

A Quarter Century of Women and Minorities in Engineering at Northwestern University

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This presentation is not that of a planned research study, but rather is a review of over twenty-five years of experience with women and minority students in engineering at Northwestern University offered in an anecdotal mode. This is admittedly a focused view and not necessarily one representative of circumstances in other institutions, but it has provided an opportunity to observe some general behavior and expectations on the part of students.

Northwestern's experiences have been many during this period. In the seventies, we were involved with Inroads, in which an on campus summer resident program was held for minority high school students with the intent of orienting them to math, science, and engineering. In June 1975, the Big Ten plus schools joined to establish CIC-MPME, Midwest Program for Minorities in Engineering, a consortium funded by the Sloan Foundation to develop a variety of approaches to bring more minorities into engineering. Later, from 1983 to 1988, there was activity with and membership on the board of the Chicago Area Pre-College Engineering Program (CAPCEP), a program to develop curricula and instruction in the Chicago Public Elementary Schools. However, our attention in this particular discussion is given to following the continuous effort from at least 1970 to the present to increase the numbers of women and minority students entering and graduating in engineering at Northwestern.

Background

Beginning in 1959, the engineering school organized to centralize in the school instead of in the university for counseling, advising, record keeping, tutoring and other undergraduate support needs. Consequently, when the special needs of minority students received attention there was no thought of setting them aside in some separate approach, but rather to address them within the existing organization. This was thought to be appropriate in view of the presence of an experienced and successful staff in undergraduate engineering and also giving consideration to the size of the engineering school which was not large enough to establish many separate organizations for the same purpose.

Further, in the early development of the tutoring program in engineering an important lesson was learned. In an effort to bring the benefit of tutoring to bear at an early phase, we identified, on the basis of high school records and board scores, those students most likely to find advantage in the program and invited them to utilize the service. There was a backlash effect when this selectivity was realized and there was accusation by the invitees that they had been "identified for failure". Clearly, the experience had not been helpful to the students' personal pride and confidence. This episode was indelibly imprinted



in our minds and always present in our instincts in working with future students including an increasing number of minority students.

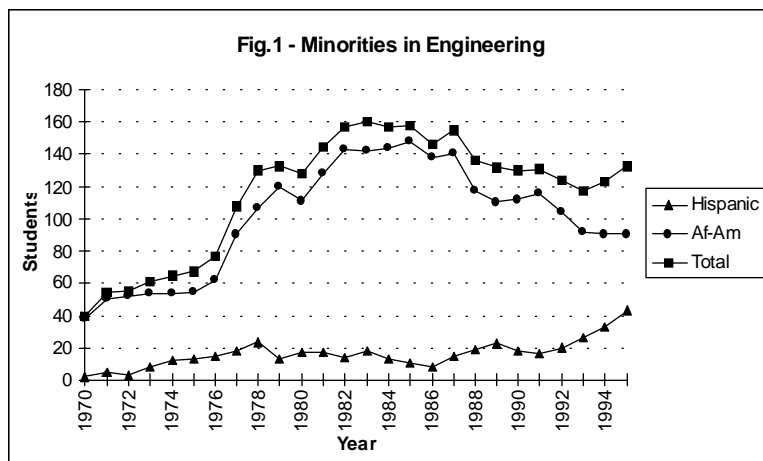
Years of experience with the admission process and criteria has provided confidence that any student admitted to engineering at Northwestern has the intellectual ability to succeed. This provides an honest and forthcoming attitude emanating from the undergraduate engineering office that admitted women and minority students belong very naturally in engineering and are expected to succeed academically.

Thus, two guiding principles were recognized from the outset of our minority effort: (1) there should be no separation of academic support programs, and (2) success would be expected from all students admitted to engineering programs.

