -- the women arrive on campus with substantially less confidence. Moreover, even though the women perform at the same level with the men in their first term, they remain less confident at the end of the semester.

VIII. Focus Groups

In order to better understand first year engineering women's feelings about their level of confidence in their abilities to succeed in engineering, the COE decided to form focus groups of students from the 1996 freshman class. Two randomly selected groups of twenty women were invited by letter to attend two sessions to be held on successive days in late January, two weeks into the semester. Subsequently, a couple of days before the sessions, all of the students were e-mailed to remind them and encourage their attendance. A total of eight women showed up for the two sessions, four each time. Shortly thereafter, all 193 women who had not attended one of the two sessions were invited to yet a third focus group meeting; and again, four attended.

While the COE was disappointed that the attendance at these sessions was so sparse, there was nevertheless some good news in the fact that there were not scores of women engineering freshmen who wanted to attend the sessions to complain about the atmosphere in the College of Engineering.

Table 5	1995 Responses						1996 Responses					
	Pre Test		Post Test		Change		Pre Test		Post Test		Change	
Basic Engineering Knowledge and Skills	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Confidence in physics.	**3.45**	**3.89**	**3.37**	***3.84***	-0.08	-0.05	***3.32***	***3.91***	***3.37***	***3.85***	0.06	-0.06
Confidence in calculus.	3.84	3.91	3.76	3.92	-0.08	0.01	3.80	3.95	***3.63***	***3.97***	***-0.16***	***0.03***
Confidence in engineering.	***3.44***	***3.83***	***3.50***	***3.88***	0.06	0.05	***3.40***	***3.83***	***3.51***	***3.86***	0.11	0.04
Confidence in computer skills.	***3.20***	***3.55***	***3.24***	***3.73***	0.04	0.17	***3.12***	***3.70***	***3.30***	***3.77***	0.18	0.08
Engineering Skills												
I feel I know what an engineer does.	***3.12***	***3.50***	***3.40***	***3.64***	0.28	0.15	***3.16***	***3.46***	***3.41***	***3.66***	0.24	0.20
Creative thinking is one of my strengths.	***3.34***	***3.78***	***3.45***	***3.79***	0.12	0.01	***3.58***	***3.84***	3.57	3.71	-0.01	-0.13
I have strong problem solving skills.	***3.47***	***3.86***	***3.50***	***3.87***	0.03	0.01	***3.52***	***3.90***	***3.54***	***3.82***	0.02	-0.08
I feel confident in my ability to succeed in E.	***3.98***	***4.21***	***3.64***	***3.94***	-0.34	-0.27	3.99	4.16	***3.79***	***3.98***	-0.20	-0.18
I am good at designing things.	***3.15***	***3.63***	***3.32***	***3.68***	0.18	0.05	***3.27***	***3.62***	***3.34***	***3.59***	0.07	-0.03
I consider myself mechanically inclined.	***3.23***	***3.81***	***3.31***	***3.85***	0.08	0.04	***3.16***	***3.83***	***3.26***	***3.78***	0.10	-0.05
I consider myself technically inclined.	***3.35***	***3.87***	***3.33***	***3.86***	-0.02	-0.01	***3.36***	***3.90***	***3.39***	***3.84***	0.04	-0.06
I enjoy solving open-ended problems.	***3.49***	***3.69***	***3.39***	***3.65***	-0.11	-0.04	***3.43***	***3.68***	***3.47***	***3.65***	0.04	-0.03
Enjoy solving probs that can be solved diff ways.	***3.79***	***4.00***	***3.63***	***3.84***	-0.16	-0.16	3.91	3.99	3.72	3.89	-0.18	-0.10

Highlighted scores indicate significant differences between groups at $p < .05$.
Bold scores indicate significant differences at $p < .01$.

For the most part, participants were relatively happy and focused with their academic programs. When asked how they felt about being in the College of Engineering, they shared such words as "challenging," "motivated," and "competitive." Five women mentioned "pride." Words used to describe the College included "organized," "helpful," and "impressive."

