

Assessing Success: Female Engineers at The Cooper Union

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At the Cooper Union School of Engineering, female students account for about thirty five percent of the student population. This figure has held constant for the past ten years. Rather than trailing male students, female engineers at Cooper show a remarkable success in various areas, as measured by positive perception of the school's curriculum and programs and academic results. This paper presents and analyzes the basic evidence of female success at Cooper for the past years. It also provides a context to understand and pursue success by female engineering students elsewhere. Rather than providing their own interpretation of the data, the authors asked the female students themselves to give their opinions by responding to a questionnaire. The results of this survey, conducted among female engineering students, are included and commented.

The Admissions Process

Determination of the success of female engineering students begins first with an investigation of female student admission and attendance in The Cooper Union School of Engineering. Data was assembled with respect to the number of female students who applied to the school of engineering, the number admitted, and the number which accepted the offer of admission. The statistics, which include data from 1995 to 2000, were then compared to male students and the total amount of students who applied, were admitted, and accepted admittance to the engineering school. The collected data is displayed in Table I.

Traditionally, there are a greater number of males than females who apply to engineering schools. This trend also occurs at Cooper Union. Although this is the case, statistical examination of the percentage of female students offered admission versus their male counterpart shows that the percentage of female students offered admission for the aforementioned time period has usually been higher than the percentage of male applicants accepted. As displayed in Figure 1, this is also true for the percentage of admission offers to female students versus the overall offers of admission. Even in 1999,

when the percentage of female students offered admission was not higher than male students, the data was not statistically significant. Admission differed by one percentage point between the two groups.

The percentage of female students who accept offers of admission is also important with respect to the success of female engineering students. The success of Cooper Union female engineering students is directly related to the number which decide to attend. Figure 2 displays this data. It is important to acknowledge that, of the female students offered admittance, except for those from 1996, over 50 percent accepted admission. The figures for female acceptance were also no more than a few percentiles lower than that of male acceptances in the other years probed.

Evidence of Success

In this section we would like to present and comment on some strong evidence of success regarding female engineering students at Cooper Union. We take success to be the lack of significant gender differences in the statistical and assessment data collected. Further, whenever we find gender differences in the data gathered, they are favorable to the female students.

In Table 2 we have selected statistical data on academic performance by gender (the GPA's by number of years taken to graduate, the percentage of graduates in four and five years, and the percentage of drop outs). As we can see, there are no significant gender differences in GPA's in the cohorts considered. In all cohorts and for both male and female, the average GPA is over 3 points for those students graduating in 4 years. Figures for students graduating in 5 years are less representative since their number is small. A lack of differential patterns by gender can be observed as well in the percentage of graduates in 4 and 5 years. Likewise, the percentage of drop outs for the cohorts considered does not offer enough evidence to argue the occurrence of a gender gap at the Cooper Union, although for the years considered (1990-94) the female figures are slightly higher than those of the male students.

In addition to the academic performance data, we present the results, categorized by gender, of several assessments conducted at Cooper Union during the past few years. First, in Table 3, we present the results of a Student Self-Assessment which represents student perception of competency development. Figures in this table are the average of fifteen engineering courses assessed between 1997 and 1999. If we look at the average figures at the bottom of the page, the only gender difference to note

is the slightly higher percentage of females (20.1) than males (16) who say that they developed the competencies "to a very great extent." Conversely, the percentage of males who say that they developed the competencies "to a moderate extent" is slightly higher (16.9) than that of females (12.7). These small differences point to a better perception of competency development among females than among males. If we look at each individual competency, we see a similar pattern. More females say that they developed an ability to use technology, teamwork skills, life-long learning skills, and humanistic values "to a very great extent" than the males.

