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Thinking About Graduate School

Abstract

Less than 18% of graduating engineers in the US go directly full-time to graduate school and very few women and underrepresented minority students go on to graduate school. Our country needs more diverse researchers in engineering, and students do not realize the creative and challenging work that they can obtain with a graduate degree. There are many reasons for the low numbers of graduate students in engineering: a lack of finances, a low graduating GPA, a belief that graduate school is only for those who want to become a professor in a university, a belief that you have to be a super “brain” to go to graduate school, a lack of information on the different types of jobs in industry for those workers with a graduate degree rather than an undergraduate degree, a belief that graduate school is just more undergraduate school except a lot harder, a lack of information and encouragement, and a lack of ever having considered attending graduate school. Many engineering and computer science students focus on graduating from a low-income life to a great job with financial security and freedom at last.

Engineering professors generally do not do a very good job of encouraging engineering and computer science students to consider graduate school. What can be done to get more of these good students into graduate school? Faculty can be encouraged to talk about graduate school in their classes and to their advisees. However, through academic scholarship programs students can learn that most or all of the above objections to going to graduate school are either not true or can be overcome.

This paper will describe the approaches used to inform engineering and computer science students about the advantages of graduate school. These approaches include: hearing graduate students talk about what graduate school is really like; informing students of joint BSE/MS programs; bringing in engineers from industry with advanced degrees, who describe the interesting work they are doing because of their graduate degree; encouraging students on internships to notice what jobs are done by BSE employees and what work is done by employees with a graduate degree; and talking to freshmen and transfer students about graduate school as soon as they matriculate into the Fulton School. The students are also encouraged to do research as an undergraduate which can sometimes lead to a graduate thesis topic. Hearing industry engineers with graduate degrees dispels the myth that a PhD in Engineering is only good for someone in academia.

The methods described in this paper were used to generate a 40% rate for non-transfer engineering and computer science students in an academic scholarship program going into graduate school full-time and over a 30% rate of such transfer students.

I. Introduction

For some time, there has been a growing concern about the future of the United States in terms of new discoveries and inventions. One of the people leading this battle cry is Professor Romer,

“a big-name Stanford University economist.”¹ He argues that discoveries don’t simply appear when inspiration strikes, but reflect the effort put into innovating. The bottom line for this concern is that the number of undergraduate engineering degrees being earned in the United States has been declining since 1996 and the number of engineering graduate degrees have been basically flat for the past ten years. The number of U.S. citizens earning graduate degrees in engineering has been declining, while the number of graduate degrees being earned by international students has been increasing. In 2002, less than 59% of the Masters degrees in engineering were earned by U.S. citizens or permanent residents.² In 2003, only 36% of the engineering doctoral degrees in the nation were earned by U.S. citizens or permanent residents.² Many of the freshly minted doctors return to their homeland.

In addition to the low numbers of U.S. citizens earning Master’s and Ph.D. degrees in engineering, the numbers of women and members of underrepresented minority groups continue to be very low. The increase in women earning PhD degrees is due to the increased numbers of international women. Table I shows the lack of diversity in engineering graduate schools.

US Earned Engineering Degrees	1995	2002
Master’s total	28,630	26,266
Women	4,632(16.2%)	5,574(21.2%)
Men	23,998(83.8%)	20,692(78.8%)
U.S. citizens/permanent residents	18,931(66.1%)	15,463(58.9%)
Women	3,297(11.5%)	3,442(13.1%)
Men	15,634(54.6%)	12,021(45.8%)
Black	665(2.3%)	738(2.8%)
Hispanic	711(2.5%)	855(3.3%)
Native American	43(0.2%)	57(0.22%)
	1995	2003
PhD total	6,008	5,265
Women	696(11.6%)	896(17.0%)
Men	5,270(87.7%)	4,346(82.5%)
U.S. citizens/permanent residents	2,386(39.7%)	1,898(36.0%)
Women	374(6.2%)	370(7.0%)
Men	2,012(33.5%)	1,528(29.0%)
Black	53(0.9%)	69(1.3%)
Hispanic	61(1.0%)	90(1.7%)
Native American	9(0.15%)	10(0.19%)

TABLE I. EARNED MASTER’S AND DOCTORAL DEGREES BY GENDER, ETHNICITY, AND CITIZENSHIP, 1995, 2002, 2003.²

For a fuller discussion of the trends in engineering graduate enrollment and on why ASEE needs to help promote the importance of graduate level engineering education, see reference 3.