Early Minority Experiences

In 1965, Northwestern University set forth a plan and developed a concerted effort to bring an increased number of minority students into undergraduate studies. The initial efforts were directed toward African-American students in Chicago area schools. [Throughout the first part of this discussion, the use of the term minority equates to African-American since this ethnic group received our attention and was the only group with significant enrollment.] Of the students brought to Northwestern under the program, a few, but very few, enrolled in engineering. Since the number was small, (3,4,3,7 in years 1966 through 1969) it was felt that attention could be directed to the individual to meet any needs on a personal basis. Although we did get to know these students very well and responded to apparent need for support, there was no African-American engineering group with which to associate and the students felt somewhat overwhelmed by the school and engineering studies.

Only 6 out of the 17 students who enrolled as freshman in engineering finished in engineering in the subsequent four year period, a rate of 35.3%. However, 5 did receive a bachelor's degree in another school of the University and 6 withdrew or were dismissed. This situation was considered to be less than satisfactory and a better plan was sought.



The Seventies

The minority students admitted to engineering in 1970 numbered 24 up from 7 the previous year and clearly the largest group to that date. With the help of some faculty members who volunteered their time, a pilot summer orientation was setup as a development program for minority students in science and engineering. In the fall quarter we convened all of the minority engineering students with the dean to try to determine what the group as well as the individual needs might be and how they might be met. This 1970

advisory group and the summer orientation provided the seed for what became the full program by the middle of the decade.

During this period, several formats for pre-freshman summer orientation were utilized and several suggestions for developing a group identity were followed. At one point a “Support Program for Black Freshman in Tech” was instituted in conjunction with a black engineering faculty member and five black graduate students. The intent was to provide a “big brother/big sister” arrangement and focused tutoring.

Taking 1970 as the reference year, the subsequent growth and a later downward trend of minority enrollments are shown in Table 1 and Fig. 1.

The first half of the decade of the 70’s saw the freshman enrollment rise to 69 or 6.4% of the class and the number of graduates four years later to 50 or 5.4% of the class. The overall B.S. to freshman ratio was 0.725 (or 72.5%).

YEAR	FROSH ENROLLMENT			ENROLLMENT ALL CLASSES			B.S. DEGREES		
	AF-AM	TOTAL	%AF-AM	AF-AM	TOTAL	% AF-AM	AF-AM	TOTAL	%AF-AM
1966	3	204	1.5%	3	736	0.4%			
1967	4	244	1.6%	6	764	0.8%			
1968	3	221	1.4%	7	777	0.9%			
1969	7	235	3.0%	14	809	1.7%			
1970	24	208	11.5%	38	786	4.8%			
1971	17	213	8.0%	50	768	6.5%			
1972	13	177	7.3%	52	718	7.2%	1	137	0.7%
1973	16	227	7.0%	53	757	7.0%	2	151	1.3%
1974	12	206	5.8%	53	789	6.7%	3	141	2.1%
1975	11	247	4.5%	54	884	6.1%	7	149	4.7%
1976	24	286	8.4%	62	1014	6.1%	10	165	6.1%
1977	27	297	9.1%	90	1117	8.1%	7	178	3.9%
1978	28	324	8.6%	107	1218	8.8%	13	212	6.1%
1979	36	283	12.7%	120	1228	9.8%	13	221	5.9%
1980	24	312	7.7%	111	1299	8.5%	13	232	5.6%
1981	36	291	12.4%	128	1281	10.0%	23	282	8.2%
1982	37	300	12.3%	143	1334	10.7%	25	301	8.3%
1983	39	358	10.9%	142	1420	10.0%	21	287	7.3%
1984	39	279	14.0%	140	1332	10.5%	16	298	5.4%
1985	42	279	15.1%	148	1292	11.5%	30	316	9.5%
1986	25	265	9.4%	138	1247	11.1%	32	308	10.4%
1987	30	310	9.7%	140	1176	11.9%	27	329	8.2%
1988	31	282	11.0%	117	1112	10.5%	29	275	10.5%
1989	31	308	10.1%	111	1139	9.7%	41	262	15.6%
1990	27	262	10.3%	112	1167	9.6%	14	207	6.8%
1991	27	350	7.7%	115	1254	9.2%	23	271	8.5%
1992	23	352	6.5%	104	1308	8.0%	23	277	8.3%
1993	18	328	5.5%	91	1309	7.0%	25	294	8.5%
1994	27	365	7.4%	90	1408	6.4%	19	240	7.9%
1995	24	347	6.9%	90	1419	6.3%	19	297	6.4%