Tables 4, 5 include data from the Engineering Student Council Survey conducted during the spring of 2000. In Table 4 we see the results by gender of a question asking the students to evaluate the quality of a number of aspects of Cooper Union. Table 5 presents the responses to a question asking to rate preparation on a number of competencies. If we look at the average figures at the bottom of the table, we see that no significant gender difference is noticeable. There are of course some individual cases where the differences are greater, but this does not affect the overall results. Table 5 shows a similar pattern, although differences are somewhat more clear for average figures. For example, more female than male students say that Cooper Union has prepared them "moderately well" in the qualities or competencies included in the question.

Tables 6, 7 include results of an Alumni survey conducted during 1999. We present responses to questions on competency development and on non-engineering issues in design. Table 6 shows the percentage of respondents who believe that Cooper prepared them "very well" or "extremely well" on the competencies included in the question. Once again, average results are extremely even for female and male alumni. If we look at the individual competencies, we only find a few cases where the gender differences are over 3 percentage points. Most cases are below that. Therefore, there are no gender differences in the way alumni perceive their preparation at Cooper. Table 7 shows the percentage of alumni who believe that their major design experience addressed "to a great extent" or "to a very great extent" a number of non-engineering issues. There is here a difference that needs to be noted. The female figure for the most recent cohorts (between 1990 and 1995) is higher (26.1) than that of male students (19.4). This is another case in which we find differences in the data that favor female students.

Finally, in Tables 8, 9 we have included data from a survey conducted among the 2000 graduating class in the spring of 2000. The questions selected deal with the design experience and with the preparation and importance of a number of competencies. Both tables show mean scores on a 1 to 5 scale, where 5 is the highest score possible. In Table 8 we see that the females give slightly higher scores in almost all the issues, except "social issues" and "political issues." The average figure is 2.96 for the males and 3.19 for the females. We find a similar pattern when looking into departmental scores. Table 9 shows mean scores for the question on preparation and importance of a number of competencies. Again here, the average scores are not very different for males and females. Regarding preparation, the male score is 3.02 and the female score is 3.11. Regarding importance, the male score is 3.82 and the female score is 3.9. Likewise, differences in the individual competencies do not amount to more than 3 percent, and are negligible in most cases.

The Fall 2001 Survey

In order to probe the overall conclusion obtained from the statistics and assessments conducted during the past few years (namely, that there is no gender gap in the school of engineering at Cooper Union), we conducted a survey during the fall of 2001 among the female engineering students. We sent the questionnaire (which you can see in Tables 10, 11) to all enrolled female students, a total of 136. We sent it via email and obtained 73 responses, or 53.6 percent. This response rate can be considered high. Anonymity was never an issue because Cooper students have responded to other surveys in the past and have given their names. In the questionnaire we included new questions asking directly whether the students perceive any difference in the way they experience Cooper Union and in the way they are treated by peers and faculty. We also asked the students whether they would discourage other female students from studying at Cooper. Finally we wanted to know the opinion of the students about the higher rates of drop outs among female students.

The results of the survey are consistent with the results of previous assessments and confirm the impression that there is no gender gap in the school of engineering at Cooper. Female students do not feel that they are treated differently at the school. As we see in the responses to question 1 in Table 10 ("According to your experience, do you believe female students are treated differently than male students in the school of engineering?"), 65.8 percent of the respondents say that they are not treated differently, and 30.1 percent say they are. Further, female students believe that their experience at

Cooper depends on each individual, and has no bearing on gender issues. As we see in the multiple-choice responses to question 2 ("When you compare your experience at Cooper with that of your male counterparts, would you say yours is...?"), 71.2 percent of the respondents believe that their experience at Cooper depends on each individual; 24.7 percent think that their experience is similar to that of male students, and only 2.7 percent believe that their experience is different because of gender.