III. Why So Few Graduate Students?

The decrease in engineering undergraduate enrollment cannot be used as an excuse for the low numbers of US citizens/permanent resident in graduate school. Less than 18% of graduating

engineers in the US go directly full-time to graduate school and as we have seen very few women and underrepresented minority students go on to graduate school.

For an engineering student to attend graduate school, the student must go through a four-stage process:⁴

- The decision to at least consider attending graduate school, in lieu of entering the work force.
- The decision to pursue an advanced engineering degree, in lieu of an MBA, law or medical degree, or a non-engineering M.S.
- The decision to apply for admission to certain M.S. or Ph.D. programs at certain universities.
- The decision to enroll in a specific program.

Batson, Merrit, and Williams⁴ highlight the role of the faculty member in recruiting students currently enrolled in B.S. programs in engineering and the sciences to be full-time graduate students. Many students never get to the first stage in the process of attending graduate school: they never consider graduate school! Many good engineering students never consider graduate school for themselves because no one ever encourages them to consider graduate school.⁵ Reichert and Absher⁶ believe the main challenge to getting more underrepresented minority students to graduate school is get them to more frequently consider the graduate school option.

The myths and reasons given by students on why they do not consider or want to attend engineering graduate school are many. Engineering faculty have the prestige to effectively counteract the attitudes about graduate school that the students have formed based on misinformation, peer pressure, the mass media, campus information sources, and family not to attend graduate school.⁴ Here are some of these attitudes:

- Tired of school⁷
- Want to start earning a living⁷
- Want to work at least a while before going to graduate school⁷
- Going to graduate school results in loss of industrial experience⁸
- A graduate degree will result in overqualification/specialization⁸
- Lost income while in school^{8,9}/Missing lucrative careers in industry¹⁰
- Want to pay back prior debts/avoid new debt⁸
- Will have to pay my tuition and fees for graduate school¹¹/No source of income to pay for graduate school⁸/ Will have to take out loans and get more money from parents for graduate school¹¹
- Indefinite completion date⁸
- Indefinite or long-term income recovery period⁸
- Only really smart people go to graduate school¹¹
- Graduate school does not help prepare for the career the student wants¹²

Research has shown that students believe the following items could make graduate school more attractive to prospective graduate students:¹³

- Provide more information about opportunities available¹³
- More financial aid available¹³
- Opportunities for undergraduate participation in research¹³
- Industrial recruiters show a positive attitude about graduate school¹³
- Faculty show a more positive attitude about graduate study¹³

A group of faculty members at Purdue University believe that providing more information about graduate school is so important that they have developed a successful seminar series which educates engineering undergraduates about graduate school, including how to apply for admission and how to apply for financial aid.^{14,15} The series consists of four seminars on the topics of: 1) Motivation, Identifying Schools, the Application Process, 2) Preparing for the General Graduate Record Exam (GRE), 3) Helpful Hints on the GRE Engineering Exam, and 4) Strategies for Applying to National Fellowship Programs. An alternate format is to offer a single seminar which includes all of the first seminar and a short summary of the others. In addition, there is a single, thirty minute seminar version. Student feedback and graduate school enrollments show these seminars are successful.^{14,15}

Much has been written about undergraduate research as a motivation for attending graduate school.^{16,17} A student that participates in research participates in many areas that are similar to graduate school: writing reports, public speaking, research documentation and dissemination, discussions on creating articles for scientific conferences and journals, and becoming familiar with scientific literature.¹⁶ As an undergraduate student participates in these activities, he/she is often interacting with graduate students and a faculty member. Through this interaction, the student is often motivated to learn more and to go to graduate school. These activities are not generally found in the classroom. Auerbach et. al. describe a ten-week program open to junior- and senior-level undergraduate students from across the nation that exposes minority students to engineering research with the intent of interesting the students in graduate school.¹⁶ Based on a survey completed by 58.7% of the program's participants, 72.6 % of the students enrolled in or completed a graduate program of study.¹⁸ Undergraduate research programs can interest students in going to graduate school and can also confirm the decision for graduate school for students. The National Science Foundation sponsors many Research Experiences for Undergraduates (REU) summer programs across the nation.

