

Getting U.S. Undergraduates into Graduate School: Providing Information and Opportunities

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Abstract

The current booming economy is great for engineering graduates as they see rising starting salaries and lucrative signing bonuses. Unfortunately it is a problem for engineering faculty and graduate programs. The strong job market is making it even more difficult to convince U.S. undergraduate students to continue on for a graduate degree. In several areas of the country including the Midwest, large percentages of the undergraduate population are first generation college students. Their personal and family aspirations are to get a baccalaureate degree and find a good job. Many of these students know very little about graduate school as a career option. In fact, often they have many misperceptions and incorrect information about attending graduate school.

In an effort to determine why students choose to go graduate school, a survey was developed and circulated to graduate students in engineering at Michigan Tech. This paper summarizes these results, and gives some of the initiatives that the authors have used in an effort to recruit additional students in the graduate program at Michigan Tech.

I. Introduction

As universities make more and more partnerships with industry, colleges of engineering are striving to be "one-stop-shops". As part of these partnerships, the role of research and graduate education is often a central focus. Indeed, in addition to tangible research results, companies are often very interested in hiring advanced degree candidates as well as traditional undergraduate engineering students. One of the key ingredients in working out such partnerships is finding ways to entice outstanding students into completion of an advanced degree.

Despite the increasing prevalence of such opportunities, graduate school is not often thought of by students as a career path, especially early in their undergraduate curriculum. Most universities and colleges do discuss graduate school as an opportunity, but at Michigan Tech, these discussions had usually occurred during the senior year in selected classes or as part of an undergraduate engineering society meeting. Indeed, there is little if any direction given to freshman and sophomore engineering students that graduate school can be an integral part of a clearly defined career path with an emphasis on careers in research and development.

One of the primary challenges in having students consider graduate school as part of their career path is to dispel many of the myths about graduate school that exist in many students' minds.

Students typically do not fully understand topics related to graduate studies such as financial support for graduate school, selection of a research project, or taking appropriate support classes for their chosen thesis topic. To better understand the preconceptions students have prior to entering graduate school, we surveyed seniors and graduate students in engineering at Michigan Tech.

II. Survey

The authors felt we had some anecdotal information about why students do not go to graduate school. To try to substantiate these ideas we composed a survey to measure the reasons why currently enrolled graduate students decided to pursue graduate degrees. The survey is given as Table 1. The survey was distributed via listservers to all the graduate students in engineering. The survey was filled out by 27 engineering seniors or graduate students (Chemical Engineering-11, Electrical and Computer Engineering-7, Environmental Engineering-2, Civil Engineering-4, 3 undeclared). Five of the respondents were Ph.D. students, fourteen were M.S. students, three were seniors that are planning on attending graduate school next year and five were unspecified. Eighteen were U.S. citizens; five were non-US citizens and four undeclared.

The survey was designed to get reactions related to when the students decided to go to graduate school, why they went to graduate school, who or what influenced them to go to graduate school, and what were their impressions of graduate school during their first or second year in undergraduate school.

III. Survey Results

The tabular results for the survey are listed in Table 2. One of the most telling numbers is that almost 50% of the current or upcoming graduate students did not decide to attend graduate school until their senior year. The top three reasons for going to graduate school were:

1. To get more depth in my discipline
2. To provide future job opportunities
3. To explore/investigate a topic in my discipline

The biggest positive influences that helped students decide in favor of graduate school were advice from a faculty member, encouragement from a family member and interactions with graduate students. Over two thirds of the students had an immediate family member who had gone to graduate school. Only 29% had a parent go to graduate school. The rest were same generation relatives.

The most important set of answers related to the students' impressions of graduate school during their first or second year in college. Over two-thirds of the students did not consider graduate school in their future. Almost 80% did not realize that engineering graduate students usually receive a monthly stipend and 70% thought that had pay for tuition during graduate school. Over 60% did not have anyone discuss going to graduate school with them. Additionally 40% of the survey respondents felt intimidated by graduate school and thought that only 4.0 GPA students attended graduate school.

The results of this survey confirm the following predominant misconceptions by undergraduate students about graduate school:

- Only really smart people go to graduate school.
- I will have to pay my tuition and fees for graduate school.
- I will have to take out loans and get more money from my parents for graduate school.

Tables 3 and 4 give longer responses to questions about why students decided to go to graduate school and what faculty could do to encourage more students to consider graduate school.