Responses to a question about "the best thing that happened to you academically" at the University centered around being successful on tests (especially in math and chemistry courses) and the resulting confidence which this contributed. Comments to "the worst thing that happened academically" included having to work for courses (this being behavior very different from that in high school), getting lost in classes, and not being able to easily make A's. One woman recounted an incident of sexual harassment with her TA.

Non-academic successes included meeting new people, diversity, and making friends, whether in the residence halls or in a sorority. Non-academic challenges included wanting to manage time better, being isolated from family and friends back home, and having a bad roommate.

Many different factors influenced the participants' desires to become engineers. Participation in programs such as Summer Introduction to Engineering, Odyssey of the Mind, and Space Camp were mentioned. Five women cited their abilities in math and science as motivation to pursue their degrees. Three women cited the involvement of at least one parent in an engineering field as support for their academic pursuits in engineering. All women stated that they were planning to stay with their Engineering goals.

When asked about their perceptions of being a woman in the College of Engineering, most participants seemed to downplay their uniqueness:

- The "ratio is not a big thing; if people didn't say it, (I) wouldn't notice it."
- "People react differently to you when you say you are an engineer, but nothing bad."
- "I've met an equal number of men and women."

A few participants saw advantages because "we bring different aspects" to classes, and we can "get men to look at things in a different light." Other participants stated that they feel they have "something to prove." An African American participant felt "like I am a minority going into the field of engineering."

When asked if Engineering was what they thought it would be most of the participants replied "yes" although none had taken any engineering courses besides their orientation course and an introduction to the computing environment. A few participants commented on the problem-solving aspects: some said there was more than they thought, others wanted more experience in problem solving.

When asked for ideas to improve the atmosphere for female students in the COE, most women said this was hard to say. Some comments focused on the fact that the environment is "good, supportive, and encouraging" and there should be no special focus for female students only. Two participants commented on the need for a program for teachers and TA's to "teach the professors what's okay and what's not" in reference to sexual harassment. One woman highlighted a self-awareness program for the professors and advisors to say that "there are women coming into engineering even if they (the men) don't like it." Women engineers, she continued, could also have a program to learn they do not have to be stepped all over.

In summary, comments from these 12 first year women engineering students seemed to show a high level of confidence and commitment to their engineering pursuits. The participants were proud, challenged and motivated to be pursuing engineering curricula. External experienceships and math and science abilities were mentioned as often as parental influence in their motivation to pursue degrees in engineering. Special programs to assist women were not identified by these participants.

Subsequent to the focus group meetings, COE researchers determined how the women who attended the sessions had responded to the question about confidence in their ability in engineering. Only 3 of the 11 women (27%) who responded to that question on the pre-test indicated they were confident. The equivalent percentage for all women responding was 46%. However, the difference between the two groups (focus versus non-focus) was not statistically significant. Thus, we conclude that the women in the focus groups had about the same level of confidence in their engineering abilities as all women in the cohort.

IX. Conclusions

The women in these freshman cohorts began their college careers less confident, on average, than the men about their ability to succeed in engineering. And even though they performed academically about the same as the men, they lost more confidence in that ability than did their male counterparts. Indeed, the difference in the level of confidence between men and women is so pronounced that the men from the 1995 cohort who did *not* matriculate were significantly more sure of their ability to succeed in engineering than were the women who did matriculate.

However, the sparse turnouts to three focus groups specifically advertised as an opportunity to discuss "the climate for female students in our college" would seem to indicate that the first year women are not concerned with the academic atmosphere in which they are studying. Indeed, the women who did attend the focus groups, even though they scored significantly lower than their male classmates on their confidence in engineering, actually appeared to the focus group facilitator to be quite self-assured and happy with their academic situation.

One possible conclusion one might reach is that the women who enroll in the college of engineering are not so much lacking in confidence about their abilities to succeed in the program as they are expressing a healthy respect for what they are undertaking. Perhaps the problem is that their male classmates are over confident.

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