Discussions are ongoing about the best practices for promoting diversity in graduate engineering education.¹⁹ After a student has decided that he/she will attend graduate school, there are many decisions to be made and factors that will influence the success of the decision. It is desirable for the student to understand the graduate school process and importance of selecting the right advisor, the right school, and to understand some of the difficulties that graduate students will face and how they can find support and guidance to deal with these issues.²⁰ Eisenman and List discuss what an engineering graduate student should expect each year of graduate school.²⁰ Mullenax²¹ identifies common difficulties graduate students may encounter and proposes some possible solutions. This author also cites some excellent resource books that are helpful for engineering graduate students. Best practices also include programs that focus on the retention of engineering graduate students.²² Graduate level program components can include Career shadowing, Seminars on the professoriate, International experience, Financial Awards, Mentoring, and a Postdoctoral Program.²² Ogunfunmi²³ examines best practices for advising and

mentoring minority graduate students. Her study recommendations include having a minority faculty member to ensure that minority students have a mentor and role model, ensuring that minority students form study groups, get minority students involved in a student organization such as NSBE, and to hold a mandatory orientation meeting each semester for new minority graduate engineering students.²³

A retention factor that needs to be considered is the climate for graduate students in science and engineering especially on the advancement of female graduate students. Litzler, Lange, and Brainard did a research study “to explore the extent to which department climate, integration experiences, and concerns about work/life balance are related to gender differences in degree progress and commitment to STEM professional careers.”²⁴ This study found that men and women experience the pace and workload of graduate studies differently and that discrimination is still alive and well in STEM departments. The authors found that these climate issues significantly affected the career commitment and degree progress of the woman graduate student. The study suggests that departments should emphasize teams and collaboration early in the doctoral programs to better support women graduate students.²⁴

Not only do few students choose graduate school, but there is also attrition in graduate school. Nerad and Miller²⁵ studied students in graduate and professional programs and found that the categories of early leavers included: 1) those who did not intend to earn a Ph.D. (enrolled for a doctorate to get financial support to earn a Master’s degree); 2) field switchers; 3) institution switchers; 4) mismatch of student’s interests and those of the program; 5) frustrated student life expectations; and 6) students who had difficulty with the academic culture. The categories of late leavers include: 1) the undecided student; 2) those with poor student-advisor relationships; 3) those with lack of financial support; and 4) those who perceived a chilly departmental climate.²⁴ The National GEM Consortium studied “Graduate Student Socialization in Science and Engineering” to better understand how the numbers of underrepresented minority engineering graduate students can be increased.²⁶ Prewitt, Eugene, and Daily analyze the retention of minority students through the pipeline to the graduate degree in terms of the development of social capital.²⁷ They point out that an organization such as NSBE can offer black students a wide variety of opportunities to see, meet, and interact with black students and faculty at every stage of the pipeline. These interactions can help to build a system of social networks to help minority students succeed.²⁷

IV. Attitudes and Misconceptions about Graduate School

Most undergraduate students have attitudes and misconceptions about graduate school, but do not act on them because they have never considered graduate school for themselves. A study done in 1995¹⁷ showed that the two main encouragers of students to go to graduate school were participation in semester or summer research and mentoring (encouragement) by faculty. A faculty member can dispel the attitudes and misconceptions. Batson, Merritt, and Williams⁴ used a force field analysis of factors influencing undergraduate students to not go to graduate school. This analysis is illustrated in Figure 1 in their paper and they summarize the resisting forces into two groups:⁴

1. Interested in graduate student engineering study *but*
 - A. I’m frightened by the difficulty

- B. I'll go later
 - C. It's not worth it
 - D. I don't have time and funds to engage in the application process.
2. Not interested in graduate engineering study *because*
- A. B.S. experience has prepared me, but I'm "burned out"
 - B. Not a family tradition
 - C. University teaching is not attractive as a future career option.