In 1972, the total enrollment in engineering at Northwestern reached a clear low point and it was concluded that any real growth in the future would come only from the inclusion of significant numbers of women and minority students. Thus, additional incentive was provided to that already held which was based on the double edged feeling that engineering provided a career opportunity that should be made available to more women and minorities and that the profession could be enriched by a more diverse makeup of participants.

The Northwestern Society of Black Engineers

By the mid 70’s much of what had been seeded in the previous five years began to come together. The

students, who previously had several informal arrangements, in 1975, seeking a stronger group identity with higher visibility, organized formally as the Black Students in Technology and Science (BITS). The following year, 1976, the group reorganized with a new constitution as the Northwestern Society of Black Engineers (NSBE) and subsequently affiliated with both the National Society of Black Engineers and the National Technical Society. Although there were these external affiliations, NSBE at Northwestern concentrated strongly on local issues and the academic and professional welfare of its members. The stated goals were three, given priority as: (1) academic achievement, (2) professional development, and (3) increased minority participation in engineering.



Academic Achievement, the first goal, was held highly and was interpreted as the pursuit of academic excellence on the part of every member. Immediately following formation, NSBE received University recognition as a student organization and within engineering was assigned an office in the Technological Institute Building. With their own office as a gathering and meeting place, the members saw the advantage of the “fraternity model” and its potential in their own circumstance. Students collected notes, homework problems, quizzes and exams for a course file in the office. They organized and scheduled study groups, study marathons and tutoring arrangements. Upper-class students worked with lower-class students, but they also recognized clearly the advantages of the all Tech Tutoring Program (TTP) and strongly recommended its use to the members. TTP is used approximately 40% by minority students who make up only about 10% of the school’s population. For new students NSBE began publishing the NSBE Freshman Information Handbook (A Survivor Guide) which has been revised and issued annually. Other activities included a Freshman Orientation Mixer at which time new students were introduced to their individual Big Brother/Big Sister, and student initiated Scheduling Workshops which were held each quarter to allow upper class students to help younger students in scheduling and planning for class clusters of minority students. Clearly the goal of “academic excellence” held the primary position in NSBE activities. The increased retention and increasing number of minority graduates in engineering at Northwestern University in the later 70’s and through the 80’s gave evidence of the efficacy of these efforts.

Professional Development, the second goal of NSBE could be translated into the personal and professional development of its members. The self-help mode was also present when pursuing this second goal; in fact, the very organization and processes of NSBE lent to this goal. Every office and committee chairmanship was setup with the idea of an internship. Each committee had an upper-class chairman and a freshman or sophomore co-chairman who was thereby being groomed for leadership at a next level. The result was a student organization with unusual continuity, the usual weakness of student groups. For a considerable period the organizational arrangement and significant activity made NSBE the best student group on campus.

The NSBE agenda included sessions at regular meetings and special seminars devoted to leadership, personal and professional development as well as discussions devoted to success in studies. Alumni and representatives of company sponsors are engaged in regular events over the year such as: a Mock Interview Session, Student/Alumni Mixer, Industry Workshop, and the Annual Awards Banquet. A well produced resume directory has been a hallmark of the NSBE promotion of professionalism.

