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ABSTRACT

Statistics indicate that between 1977 and 1981, the number of graduate degrees in engineering awarded to members of minority groups in the United States constituted only 2.3 percent of the total number of master's and doctorate degrees awarded in the field over that period. A major reason for the relatively small number of minorities with advanced engineering degrees is the widely-held assumption that there are no barriers to minority access to graduate programs. In fact, when minority students assess their chances for success in graduate school, they confront such barriers as 1) the difficulty of locating supportive campus communities; 2) the difficulty of being admitted to the school of one's choice, considering the subjectivity of the admissions process; 3) the paucity of financial assistance grants for minority graduate students; and 4) problems of strained student-adviser relationships, often due to conflicting cultural backgrounds. Such barriers to access must be removed by intensifying minority recruitment efforts into graduate engineering programs; restructuring the admissions process and reformulating admissions criteria; insuring that minorities are aware of and can compete for the full range of financial resources available; and creating academic milieus conducive to fully developing minority graduate students' academic potentials. (Author/MJL)

Graduate Engineering Studies for Minorities

A Prospective

by
Howard G. Adams

GRADUATE ENGINEERING STUDIES FOR MINORITIES: A PROSPECTIVE*

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I am delighted to be able to speak to such a distinguished group of educators and practitioners. In particular, I welcome this opportunity to comment on graduate engineering for minorities and to add some thoughts to the discussion concerning an action agenda for the decade ahead.

Let me begin by saying that, todate, efforts to provide graduate study opportunities for minority students have been poor. Data supplied annually by the Engineering Manpower Commission (Table I) shows that the output of minority persons with advanced degrees in engineering, at both the Master's and Ph.D. levels, has remained relatively stable over the past five years.

TABLE I

DEGREES AWARDED IN ENGINEERING

	1977	1978	1979	1980	1981
Bachelor					
All Students	40,095	46,091	52,598	58,117	62,935
Blacks	844	894	1,076	1,319	1,445
Hispanics	658	734	1,008	1,008	1,513
American Indian	36	37	59	59	90
Master & Professional					
All Students	16,551	16,182	16,036	17,229	17,643
Blacks	147	201	159	162	182
Hispanics	210	231	205	249	276
American Indian	7	4	9	4	8
Doctorate					
All Students	3,814	2,573	2,815	2,753	2,841
Blacks	16	15	19	19	16
Hispanics	22	14	22	25	20
American Indian	1	3	0	1	3

Source: Engineering Manpower Commission Annual Reports: 1977, 1978, 1979, 1980, 1981

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* Presented at the 90th Annual Conference, American Society for Engineering Education, Texas A&M University, College Station, Texas, Wednesday, June 23, 1982.

If we total all the Master's and Ph.D. degrees awarded in engineering between 1977 and 1981, we find that of the total advanced degrees (198,437) only 2,261 or 2.3% went to minority students.

There are several reasons why minority students have not continued on to graduate school in the numbers that might be expected. Among the most crucial of these is access to institutions that offer advanced degree programs and to the resources thereof that would make successful entry and completion possible (Adams, 1982).

A major obstacle to an understanding of the plight minorities face in gaining access to graduate engineering programs is the persistence in the belief that minority students fail to go to graduate school because they are attracted to high salaried positions in industry and thus they opt for the jobs. From this line of thought, it follows that access barriers to graduate programs are down and that minority students bypass advanced studies as a matter of choice.

It is true many of the most able minority B.S. engineering degree recipients are lured into industry and away from graduate school. However, this should not be viewed as freedom of choice within an open "market place." In deciding on work over graduate school, the choice is not always made from equal options. Paramount to a decision about one's future, be it educational or vocational, is an assessment of possibilities for success (Willie and Adams, 1974). Minority students, when assessing their chances for success in graduate school, face barriers that appear insurmountable. Among these are:

1) Locating a campus community that is supportive of and committed to providing educational opportunity;

2) Being admitted and accepted to the graduate school of one's choice;

3) Finding financial resources to support the pursuit of a graduate degree; and,

4) Identify an advisor/mentor who wishes to work with and provide tutelage to a minority person.

Let me expand on each of these:

* Supportive Campus Environment: Students do not learn or grow in a vacuum. Minority students, like their majority counterpart, should be viewed as individuals who come to graduate school from anyone of a wide variety of educational, ethnic, family, economic, and social backgrounds.

They seek from their graduate study experience, opportunities to be taught and nutured while seeking recognition for who they are and hope to become (Adams, 1975).

For many minority students, even though they have been successful as undergraduates, graduate studies represent their first experience working independently and directly under a major advisor. And, because graduate departments tend to be small and close-knit, minority students need to be made to feel a part of the group.

To be conducive and supportive of the academic success of minority students, certain support systems need to be built in. These should include orientation to the campus and the department--facilities, faculty, staff, resources and other graduate students; counseling services--academic, personal, financial and career; housing referral; and transition sessions for the families (this is crucial for married students whose spouses and children accompany them to the university).

* Admittance and Acceptance: One important aspect of graduate education--that which makes it unique for the individual--is the consideration given by most students to the identification and selection of a school and program that meets their educational needs. Once identified, the next step is being admitted and accepted into the instituion of choice.

For minority students, this is a major undertaking and is made even more difficult when viewed in terms of the subjectivity involved in the admission process. This subjectivity begins with the identification of the student's ethnicity and carries over in the type of recommendation that is made by his/her professors; the admission committee's interpretation of the student's credentials; and finally, if admitted, having the student accepted by his/her department as a bonified and capable graduate student.