Although these reasons were formulated in 1993, they still hold well today. The way to combat these negative thoughts is by educating the student; in particular we will describe how two academic scholarship programs are successfully educating the students to go to graduate school.

It is interesting to note the primary reasons students give for going to graduate school. The reasons are:

- Challenging, interesting subject matter⁷
- A desire to learn more about a field⁷/desire to learn more about their topic¹³
- A desire to advance in their field¹³

These reasons for going to graduate school were rated higher by students than higher starting salaries or greater opportunities for a career in management.

V. Academic Scholarship Programs

If you were to go to the ASU website (<http://www.asu.edu>) this is what you would find: Arizona State University is a new model for American higher education, an unprecedented combination of academic excellence, broad access, and impact. This New American University is a single, unified institution comprising four differentiated campuses that positively impact the economic, social, cultural and environmental health of the communities it serves. Its research is inspired by real world application, blurring the boundaries that traditionally separate academic disciplines. ASU serves more than 63,000 students in metropolitan Phoenix, Arizona, the nation's fifth largest city. ASU champions intellectual and cultural diversity, and welcomes students from all fifty states and more than one hundred nations.

Enrollment at ASU in Fall 2007 reached a record 64,394 students, growing by nearly 9,000 students since 2002 according to another part of that website (<http://asunews.asu.edu/20070925>). All four ASU locations experienced increases, with the greatest gains at the Polytechnic and Downtown Phoenix campuses. The most notable growth is in the freshman class, with a record 9,274 students and more national scholars than ever before. ASU enrolled 265 freshman national scholars, including National Merit, National Hispanic and National Achievement scholars. National Hispanic Scholars total 111 and have increased by 164 percent since 2002. The freshman minority student enrollment continues to rise, with a 9 percent increase over last year. Thirty-three percent of the resident freshman class is made up of students of color, an increase of 121 percent in the past decade. The number of top scholars from Arizona enrolling at ASU also continues to increase at a record pace. ASU welcomed its highest number of Flinn Scholars ever, with 10 of the state's 20 Flinn Scholars choosing ASU. More than 1,800 President and Provost Scholars, including 30 percent of the freshmen from Arizona, are part of this year's class. These are students who perform at the very top of their high school graduating class. The average GPA for incoming freshmen was 3.34, and the average test scores remain constant, with the SAT

score at 1,077 and the ACT at 23.0. The percentage of students admitted to ASU has typically been around 80%.

ASU is a Research I University, one of the few without a medical school. Over 53,000 ASU students are on the Tempe campus, making it the largest single university campus in the nation. The Ira A. Fulton School of Engineering, established in 1954, is on the Tempe campus and has nearly 7,000 students. The engineering website (<http://www.fulton.asu.edu/fulton/>) tells that the Ira A. Fulton School of Engineering provides undergraduate and graduate programs for engineering, computer science and construction students, giving them the knowledge and skills they need for success in a technically oriented career. Our internationally recognized faculty engage in use-inspired research in collaboration with, and for the benefit of, individuals, organizations and society. Ranked 41st in the nation for undergraduate programs and 47th for graduate programs—with five graduate majors in the top 30—by *U.S. News & World Report*, we operate in a transdisciplinary, entrepreneurial environment that produces a creative, highly educated workforce and advancements in technical knowledge, driving sustainable growth and improved quality of life in the communities we serve.

For first-time, full-time freshmen enrolled in the Fulton School of Engineering in engineering and computer science, about 62% will graduate from ASU and about 38% will graduate from the Fulton School of Engineering. The one-year retention of these students in engineering ranges from 60-68%. The one-year attrition from ASU is around 20%. Typically the women engineering students are retained and graduate at rates comparable to the men, but their numbers are low: only 17% of engineering undergraduates are women. In general, the underrepresented minority students are not retained as well, although the underrepresented minority engineering enrollment is now over 19% , with Hispanic being the dominate ethnicity, which mirrors the local population.