Increasing Minority Participation in Engineering, the third goal, was pursued through efforts to inform high school and middle school students of engineering, engineering education and the career opportunities therein. NSBE has always had some committee with the responsibility of outreach to younger minority students. At first it was the Admission Committee and more recently the Pre-College Initiative (PCI) Committee conducting activities such as participating in Engineering Open Houses, hosting visits by minority high school students and parents, serving as guides for tours of the Technological Institute Building, sending task groups to visit area high schools, and telephoning prospective students to inform them about engineering at Northwestern. For use in conjunction with these activities they have developed some of their own materials including information pamphlets and a very fine slide show which they continued to update and improve over time. As presented in an Admission Committee Report, their work provided a force in the organization’s pursuit of excellence.



The Minority Engineering Opportunity Program

A grant from the Department of Energy enabled a comprehensive pre-freshman bridge program to be offered during the summer of 1978. This outside help enabled all of the minority students who had been admitted to engineering studies at Northwestern to be invited to a five week resident program with all expenses paid including room, board and travel. Twenty students attended the first summer session, 10 men and 10 women. The students attended classes in mathematics, chemistry with laboratory, computer science, communications skills (both written and oral), study skills and career planning. Pre-testing in math, chemistry, and writing was used to identify individual strengths and weaknesses, allowing attention to those areas needing further development and for others the opportunity to provide additional challenges. Post-testing along with instructor evaluations enabled the diagnostics necessary to appropriate placement in the freshman year sequences and provide, as well, some measure of the summer's accomplishments.

The summer session also introduced the students to dormitory living and the campus where they became familiar with facilities and services such as the Freshman Engineering Office, the Engineering Administrative Offices, and other engineering and university personnel with whom there might be need to interact during the academic year. Four upper class minority students served as tutor-counselors in the dormitory providing guidance and serving as role models.

During the 1977/78 academic year, the Minority Engineering Opportunity Program (MEOP) was established with the simply stated goal of "providing minority students the greatest opportunity possible for a successful undergraduate education and a degree in engineering". With a maturing student group (NSBE) and the summer program in place, MEOP could be thought of in terms of three components: (1) a well structured five-week pre-freshman summer program, (2) support of a strong and active student organization, the Northwestern Society of Black Engineers and (3) academic year support primarily in counseling, advising and tutoring.

The lessons of prior years were observed and identification of any particular group as needing extraordinary help was avoided. Academic year support was provided in what might be described as a "transparent mode", that is support needs such as counseling, advising, Tech Ombudsman, and tutoring were provided on an open basis. This worked well because NSBE, with a first goal of academic excellence, made sure its membership was always aware and took full advantage of these resources. The pre-freshman summer program which provided orientation required to bridge a recognized cultural gap for many was an exception to the "transparent mode" approach and consequently has been often thought of as the total of MEOP. However, the total three components MEOP put in place in 1977/78, except for appropriate fine tuning, have remained in place to the present. Support in the "transparent mode" needs to be understood, it is truly support in a variety of forms, direct and indirect. The Undergraduate Engineering Office did at the outset and does to the present meet discernible need but does not do so on a set aside or exclusive basis. An office is set up for NSBE, but other all-engineering student groups are also provided offices. NSBE clerical and databasing needs are met on request and plans for study groups are facilitated by Records Office help in clustering in class. Tutoring resources, although not exclusive, are planned knowing minority needs.

The complementary three components of MEOP provided that which was needed to graduate more minorities in engineering well prepared for professional careers. Through the last half of the decade of the 70's and the decade of the 80's the trend in the number of graduates as well as the number of



freshmen was upward (Table 1). The last year that this clearly was evident was with the class that entered in 1985 and graduated in 1989. This period was accompanied by a generally improving retention ratio.

In 1982, in being interviewed for the Penick and Morning Report on the 1981-82 NACME Retention Research Program, the observer commented on the uniqueness of our “boot strap” approach (students helping students through NSBE) and the apparent value since results were quite positive.

