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Improving Minority Representation In Engineering Programs

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Abstract

It is common knowledge that minorities are under represented in the field of engineering. This fact is also evidenced in the representation of minorities in engineering programs, both at the Associate and the Baccalaureate levels. Generally, the few minorities who have from time to time enrolled in engineering programs have consistently proved that minorities are just as capable, and have just as much chance of completing their programs as do well represented groups. Different suggestions for improving the numbers of minorities in universities and colleges are presented.

Introduction

Historically, minorities have not had equal opportunity in pursuing academic goals. Though there has been a dramatic change to this situation over the years, minorities are under represented in colleges and universities at the present time. The numbers of minorities in professions that require associate, baccalaureate, or in some cases post-graduate degrees as entry level qualification, such as engineering, are low.

A catalog of explanations can be advanced as reasons for small numbers of minorities enrolling in engineering programs, but the intention however is to examine workable processes that could lead to a set of approaches that will attract more minorities to the engineering field. These can be listed as

(i) visibility
(ii) educating the youth about opportunities in industry
(iii) for those with entrepreneurial skills, the possibility of starting their own businesses.

Numerical Estimates

In discussing this issue, it will serve well to examine some numbers to establish that there is indeed a problem that needs attention. The state of Pennsylvania[1] is used in this exercise, but the concerns are the same nationally. The statistics presented show the numbers for specific years. It must be noted that a group of students were not followed from 1st Grade through graduation from college in collecting the following data.

	1996	1997	1998
American-Indian	16,996	17,228	17,727
Asian	185,441	191,423	198,364
African-American	1,159,828	1,161,863	1,166,151
Hispanic	245,400	255,384	264,895
White	10,426,191	10,385,380	10,354,314

Table 1. Population Estimates of Pennsylvania for the years 1996 – 1998.

	1996 - 1997			1997 - 1998		
	1st Grade	12th Grade	% Drop	1st Grade	12th Grade	% Drop
American-Indian	148	96	35	153	116	24
Asian	2,440	2,195	10	2,463	2,179	11
African-American	24,479	11,229	54	24,623	11,752	53
Hispanic	6,593	2,528	62	6,810	2,911	57
White	114,235	98,135	14	112,119	100,174	11

Table 2. Student numbers for the academic years 1996-1997 and 1997-1998.

Table 1 shows an increase for the different racial groups except White where it shows a decrease for the three years. Table 2 shows the number of students starting 1st Grade and 12th Grade for the academic years 1996-1997 and 1997-1998. As stated above, the table does not reflect groups of students who were followed from the first grade through graduation from college. The numbers and percentages however indicate some stability around some mean. There are significant drops in percentage in two minority groups. There is over 50 % drop for the African-Americans and around 60 % mean drop for the Hispanics.

	Full-Time			Part-Time		
	1st Time Freshmen	1st Time Prof.	Total	1st Time Freshmen	1st Time Prof.	Total
American-Indian	196	22	218	80	1	81
Asian	3,140	496	3,636	498	25	523
African-American	6,638	250	6,888	2,313	68	2381
Hispanic	1,872	129	2,001	452	3	455
White	69,380	3,381	72,761	14,111	264	14,375

Table 3. Student numbers for Fall 96: i.e. 1996-1997 academic year

The numbers in Table 3 are only those who enter the Freshman year and the Professional program for the first time. Professional refers to programs such as law, theology, medicine, optometry. In all, there 10 professional fields. There are some numbers not included, such as those who are repeating the 1st year of college or in the professions for

one reason or another. The numbers are shown for both full-time and part-time. There is a noticeable difference between Whites and the minorities.

	Associate Degree	Bachelors Degree	1st Professional Degree	Total
American-Indian	37	115	6	158
Asian	274	2,399	392	3,065
African-American	81	3,023	278	3,382
Hispanic	200	923	110	1,233
White	12,594	54,633	3,235	70,462

Table 4. 1996-1997 Completions Awarded

Table 4 shows the numbers for completions in the 1996-1997 academic year for 2-year Associate, 4-year Baccalaureate and 1st Professional degrees. There are other completions that take less than 2 years, and others that take more than 2 years but less than 4 years. These have not been included in the analysis. The completions are for all degrees awarded.

	Full-Time			Part-Time		
	1st Time Freshmen	1st Time Prof.	Total	1st Time Freshmen	1st Time Prof.	Total
American-Indian	199	11	210	99	2	101
Asian	3,115	449	3,564	508	22	530
African-American	6,697	250	6,947	2,191	56	2,247
Hispanic	1,957	97	2,053	477	8	485
White	71,962	3,246	75,208	14,247	285	14,532

Table 5. Student numbers for Fall 97: i.e. 1997-1998 academic year

	Associate Degree	Bachelors Degree	1st Professional Degree	Total
American-Indian	30	114	11	155
Asian	279	2,550	414	3,243
African-American	1403	3,258	239	4,900
Hispanic	209	1,092	129	1,430
White	12,186	55,160	3,081	70,427

Table 6. 1997-1998 Completions Awarded

Tables 5 and 6 are the estimates of the entrants at the beginning of the 1997-1998 academic year, and the graduates at the end of that year respectively. Here too, the numbers reflect only those starting the freshman year for the first time in Table 5, and those who graduated with a 2-year degree, a four year degree, or first professional degree in Table 6. Tables 3 and 5 show intake for both full-time and part-time. The estimates shown in all tables reflect the sums of numbers for both males and females. It must be

stated however that generally the number of females were usually higher than the number of males. Again the completions show all degrees awarded.