IV: Activities to Provide Information and Opportunities

The authors are both second-generation graduate students. Since at least one of our parents had attended graduate school (and are currently university faculty), we were very familiar with graduate school as a career option. When we began our first faculty positions at the University of North Dakota, we discovered that many of the engineering students were first generation college students. To them the experience of undergraduate school was a new family experience. Not many of the students decided to continue on to graduate school unless the job market was very poor. Talking informally with the students, it became apparent that they did not consider graduate school as a career option. At UND and in our current positions at Michigan Tech, we have worked to provide information and opportunities to undergraduates so they make a more conscious decision earlier in their academic career.

The information activities include supplemental examples in class and formal sessions on graduate school as an option. By talking about research activities in undergraduate classes (even freshmen and sophomore classes), underclass students start to see that faculty members are actively involved in solving new engineering problems. There is also a need for formal sessions on graduate school as an option. This should be geared toward students of all ages and not just juniors or seniors. In these sessions you can dispel the misconceptions and give the younger students GPA targets that they should aim for during their undergraduate degree. The authors have had several students drop by their offices with less than 3.0 GPAs who did not learn about graduate school until it was too late. Having current U.S. graduate students talk on a panel of students also helps the younger students have role models since often they see international teaching assistants in their laboratory classes.

To supplement the information many students need opportunities to explore research as a career option. Possible opportunities include research experiences for undergraduates and student programs at conferences. Both authors have started sophomores with undergraduate research. By their senior years, the students were mature researchers providing major contributions to refereed publications. The NSF Research Experience for Undergraduates (REU) program provides opportunities to pay students a competitive salary to do some research. Another exciting activity is to have an undergraduate attend and possibly present at a regional or national technical meeting. Many meetings now have student poster contests and have programs to help pay expenses of undergraduates. Taking advantage of these programs may be the bait to lure the students into trying graduate school.

Table 1: E-mail survey sent to graduate students and seniors planning to go to graduate school in College of Engineering at Michigan Tech

Major:			
Current Status:	PhD	MS	Senior
Background:	US Citizen	Non-US Citizen	

1. When did you decide to go to graduate school (please list best answer)?
 - A. High School or before
 - B. First 2 years of undergraduate
 - C. Junior year of undergraduate
 - D. Senior year of undergraduate
 - E. After working a while
 - F. Other _____

2. What were your top three reasons for going to graduate school? Please rank with 1 as the most important and 3 as the least important of your top three reasons.
 - ___ to explore/investigate a topic in my discipline
 - ___ to get more depth in my discipline
 - ___ to get more breadth in my discipline
 - ___ to do an independent project
 - ___ to work closely with a faculty member
 - ___ to make more money when I graduate
 - ___ to provide future job opportunities
 - ___ to teach engineering
 - ___ other _____

3. By whom or what were you influenced to go to graduate school? Please rank the top 3 with 1 the most important.
 - ___ family member
 - ___ friend
 - ___ faculty member
 - ___ graduate students or other students
 - ___ undergraduate research
 - ___ information session on going to graduate school
 - ___ wasn't sure what I wanted to do
 - ___ other _____

4. Has anyone in your immediate family gone to graduate school?

Yes No (if yes, who _____)

5. Try to think back to your first or second year in college. Answer these questions from that point, not your present point.
 - a. Did you consider graduate school in your future? YES NO
 - b. Did you realize that engineering graduate students usually get a monthly stipend? YES NO
 - c. Did you realize that engineering graduate students usually have all or most of their tuition and fees paid? YES NO
 - d. Did anyone discuss going to graduate school with you? YES NO
If yes, who _____?
 - e. Did you think graduate school especially the MS was similar to undergraduate just two more years? YES NO
 - f. Did you feel intimidated and think that only 4.0 GPA students go to graduate school? YES NO