The very best half decade record was with the freshman class entering in 1981 through 1985 and graduating in 1985 through 1989. In this period, the minority freshman numbered in total 193 making up 12.8% of those classes. From this group the graduates four years later numbered 159 making up 10.7% of those classes. Retention may be measured by the B.S./Freshman Ratio of 0.824 or 82.4%.

Several publications provided measure of our results on national scales. The publication “Black Issues in Higher Education”, December 21, 1989, vol.6, no.20 presented a compilation of Bachelors Degrees-Awarded to Black Engineering Students in which in terms of absolute numbers of students graduated, Northwestern was ninth in the nation, with five of the schools ahead of us being Historically Black Colleges or Universities and the other three being very large public institutions in areas of high African-American populations.

The NACME Research Letter, December 1991, vol.2, no.2, reported the “Comparative Performance of American Engineering Schools, computing graduation rates based on classes entering in 1980 through 1985. On this basis, Northwestern was listed with a graduation rate of 75.7%, ranking third in the nation, and with a yearly average number of graduates of 30. The two schools ahead of Northwestern graduated 11 and 9 respectively, a total of 20 between them.

Period of Concern

Looking at trend lines of freshman enrollment, graduates and graduation rates beyond 1985-89 provides reason for concern, trends are downward. Reasons for this arrest of growth would be expected to be complex and difficult to fully understand. Clearly since the inception of a minority effort at Northwestern, the number of Minority Engineering Programs across the country has increased measurably as the competition for freshman students has increased proportionately. The financial aid picture has changed in a variety of ways tending toward making education in a high cost institution more difficult to obtain. Northwestern offers financial aid on a need base only, which reduces its competitive position to schools that can offer merit awards. These are some factors that would come to play in affecting freshman enrollments. Disturbing, however is the direction the retention measure, B.S./Freshman 4 years previous, has taken which after the high point of 82.4% in the classes graduating from 1985 through 1989 fell to 72.2% for classes finishing from 1990 through 1994. The graduating class of 1995 did not help this picture with a 70.4% retention.

Cause and effect would be difficult to demonstrate, but the NSBE student chapter had some change of character and by some measures a diminution of organizational effectiveness and quality of activity in this period of concern. For over ten years, NSBE had an organizational arrangement, membership participation, training for leadership and quality of programs, and outstanding continuity from year to year that made it the premier student group on campus. Entering the decade of the nineties there occurred a shift of focus from matters internal to matters external, from academic excellence and leadership to greater concentration on the social and the political. Membership diminished and the team chemistry suffered.



Unfortunate in all of this was what happened to the goal of academic excellence which was of the highest priority and pursued with an unusual zeal in the first ten years. There was then a clear group effort to see to the academic success of every member. That had turned around to the point that academic excellence lost its listing as the first goal (and sometimes was not mentioned), attention to setting up study groups was set aside, and, in total, less effort of member helping member was in evidence. Instead, pressures came to bear from NSBE, from the other minority groups on campus or just from the void that existed for engineering administration to provide private tutors, organize study groups and take care of the many ways that students had helped themselves and others in the past. It might be expected that there would be a loss of participation and pride from group-accomplishment.

The National Action Council for Minorities Engineering (NACME) 1991 publication "Retention by Design" by Raymond B. Landis provided a check-off against which our efforts toward retention of minorities in engineering at Northwestern could be compared. Although the basic philosophy and/or assumptions are somewhat different, the important factors appear to be covered in what is done in the three components of MEOP at Northwestern. However, of ten factors, it appears that six, collaborative learning, community building, academic survival skills, personal development, professional development and structured study groups, are ones in which NSBE, during its most successful period, played a very key role. It might be expected that if activities directed towards these factors were weakened, retention likewise would be weakened.

