CLUSTERING TO IMPROVE RETENTION OF WOMEN IN ENGINEERING

Michael H. Gregg          Dr. Deidre Hirschfeld          Dr. Bevlee Watford
Virginia Polytechnic University and State University
Blacksburg, Virginia

In an effort to improve retention rates of women in its engineering programs, Virginia Tech has instituted voluntary gender clustering in the first engineering class (EF1005 - Engineering Fundamentals, Problem Solving and Computer Programming) offered to incoming freshman and transfer students. This clustering was not intended to produce women-only sections of this class but to create multiple sections which are ethnically diverse and contain a greater number of women in each section. Gender clustering facilitates the formation of study groups by the students with their gender peers. The clustered sections were also supported by academic workshops conducted by upper-class students who were specifically trained as workshop leaders. The workshops were modeled after the program developed by Dr. Ray Landis and Dr. Kay Hedspeth, California State University-Pomona, for enhancing the retention of minority students in engineering. The instructors involved in the clustered sections have attended training sessions on improving minority retention.

INTRODUCTION

Virginia Polytechnic Institute and State University will award bachelor degrees to roughly 4300 students this academic year. Of these degrees, about 42% or 1800 will be awarded to women. Virginia Tech's College of Engineering will award 950 bachelor degrees along with 450 Masters and over 100 Doctorates. Of these Bachelor of Science Degrees in various engineering disciplines, only 160, or roughly 16% will be awarded to women.\(^1\) Nationwide, more than 10,000 women will earn engineering degrees this year, whereas over 50,000 men will attain this academic level.\(^2\) Despite the fact that women are over 50% of the population of the United States, engineering school enrollments do not reflect this gender dominance, and the engineering profession remains a predominantly white male bastion.

Undergraduate enrollment at Virginia Tech, currently at over 19 thousand per year, has seen a markedly consistent male to female ratio for the past six years. It is anticipated that Tech's 1996 enrollment statistics will show nearly 11,500 men and 7,600 women, matching the 6 year ratio trend of 60/40 male/female. Not surprisingly, the male to female ratio is higher in the College of Engineering. This ratio has also remained steady over the past six years at 83 percent male, 17 percent female. Numerous studies have been conducted over the past decade addressing low enrollment rates and poor retention rates among females in the engineering field.\(^3\) 45 Collaborative learning processes have received extensive study. One study was initiated in the Fall of 1992 at Virginia Tech,
funded through SUCCEED, to investigate the effects of voluntary collaborative learning or group study among freshman engineering students. Although many collaborative learning programs are structured, requiring students to participate and attend scheduled study-group sessions, Virginia Tech's program was voluntary. Two goals of the clustering program were to 'shape students into a supportive group in which every student knows the others......and has a sense of group spirit and cohesiveness' and "to encourage students to study together."

GENDER CLUSTERING

Virginia Tech instituted a pro-active minority engineering program in 1992. This program was aimed generally at increasing the enrollment, retention, and graduation rates of racial minorities within Virginia Tech's College of Engineering. Success with this program has resulted in its expansion to include all under-represented groups, including women of all races.

The cluster schedules were devised to provide a reasonably representative proportion of females in their engineering classes. The intent was to provide a 50-50 ratio in the clustered sections. In prior years, typical class make up has resulted in three or four female students in any one section of EF. This proportion is not seen as conducive to promoting non-organized clustering of female students. With only a handful of gender peers in each section, it is unlikely that these students would share similar schedules, the same sections of their other 6 freshman classes, residence in the same dorm or on the same floor, racial similarities, or other factors which would normally promote clustering among their male counterparts. The males in each class (at least the white males) have a much larger population of gender peers from which to generate study groups. Clustered sections were therefore devised with 10 or more females in each -- intended to be sufficient to provide the same clustering opportunities enjoyed by males. It was explicitly intended that no sections be women only. On the other hand, clustering the majority of the women in 8 sections of these introductory classes effectively reduced the number of women in the other 32 sections of these classes. The result is that although more group study opportunities were presented to the majority of the freshman women, those that did not enter a clustered section were more gender-isolated.

Of the eight sections of EF1005 that were intended to be gender clustered sections in the fall of 1995, only one had a 50% female enrollment. Three others had roughly 30% females, and the remaining 4 sections, fewer than 10 female students. In addition, instructor scheduling conflicts resulted in the two Chautauqua-trained instructors teaching 7 of the clustered sections, with the 8th taught by another member of the faculty of the freshman division. None of the spring semester EF1006 classes were intentionally gender clustered. At least one section had a greater than 50 percent female membership, in part due to the tendency of students to request the same instructor and class time for the second semester EF class. This may also be a successful result of the clustering begun in the fall semester. Female students in fall semester study groups may have attempted to schedule the same sections of their engineering classes for the second semester.

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RESULTS

A survey was distributed at the end of the spring semester to students in the EF1006 and EF1005 classes. Thirty-five percent of the freshman (519 of 1466) returned the survey forms. Distribution of the survey was voluntary among faculty, with some faculty members refusing to use class time to distribute and collect forms. In addition, about 200 freshman are not enrolled in either EF class.

Of those respondents, 53% participated to some extent in study groups. On a gender basis, 66% of the women and 55% of the men participated in these groups. Of those in study groups, 69% indicated that their study group was non-gender segregated. Again, within study groups, 55% of the men indicated that their study group was single-sex, whereas 33% of the women had same-gender study groups.

Fifty-three percent of the students in study groups indicated that the study group was effective and accomplished its goals. By gender, a larger portion of the women (64%) than men (51%) felt the study groups effective.

Seventy-one percent of all respondents indicated that they were ‘comfortable’ in their engineering classes - 72% of the men and 68% of the women. Eighty-two percent of the respondents indicated that they were not ‘isolated’ from their ethnic/racial/gender peers - 79% for men and 84% for women. Sixty-seven percent of the respondents indicated that they received a fair grade in their introductory engineering classes - 65% male and 69% female. Results, at best, can be described as tentative. In the fall semester, participation in the WEST workshops was less than had been anticipated. Instructors in clustered sections have not, intentionally, modified their approaches to the topics to accommodate these students. Because of the administrative difficulties of registering these students in special sections of EF1005, and the associated complications with the rest of their academic schedules, faculty support of the clustering process has not been overwhelming. More than one faculty member felt that ‘all students should be treated exactly the same.’ Questions need to be addressed as to whether this year’s entering freshman class is a statistical norm, as evidenced by SAT’s, high school class rank, and college level success.

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1 Projected data based on 1990 through 1994 graduation statistics. Institutional Research and Planning Analysis, Virginia Polytechnic Institute and State University
4 ASEE PRISM, March ’96, ‘Briefings’, pg 15