* Financial Support: Traditionally, graduate students in the "hard sciences" and engineering have not had to pay their way through graduate school. They have relied on fellowships, grants, or assistantships for support. While these continue to provide the bulk of graduate study aid in engineering, minority students have, for the most part, been denied the opportunity to fully benifit from these resources.

Because most monies in the form of fellowships, assistantships, and grants are controlled at the school or department level, minority students are not directed to these resources. Instead, most often they are guided to the Minority Affairs Office where several fellowships are usually housed (hardly

ever more than five), and all minority graduate students compete for these. In the larger university coffer is the hundred, in some cases, thousand or more other fellowships and assistantships that non-minority students are allowed to compete for. Since minority students are unaware of the total resources available to support graduate students, and because graduate education is expensive, they find the cost beyond their means.

* Student/Mentor Relationships: Crucial to the success of any graduate student is the direction and assistance that he/she receives from the advisor. In fact, successful students report that paramount to their completion of the degree was the interaction with and the encouragement and support given by the advisor.

Minority students, because of their ethnic backgrounds and past experiences with professors, often-times have problems becoming comfortable with the advisor. Likewise, because of stereotype views held by some professors, they have difficulty becoming a true mentor to minority students.

Conflicts, such as these, make the whole nature of the student/mentor relationship strained. And, since it is such a vital part of a graduate student's program, minority students are at a real disadvantage when this phase of the program does not work solely because of the student's ethnicity.

TOWARD AN AGENDA

Technological needs of the country for the 1980's and beyond--indeed our national needs--will require highly trained engineers and scientists from our graduate schools. If minority persons are to fully participate in the technological growth and development of this nation, they too must be highly trained.

To produce the engineering workforce needed and to insure that minority persons are produced in the numbers representative of their percentage in the population, will require that some fundamental changes occur in the way graduate engineering programs interface with minority students.

Some progress at reform has been made. However, on the issue of access, the essential steps that are needed are yet to be instituted. These steps will involve an altering in the pattern with which students are identified, recruited, admitted, supported, retained and graduated from advanced degree programs in engineering.

Specific Recommendations:

1) Efforts to Identify and Recruit Capable Full-Time Minority Students to Graduate Programs in Engineering Must be Intensified. One of the most glaring defects in graduate engineering programs is their weakness in recruiting talented minority students. Most of the blame for the underrepresentation of minority students in the graduate study pool is put on industry and its recruitment efforts. The fact is, however, graduate engineering schools have failed to develop initiatives to recruit minority students. Schools of engineering should take immediate steps to institute a minority recruitment program. And for the initiative to be most effective, each department within the school will need to make a genuine commitment to increase their enrollment of minority graduate students.

2) Restructure the Admission Process to Take Into Account a Wider Range of Criteria in Assessing the True Quality of Each Applicant. Academic grades are a legitimate part of a student's ability profile and are, therefore, important criteria. However, other factors such as motivation, previous work experiences and personal achievements can provide insight into an applicant's mental set for graduate study and can contribute valuable information for admission decisions. Whatever measure is utilized, the arbitrary use of grade point cutoffs as the sole index of ability should be discontinued.

3) Adequate Financial Resources Must be Made Available To Support Minority Students in Graduate Programs. The mode for distributing fellowships, grants, and/or assistantships must be revised and some mechanizm instituted to insure that minority students are made aware of and have the opportunity to compete for the full range of financial resources. Where possible, financial assistance should originate from departmental resources (Arner and Yates, 1974). This way, the student identifies with/and is a part of the regular academic community. Where the funds originate outside the department or are provided through special funds set up specifically for minority students, care should be taken to assimilate minority students into the regular program without special designation.

4) Immediate Steps Should be Taken to Create an Academic Milieu Conducive to Developing the Full Accademic Potential of Minority Graduate Students. The quality of the academic environment affects all graduate students, but it may affect minority students more acutely. Graduate faculty, because of their lack of contact with minority persons, often have negative attitudes about the abilities of minority students. These feelings can be picked up by the student and may undermine his/her self concept and lower his/her expectations. Schools of engineering should

develop a means for sensitizing faculty members to the needs of minority students. In particular, care should be taken to insure that as the quality of the academic environment is evaluated, the needs of minority students are considered.

Summary and Conclusion

Democratizing graduate engineering programs to make them accessible to minority groups has been slow. More specific, if we use as a measure of success, output--the number of graduates produced--the effort has been a failure.

Areas of concern that affect the success of the effort span the range of issues that affect all of graduate education. However, four areas appear to focus the problems of minority underrepresentation in graduate engineering programs:

* Low applicant pool.
* Inadequate admission procedures.
* Poor distribution of financial aid.
* Hostile academic environment.

Our past failures have been primarily as a result of our assumption that the barriers to access were down. That is not the case and therein lies our problem.

To address this problem will require that attention be given to the identification, recruitment, admission, and retention of minorities in graduate programs. Adequate financial resources will be required to insure that support is built into sustaining the effort.

We should not weight our commitment, however, in terms of cost. For the cost will be even greater to society if we fail to harness the energy and talents of minority students and utilize them to further develop the resources of this nation.

Today, most of the executives and managers in industry, business, government and academia have advanced degrees. The continued health and vitality of these groups depend critically on the availability of highly trained persons for positions of leadership.

Graduate schools, because they traditionally have provided the pool of talent from which this leadership is recruited, are in a strategic position to make a significant contribution towards increasing the participation of minority group members in these endeavors.

The challenge that lies ahead is to insure that minority students have access and choice of opportunity to pursue graduate study in engineering. We can think of no challenge more exciting, requiring all the creativity and vision we can bring to bear.

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