MEOP Alumni Advisory Council

A view of the African-American student situation, at the present, still offers basis for concern but with some aspects that are brightening. The rapid descent of freshman input appears to have been arrested and overall enrollments although not stabilized or growing are trending down only slightly. The NSBE leadership is showing a renewed interest in a focus on the ideals and goals of excellence. This, in part, may be the influence of the MEOP Alumni Advisory Council, a group of successful engineering graduates, all of whom were active in earlier NSBE activities and who are seriously interested in the well being of present students. Minority alumni have always been active and helpful in engineering affairs but this particular council was formed in 1993 to address the concern with diminishing enrollments and graduation rates of minority students. Their approach has been comprehensive and they have given considerable time to studying reports and information but more so with talking to students, faculty and administrators. They found the direction that NSBE was taking somewhat alarming and made the recommendation that "NSBE should make academic excellence its number one priority such that the organization (meaning its members, leaders, and programs) becomes synonymous with academic excellence". Their recommendation goes on to point out that "all members, especially leadership, will have to accept responsibility for being academic role models first".

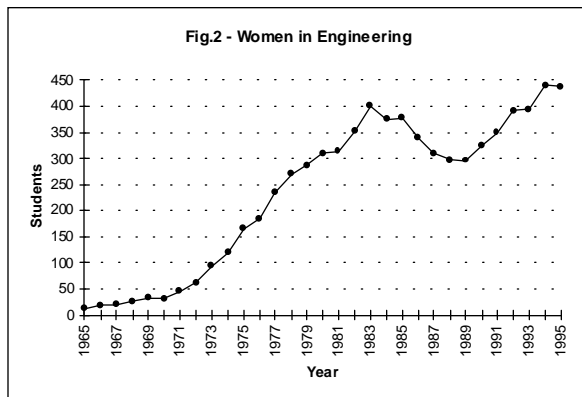
This advice can be helpful and it is the heart of the Advisory Council's continuing work with the students. The students do have high regard for the Council members, who were successful engineering students at Northwestern and successful in their professional pursuits and it is hoped that their advice may redirect student goals towards accepting only excellence.

Hispanic Component

To this point in this presentation minority has been equated to African-American since this is the way it was in the period discussed. There were always Hispanic students but their numbers were very few and there was no unifying force. Their needs were handled on an individual basis in our open system of



support. The makeup of the Hispanic group has changed with time and in 1991, when Engineering began to play a greater role with the Admission Office in recruiting this ethnic group, our students, although few in number, voiced interest in forming a chapter of the Society of Hispanic Professional Engineers (SHPE). We responded with an eagerness to see that this did happen and in a successful way. Our support took the same “transparent” form as with NSBE. The McCormick Undergraduate Engineering Office provides office space, clerical and office help to SHPE as they carry out their projects. In the brief period of their existence, SHPE has displayed the same sort of vigor and sense of direction that NSBE had earlier. It is somewhat early to evaluate SHPE and its contribution to its membership and the school but since it was formed, Hispanic enrollment has increased in engineering. This



may be seen in Fig. 1 which also presents the total minority population considering two components, African-American and Hispanic. Combining enrollments in this way tends to show somewhat of a leveling effect during the nineties.

Women in Engineering

To state the obvious, women in engineering at Northwestern have also always been a minority. However, in the fall of 1995, women numbered 458, making up 31.2% of the undergraduate engineering student body. This is clearly a strong proportion and in the national picture

always ranks near the top. This relatively high proportion of women has not been by chance, nor the result of having formalized a program for women. It is the result of a concerted effort in the Office of Undergraduate Engineering supported by the administration and faculty of McCormick. This has brought an overall ambiance in which women engineering students generally feel comfortable and most certainly confident. Vigorous recruiting of women faculty has put in place a visible set of role models, with as many as sixteen women (10% of a faculty of 160) being appointed at all levels of professorial rank and in significant administrative posts. Overall, the result in terms of graduation of well qualified women engineers is excellent.