Observations from the Estimates

With the small increases observed in Table 1, come relative increases in 1st Grade intake for all the minorities in Table 2. The decrease of Whites in Table 1 also reflects a decrease in intake for 1st Grade in Table 2. What is striking however is the percentage drop from 1st Grade to 12th Grade. For both African-Americans and Hispanics the drops were generally over 50 %. American-Indians have the next noticeable drop of 24 % to 35 %. Asians and Whites show the least drop between 10 % to 14 %. When comparing Table 3 to Table 4, and Table 5 to Table 6, similar patterns are observed in that the numbers of graduates show decreases compared to the numbers of intake by similar percentage margins.

Strategies for Improvement

Focussing on the two minority groups that show the largest drops, it can be argued that great effort needs to be directed right at the beginning of the students time in school. The intention is to lay a strong foundation in the youths' interest in academic achievements, then build on this during their time in academia. Some factors that can be viewed as suggestions in improving the numbers are

(i) visibility
(ii) mentoring
(iii) academic support

(i) Visibility

When one considers the amount of exposure given to activities such as sporting events and entertainment, it stands to reason that many people will be attracted to these. Coupling the media exposure with the high salaries reported in association with these professions makes them very difficult to resist. No glamour is linked to the field of education in the media, and the return on investment in pursuing academic achievements is modest for the majority of people. This makes education rather unattractive compared to other professions as those referred to above, and engineering even less attractive when faced with the mathematics involved. The security in having a good education can never be downplayed. A strategy for presenting education as a viable option that will result in a good career choice is worth serious consideration. Engineering technology which stresses hands-on application and not the high level mathematics associated with the generic engineering program needs to be articulated clearly. The current technological growth translates to many job opportunities for engineering technology graduates. The position being presented here is that engineering, and for that matter, education can be given the visibility that will make it attractive, and professionals in this field can make viable contribution to this process.

Another form of visibility mainly in high schools, and colleges and universities is where a minority may be the only student of color[2] in a class. This can sometimes result in isolation and loneliness. In some cases, personal behavior and comportment are evaluated as representative of a whole ethnic group. In this sense, students are not allowed to be themselves as individuals and situations like these can result in discomfort. Improving minority student numbers to create greater diversity can improve the comfort level. Also, a mix of both minority and non-minority faculty and staff in the academic environment will help. Sensitivity of the faculty in discussion racial issues is has to be considered. It is important to provide a safe environment for honest open discussion on differences, and whoever leads such a discussion, for example the faculty member, should feel comfortable with diversity issues.

(ii) Mentoring

It is important to separate the role of advising from that of mentoring. Mentors fulfil the role of advocate[2] and help promote individual development and responsibility. The need for an advisor is stressed through out the course of a student's academic life, and the need for a mentor should be considered as equally important. While the advisor can help the student make proper course selection, the mentor will help the student steer a safe course through the college system.

The mentor will have the responsibility of assuming many roles. These may be a friend, a counselor, an advisor, a contact person, an intermediary and many more. The mentor can also be a role model for the student to emulate. Also, the mentor can maintain contact through the summer months.

(iii) Academic Support

Poor academic result is one of the major causes of students dropping out of school. This makes academic support very important in a student's life. Even where a student may be forced to drop out for any other reason, if the one is academically strong, the pull to return to college at a later date is stronger. Inadequate preparation in high school[3] always creates problems later for the student while in college. It is therefore important for the student to develop good learning habit very early in their academic life. The requirements in college for success is more stringent than in high school, and after making the transition from high school to college, the student is expected to improve his or her study habits. Students can receive academic support also in test-taking skills to improve their grades. In this sense, the student can receive tutoring through out the course of study to maintain high grades. Tutoring should not be viewed as essential for only weak students. It can be a source of building confidence even in high achievers.

The students' academic life is not the only important factor. The home environment is crucially important. Studying demands peace of mind and a clear head, and the home environment can provide these. It is a good strategy for students to be in a dormitory at least for their first year of college when they are expected to form new study habits, study groups, new friends and get involved in other activities that contribute to forming a

college life. It is important not to spread the minorities so thinly that they will feel isolated. It is a good idea to assign good numbers of minorities to the same floor.

Technology is growing very fast particularly in information technology and internet-related applications. Attendant to the growth, are many opportunities for developing small businesses. The idea of starting one's own business is a fact that can be stressed to the independent-minded individuals, and also to those who have entrepreneurial skills to encourage them while at college.

Conclusion

The need for improving minority representation in engineering programs in colleges and universities has been demonstrated by showing that over 50 % of those who start the first year of college for all programs drop out before the completion of their programs. Suggestions to improve retention have been presented. Improving the intake and retention numbers should improve the numbers for engineering as well. With the proper preparation and support many of those who start college will stay the course to graduation from college.

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