In Fall 2002, an academic scholarship program for engineering upper division students was created with support from the National Science Foundation (NSF) CSEMS program (grant #0123146). In Fall 2003, a similar academic scholarship program for engineering transfer students was begun, also with support from the NSF CSEMS program (grant #0324212).. Students must be U.S. citizens/permanent residents, have a 3.0 GPA, be a full-time student in engineering or computer science, and have unmet financial need based on their FAFSA submission. The students attend six 50-minute workshops each semester on topics such as resumes, internships, research, portfolios, and graduate school. In addition, engineers with graduate degrees who are working in industry are brought in as special speakers. These engineers describe how having a technical Master's or a Ph.D. degree allows them to be involved in more interesting projects. The students are encouraged to discuss research with professors and to write a research proposal with a professor to obtain School of Engineering funding to support research. The students enter these programs as juniors or seniors. A third program, a NACME (National Action Council for Minorities in Engineering) Academic Scholarship Program directed by the author starts working with most of the minority students in the program when they are freshmen. The retention of these NACME students is higher than that of non-minority students in engineering and much higher than the retention rate of other engineering minority students not in the NACME program.²⁸⁻³⁰

In all three of the academic scholarship programs, the Guaranteed 4.0 learning system, developed by Donna O. Johnson, is taught to help the students make effective use of their time and to help them earn good GPAs so they will be eligible for graduate school.³¹ Also, in all three of these programs, the students are required to do assignments which include researching graduate schools.

We will now describe point-by-point how these program activities and others can educate students about graduate school. This material is based on the force field analysis in Figure 1 in the paper by Batson, Merritt, and Williams⁴ and the personal experience of the author in directing the academic scholarship programs.

A first step is to make sure “going to graduate school” is on the student’s radar. Graduate school is discussed early (starting with freshmen students in the NACME Academic Scholarship Program and juniors in the two NSF CSEMS Programs) and often. This impact is possible because the students in the academic scholarship programs are captive audiences as a condition of their scholarship.

- 1A. Interested, but I’m frightened by the difficulty
 - I’m not qualified
 - I don’t have the prerequisites
 - Don’t a lot of people fail (like undergraduate engineering students)
 - Thesis will be too hard
 - Only really smart people go to grad school

To educate the student:

- Since the students have a GPA greater than or equal to a 3.0, they are all told that they have the ability to go to graduate school. Bringing in panels of graduate students to talk about graduate school can convince the student that they are as qualified as the graduate students talking to them.
 - Panels of graduate students, who are just like they are, are brought in to talk about graduate school with them and to answer questions
 - Talk about the prerequisites and the qualifying process, but don’t make it sound impossible
 - Explain that most Master’s degrees have a non-thesis option. Most students do not understand that there are different ways to get a Master’s degree.
 - The students see their colleagues in the program, who are just like they are, go into graduate programs and realize that they can also
-
- 1B. Interested, but I’ll go later.
 - Want job experience
 - My company will pay
 - Family needs income
 - Want materialistic rewards
 - Loans to repay

To educate the student:

- The percentage of students who work and then earn their Master's degree or doctorate is very small. One local engineer was one of 14 students from her company who started a Master's degree in engineering at the same time. She worked full-time and took two courses a semester. Only two of the 14 students earned a Master's degree. She was not able to go to graduate school full-time upon graduation due to the parental support that she needed to provide.
- It is very difficult to go to school and to be working full-time, taking at most two courses a semester. Sometimes students can only manage one course a semester, extending the time by double.
- If parents need your support immediately, then perhaps you should work in industry right away and then come back to earn the Master's degree.
- Profession of engineering is about service not rewards.
- Availability of national scholarships as well as RA and TA departmental positions and industry internships for summer support + local scholarships

- 1C. Interested, but it's not worth it.
 - 2-5 years lost income
 - Starting salary for M.S. not much higher than B.S.
 - 2-5 years lost experience
 - Indefinite completion time
 - Get rich much quicker as a doctor, lawyer, or MBA

To educate the student:

- Show valid up-to-date data on salary differentials. Usually a Master's employee is given credit for 3-5 years of experience and comparable pay.
- Talk about career options.
- Talk about interest of work and choice of what you work on
- Cite recent completion times
- Cite recent student employment/salaries

- 1D. Interested, but don't have time and funds to pursue application
 - GRE Exam apply and take
 - Daunting application procedure
 - Uncertain outcome of applications for admission and financial aid
 - I'm too busy interviewing
 - I'm too busy with senior projects
 - I'm studying for the FE exam

To educate the student on simplified admission procedures

- GRE may not be necessary (need to check), especially for BSE ABET-accredited departments
- Early admission and promise of financial aid is possible; school may have BSE/MS integrated program where 3 classes can double count on BSE and MS degree
- Staff assistance is available

- Set faculty expectation that student should apply
- Continuing faculty interest in where student applies, what sort of admissions and offers are received

- 2A. Not interested in graduate engineering study because
 - Not pleased with B.S. experience
 - More of the same, only harder
 - Don't understand research, not excitement of discovery
 - Burned out on B.S.
 - I know enough now; I'll be overqualified
 - More theory, I need practice
 - I can get a job now
 - I've seen what grad students go through

To improve the B.S. experience as a transition from secondary school to professional school:

- Decrease extent of specialization at B.S.
- Increase creative and design experiences
- Increase student collaboration in faculty research
- Most graduate classes are not like undergraduate classes. Take graduate classes in a BSE/MS program.
- Educate students about engineering organization and project/line leadership
- The positions for which you will be overqualified are not positions that you want. One large local employer of engineers is hiring over 50% of their engineers with graduate degrees; another local employer of engineers requires that new hires start an engineering Master's degree within three years of the hire: companies need to replace technically competent managers.
- You still know very little about any specialization
- Jobs will still be available after a few years
- Treat current graduate students better.

- 2B. Not interested in graduate engineering study because this is not a family tradition
 - I'm the first to get a BS; M.S./Ph.D. is for next generation
 - Don't know what graduate degrees are, or what value they hold
 - Parents expect me to get a job

Educate both student and his/her parents:

- Long-term value of a graduate degree
- Set faculty expectation that student should continue

- 2C. Not interested in graduate engineering study because university teaching is not an attractive option
 - Too much stress
 - Too little reward
 - I could never teach
 - I could never create and publish

- Only for white, middle-class males

Present profession in a more realistic light:

- Financial Rewards
- Consulting Opportunities
- Job Security
- Professional status
- Role models for women and minorities
- Choice of research focus
- Summers and vacations same as public schools
- A graduate degree is not only for academia, it is highly valued in industry

VI. Results of the Academic Scholarship Programs at ASU

Nationally, less than 18% of engineering graduates go directly on full-time to engineering graduate schools. The graduates of the CSEMS academic programs have a 40% rate for non-transfer engineering and computer science students in an academic scholarship program going into graduate school full-time and over a 30% rate of such transfer students going on to graduate school. Only a couple of these students are known to have gone to a graduate school other than ASU, so the numbers could be larger. To understand how this compares to the status quo in the Ira A. Fulton School of Engineering, over the past 6 years, less than 10% of the ASU engineering graduates have continued full-time in graduate school the next semester at ASU. Of course, we are not accounting for the students who graduate from ASU and then enter a graduate school full-time the next semester at another university.

The explanation for the high number of these academic scholarship students going on to graduate school includes the activities carried out in the CSEMS programs to fulfill a mission of the program to have students go to a technical graduate program after they graduate with a BSE/BS. Although the promise of a continuation of their scholarship if they choose to go to graduate school full-time at ASU may be an incentive for some students to go to graduate school, it is believed that the scholarship in itself does not persuade students to go to graduate school. However, the scholarship program requires the students to attend workshops and so as a captive audience they learn about graduate school. Some of these students probably would never have gone on their own to a workshop about graduate school. So the scholarship students are made aware of graduate school and learn about graduate school. They are educated with reasons to go to graduate school that usually outweigh their own reasons for thinking that graduate school is not for them. At the same time their myths about graduate school are usually destroyed as they talk with real, current engineering graduate students. Assignments require them to research graduate schools, give reasons why graduate school would or would not be good for them, and the students are encouraged to do a research project with a professor through one of two programs available to help support the student for the research.