Background — Women

From the inception of the Engineering School in 1909 until the formation of the new Technological Institute in 1939, only three women had enrolled in engineering and only one received a Bachelor's degree in 1929. After 1939 and until the mid-sixties, the enrollment and the graduation of women students was random and few. The last half of the decade of the sixties presented low enrollment of women, but enrollment numbers ever growing.

TABLE 2
WOMEN ENGINEERING

FALL	FRESHMEN			UNDERGRADUATE TOTAL			B.S. DEGREES		
	WOMEN	TOTAL	%	WOMEN	TOTAL	%	WOMEN	TOTAL	%
1965	7	211	3.3%	11	777	1.4%	1	136	0.7%
1966	7	204	3.4%	19	736	2.6%	1	137	0.7%
1967	4	244	1.6%	20	764	2.6%	1	131	0.8%
1968	11	221	5.0%	27	777	3.5%	3	132	2.3%
1969	12	235	5.1%	33	809	4.1%	4	117	3.4%
1970	10	207	4.8%	31	786	3.9%	6	144	4.2%
1971	22	217	10.1%	47	768	6.1%	2	138	1.4%
1972	26	177	14.7%	63	718	8.8%	6	151	4.0%
1973	43	227	18.9%	95	757	12.5%	9	141	6.4%
1974	34	206	16.5%	119	795	15.0%	8	148	5.4%
1975	50	247	20.2%	165	884	18.7%	12	149	8.1%
1976	48	286	16.8%	185	1014	18.2%	19	165	11.5%
1977	75	293	25.6%	235	1117	21.0%	25	178	14.0%
1978	83	324	25.6%	271	1218	22.2%	44	212	20.8%
1979	73	283	25.8%	286	1228	23.3%	48	221	21.7%
1980	75	312	24.0%	310	1299	23.9%	38	232	16.4%
1981	78	291	26.8%	313	1281	24.4%	66	282	23.4%
1982	96	300	32.0%	352	1334	26.4%	68	301	22.6%
1983	97	358	27.1%	399	1420	28.1%	69	287	24.0%
1984	76	279	27.2%	374	1337	28.0%	76	298	25.5%
1985	68	279	24.4%	377	1292	29.2%	84	316	26.6%
1986	66	265	24.9%	340	1247	27.3%	95	307	30.9%
1987	89	310	28.7%	310	1176	26.4%	104	336	31.0%
1988	66	282	23.4%	297	1112	26.7%	73	275	26.5%
1989	80	308	26.0%	296	1146	25.8%	70	266	26.3%
1990	83	262	31.7%	325	1167	27.8%	48	207	23.2%
1991	98	350	28.0%	350	1254	27.9%	76	277	27.4%
1992	114	354	32.2%	404	1343	30.1%	66	282	23.4%
1993	94	328	28.7%	394	1309	30.1%	85	294	28.9%
1994	120	365	32.9%	440	1408	31.3%	61	240	25.4%
1995	113	383	29.5%	458	1468	31.2%	83	297	27.9%

In 1970 there were 31 women enrolled in engineering programs at Northwestern. This number made up four percent of the overall enrollment of 786. That this was unique was only brought to our attention when a representative of an Ivy League school inquired as to how we had been so successful in recruiting women, in that we had the highest percentage of women in engineering in the country. It was realized that we were in a somewhat fortuitous situation, in that we were an engineering school within a private university, where the overall breakdown of undergraduates by gender was approximately fifty-fifty. Realizing this position, efforts were made to build on this and to increase our enrollment from this base of 4%. The enrollment table (Table 2) and the graph (Fig. 2) give evidence of the resulting growth that has taken place since 1970.

Activities — Women

As was stated previously, we do not think of any of the efforts that have been made or the activities that have taken place, as constituting a program for women, but there are three main areas of activities that have been sustained through this period of growth and which could be thought to contribute therein.

1. The Open House for Women was initiated in 1971 to get the attention of young women at the high school level in order to inform them of the excellent educational and career opportunities available to them in engineering. A secondary intention has been to showcase Northwestern University as a place to obtain an excellent education in engineering.