Most students do not feel discriminated against by faculty at Cooper. Students feel comfortable asking professors for academic help (74 percent do, as we see in the results of question 3), and the majority do not think that faculty treat female students differently than male students. 71.6 percent of the respondents disagree with the statement proposed in 5 ("Faculty tend to treat female students differently than male students"). Students do not see that the supporting staff is helpful in regards to retention. In question 4 ("The supporting staff (Dean of Admissions, Dean of Students) is helpful in regards to retention"), we see that over half of the respondents do not know whether to agree or disagree with the statement proposed, probably because they are not aware of the work of the supporting staff. Further, 13.7 percent of the students do not think that the supporting staff is helpful. A similar sense of confusion arises from the responses to question 6 ("I feel there is outreach for me and my needs as a female"). Responses to this question are almost evenly distributed among those students who agree that there is outreach for females, those who disagree and those who do not know.

Finally, the responses to question 7.1 ("Would you discourage other female students from entering the engineering school at Cooper?") are very telling. When asked whether they would discourage other female students from entering the engineering school at Cooper, a staggering 89 percent say "no," and only 9.6 percent say "yes." This is a clear indication that the issues facing female engineering students at Cooper are of secondary importance and do not compromise the loyalty of the student body to the school and their satisfaction with their experience at Cooper Union.

The patterns of responses presented above for overall results hold when we look at the data by cohort, as in Table 11. Only the individuals in the 2001 cohort are above average in question 1. In each cohort, however, the percentage of students who think that female students are not treated differently is higher than the percentage of those who think that such is not the case. In question 2 we see that the pattern commented above for overall results remains. Most students in each cohort chose to respond that

their experience is either "similar" to that of males, or that it "depends on each individual." Except for students in the 1999 cohort, most respondents chose to say that "it depends on each individual."

Feeling comfortable asking professors for academic help does not seem to have a close correlation with the length of study at Cooper. In all cohorts except one, most students feel clearly comfortable asking professors for help. The case of the 2000 cohort is exceptional. In question 5, most respondents in each cohort disagree that faculty tend to treat female students differently. Results for question 7.1 by cohort are consistent with the overall results. An overwhelming majority of students in each cohort would not discourage other female students from studying at Cooper.

In Table 2, the data suggests that a higher rate of female students drop out. As a result, female students were asked why they thought that more women than men decide to leave Cooper Union. The question read: "There is evidence that, at Cooper, female students drop out at higher rater than male students. Why do you think this is so?." The responses were varied. Several of the students stated that it was difficult to believe that the female dropout rate was higher than that of the males because they experienced more males leaving than women. There were also several responses which alluded to the fact that women set higher standards for themselves than their male counterparts and therefore placed more stress upon themselves. As a result, they may have been unhappy with the intense pressure level causing them to rethink their decision and change their major. Because of Cooper Union's narrow focus, they were forced to leave in order to pursue a different field. It was also suggested that since there are more male students than female, one female leaving would have a significant effect on the retention rate. Other responses noted that some women had left because of unmet expectations. Due to this school's size, some of the social outlets available at larger universities are not as available at Cooper.

The Cooper Union School of Engineering is dedicated to engineering and two responses suggested that broadening the school's focus would aid in retention of female students. Lastly, women being in the minority was offered as a possible reason for the trend seen in Table 2. One positive result of asking this question was that many of the responses stated that the lower retention rate among female students is not caused by a different treatment of women by faculty and staff.

Conclusions

1. Female students at Cooper show academic results which are as good or better than the males. Female students get similar GPA's or even higher GPA's than male students, and graduate at almost the same rates over the years.
2. Although the drop out rates appear to be slightly higher for female students, further investigation and longitudinal tracking is needed to determine whether this is a truly "gender" feature. The results of our survey indicate that women leave Cooper Union because of unmet expectations after setting higher standards for themselves.
3. Female students have a positive perception of the school's curriculum and programs. They feel equally or slightly better prepared than male students on a number of competencies. There are no gender differences in the way students rate a number of aspects of Cooper Union. When gender differences are observed, they are positive for female students.
4. There are no gender differences in the perception by Cooper alumni of the school's programs and in their perception of competency development.
5. Further investigation is needed in order to determine the causes of female drop out rates at Cooper Union. Exit interviews to female students may prove very relevant for this point.

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