Another factor that is helping the students decide to go to graduate school, which is backed by research, is the continual, positive support for graduate school that the students receive from the faculty program director and the engineers and faculty that present in the workshops.

Students report that sometimes it took over a year of hearing programs on graduate school for them to be convinced that graduate school was for them. Many students report that they had not considered graduate school before they were in the academic scholarship program. Other students report that the program confirmed that graduate school was right for them. Most students think that graduate work is only for those planning to go into academia. They are surprised and inspired by engineers from industry who tell about interesting and challenging careers because they have a graduate degree. Some students are convinced that graduate school is good, but they need to go to work in industry right after their BSE/BS. Although it is very difficult to do graduate school while working, some of the program students have completed a Master's degree while they have worked full-time in industry.

Since the programs are composed of over 50% of the students being either a woman or an underrepresented minority student, the peer support and role modeling undoubtedly help to encourage women and underrepresented minority students to go on to graduate school. We saw earlier in the paper that the numbers of women and especially minority students are very low nationally. Since these students all have a GPA of at least a 3.0 and are helped by the Guaranteed 4.0 learning system, chances are good that the scholarship student will graduate with a GPA good enough to get into graduate school and to be able to do well in graduate school.

The scholarship students continually evaluate speakers with graduate degrees very highly, as they also do the graduate student panels. The students also continually requesting more industry speakers and more meetings with a graduate student panel. Therefore future workshops for the Academic Scholarship Programs will continue to have industry speakers and graduate student panels, as well as academics who tell of their experiences and how they came to go to graduate school. The director will also continue to urge students to become involved in research. In several instances, the scholarship students did research with a professor that led them to continue the research for a Master's or PhD program.

The scholarship programs are now in their sixth year. The director is continually looking for new workshops to strengthen the skill set of the scholarship students. As an example, this past year an engineering librarian taught the students how they can conduct searches on the Internet to assist with their research. At the same time the student assignments are continually being updated. Additional funding has been secured to continue the transfer program for another four years and the non-transfer program for another three years. In closing, the following are some reasons that CSEMS students chose to go to graduate school in engineering:

I had always had a goal to earn a Master's degree, but I had become a little tired of school. It became clear to me though, that if I wanted to get a job that interested me and engaged my curiosity at the same time, I would have to earn a Ph.D. before moving into industry. Some favorable experiences that I had while doing research as an undergraduate finally persuaded me to apply to some graduate schools. ..I chose a Ph.D. program (because) I thrive in a research oriented environment; second, I anticipate better employment opportunities after earning a Ph.D.; and third, the fact that my tuition and other expenses are funded through my advisor.

I chose to go to graduate school mainly because I was not happy with the opportunities a bachelor's degree would provide. I wanted more challenging and cutting edge work. I chose ASU mainly because of my advisor.

My decision to go to graduate school is based on several reasons that I expect to have a profound impact on me throughout my career and lifetime. First of all, a bachelor's degree is not what it used to be...a graduate degree provides that extra edge to get the high paying positions...I plan to retire early and start a consulting firm as well as teach community college.

When asked, "Do you plan to go to graduate school?" students answered "Yes" and then were asked why they made the decision they did:

(This program) has convinced me that getting a master's will help me make more money, stand out from my peers, gain more respect in the field, and obtain a better position than if I only had a bachelor's degree.

Brother and Academic Scholarship Program activities.

An advanced degree seemed to be advantageous to have.

I want to have the opportunity to specialize in a discipline.

Academic Scholarship Program convinced me it is worth it!

A big contributor in this decision was the Academic Scholarship Program. I have learned so much about the incentives and benefits in attending Graduate school from the guest speakers and the Graduate school panel.

I made my decision to go to graduate school right away after the last semester's graduate school seminars, because it will be difficult for me to go back to school once I start working due to family responsibilities.

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