After twenty-four years, this program, now called Career Day, is still ably serving the same purposes. Whereas, in 1971 there was difficulty in finding speakers as role models from the very few practicing women engineers, today this is no problem. In fact, in the last two Career Days a full speaker schedule of successful women, representing a wide range of professional activity, have been drawn completely from our own engineering alumnae. This provides another positive way to present engineering education at Northwestern. The participation in these workshops in recent years has been extended to include teachers, counselors, and parents as well as students from elementary grades through junior college.

2. Recruitment Activities, coordinated with the Admission Office, are in part focused on women. This follows the conviction that there is both opportunity and need for women in engineering. The first women's brochure aimed at attracting women to engineering at Northwestern was developed in the 70's.

3. The Society of Women Engineers (SWE), at the present, is a strong force in student activities in McCormick. This is an organization that has grown from a beginning in 1974 as "Women in Tech." In 1976 this group became a chartered Student Chapter of the Society of Women Engineers. The chapter activities provide service to Tech as well as opportunity for members to develop organizational and leadership skills. These activities include:

- an annual Industry Day, this year attracting over 40 companies
- professional seminars
- a resume book
- an orientation brunch
- various social activities

Results, relative to women in engineering may be first displayed in Table 2, which presents enrollment of women and shows the remarkable growth in the number of women in engineering from 1970 to a peak in 1983. This growth is portrayed graphically in Fig. 2, which indicates the significant role played by the numbers of women in the overall increase in Tech enrollments between '72 and '83. It might also be pointed out that there was a concurrent increase in enrollments of women in engineering nationwide at this same time. However, while in this national enrollment picture an increase was demonstrated, the portion of these students completing the B.S. in engineering steadily declined to a low in 1986 of 58% graduating versus those that had entered four years earlier.

From our own experience, we did not realize that there was general concern as to the retention of women in engineering programs. From Table 2 a retention factor defined as the ratio of the number of women receiving a B.S. in Engineering in a given year compared to the number of women in the freshman class four years previous may be derived. Retention has been very good to excellent and always at or above retention for the class as a whole. In graduating classes from 1975 through 1995 the average retention of women is 91.4%, for men it is 87.2%.

Funding

Since 1978 with the advent of the five-week summer bridge program and its associated costs, we have needed external funding to sustain our minority efforts. These costs have included those of minority participants but not for any pay to regular faculty or administrative staff, such costs have been covered by the University.

In the first three years of MEOP, major support was received through the PREFACE program of the Department of Energy. NACME provided support in the fourth year and thereafter support was generated through contribution from various companies or industry foundations. Affirmative Action provided a climate in which such support was available to the extent that we could sustain our minority efforts on a reasonably stable basis. As we entered the nineties and cutbacks and downsizing were common, support from business and industry tended to diminish. A few companies discontinued providing such support and almost all companies reduced their contribution. In the last two years, in order to extend the summer program to Hispanic students and to conduct an experiment in collaborative learning, we have joined with a consortium of five other Chicago area schools to receive support through



the Alliance for Minority Participation program of the National Science Foundation. Presently our financial position is stable.

Summary Statement

Twenty-five years of experience with minorities and women in engineering has left us with some strong beliefs we feel appropriate in our circumstance.

1. We believe that academic support should be fully available but should not be established on separate minority or women bases in any normal circumstance.
2. We believe that a pre-freshman summer program providing intensive preparation and extensive orientation is a necessity for minority students who on average are entering an experience and community considerably different than in their high school.
3. We believe that every student, most certainly including minorities and women, admitted to engineering has the ability to succeed and we should not only let this be understood but also should challenge the individual to not only just succeed but excel.
4. We believe that group formation is necessary for minorities and women and the groups should be not only supported but should be challenged to provide leadership to the membership to bring about individual academic excellence.

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