Table 2: Tabulated Survey Results

1. When did you decide to go to graduate school (please list best answer)?			
A. High School or before	4		
B. First 2 years of undergraduate	3		
C. Junior year of undergraduate	4		
D. Senior year of undergraduate	13		
E. After working a while	2		
F. Other		1 (Researched Job Market)	
2. What were your top three reasons for going to graduate school? Please rank with 1 as the most important and 3 as the least important of your top three reasons.			
	1	2	3
___ to explore/investigate a topic in my discipline	7	2	2
___ to get more depth in my discipline	7	9	5
___ to get more breadth in my discipline	1	3	1
___ to do an independent project	1	2	
___ to work closely with a faculty member	1		
___ to make more money when I graduate	1	1	3
___ to provide future job opportunities	6	7	7
___ to teach engineering	1		3
___ other (Solve new tasks, Peace Corp Masters)	2		
___ other (working internationally)		1	
3. By whom or what were you influenced to go to graduate school? Please rank the top 3 with 1 the most important.			
	1	2	3
___ family member	5	6	
___ friend	1	4	2
___ faculty member	6	6	3
___ graduate students or other students	2	2	6
___ undergraduate research	1	4	2
___ information session on going to graduate school	1		3
___ wasn't sure what I wanted to do	3	1	4
___ other (Coworker, felt undergraduate training not enough, job related research, learn more, opportunity of becoming an exchange student)	6		
___ other (not ready to start a job, take classes in Germany)		2	
___ other (hiring preference for consulting firms, Co-op helped decided)			2
4. Has anyone in your immediate family gone to graduate school?			
No	Yes	(if yes, who _____)	
11	17	Mother 3, Father 5, Wife 2, Husband 2, Brother 2, Sister 3	
5. Try to think back to your first or second year in college. Answer these questions from that point, not your present point.			
		Yes	No
a. Did you consider graduate school in your future?		8	17
b. Did you realize that engineering graduate students usually get a		5	18
c. Did you realize that engineering graduate students usually have all or most of their tuition and fees paid?		7	16
d. Did anyone discuss going to graduate school with you?		9	15
If yes, who _____? 3 family, 4 friend, 4 faculty, 1 speaker			
e. Did you think graduate school especially the MS was similar to undergraduate just two more years?		3	21
f. Did you feel intimidated and think that only 4.0 GPA students go to graduate school?		10	15

Table 3: Student responses to questions about why they went to graduate school.

- Felt that the knowledge I had wasn't quite complete yet.
- I think it is very challenging to me to study real research. This can explain to me something that I don't really understand when I was an undergraduate student.
- I entered graduate school to gain a greater depth of knowledge that I can apply in future endeavors.
- I could work in research and development when I leave college and so I could become a Prof. someday.
- Have not attended yet however my reason is to position myself in a higher level of understanding and a higher level position upon entering Industry.
- I thought that graduate work was more of a challenge. It was not only learning like undergraduate work, it was more implementation of knowledge and exploring new ideas, which seemed exciting.
- To have a break, to be more qualified for my future job, and to be with my wife.
- I enjoyed the research I was doing as an undergraduate and wanted to investigate the area further. I also know that having a master's degree could provide more opportunities in the future.
- Interested in learning more theory before entering the work force.
- To learn more and get a good job.
- wanted more knowledge and wanted to separate myself from everyone with a BS
- I didn't find my work in consulting fulfilling so I decided to try research. I figured at the very least, I would get a job in consulting that I liked better than my current one. I also considered teaching.
- Wanted to learn something more deeply in my favorite major—automation or control.
- To focus more on my area of interest. I don't think that what I have learned as an undergraduate qualifies me for the real world yet. I have had only 3 classes that really focused on power.
- To broaden my knowledge in areas that were not covered in my undergraduate curriculum. To deepen my knowledge in interesting areas.
- Better job opportunity for a person my age and with my previous professional background.
- Felt my education was not complete.
- Wanted to see the world through the Peace Corp.
- Wanted to learn more about EE. Got my BS in 3 years so I wanted to stay in school. I also liked doing research for my senior design project.
- I felt graduate school would further my independent thinking and give me the training to approach more diverse problems, without the structured format of a class with a textbook.
- Dreamed of a Ph.D. when I was a child. People with knowledge gain a lot of respect.
- At the time of graduation with my BS I started my job search and talked to some professors about graduate school and found out about opportunities at Tech. I decided to stay.
- I needed more in depth learning of what I was interested in. I also wanted to earn extra "status" the higher degree gives. This "status" is important for consulting firms and if one wants to work internationally and get higher management positions.

Table 4: Student responses to question on what faculty should do to encourage more students to consider graduate school as an option.

- It depends on what the students are interested in. If undergraduate research was a requirement, many might be encouraged to continue researching, getting the extra degree, and getting more knowledge, experience, polish, etc. which can lead to more money, responsibility, and better job positions.
- Offer research opportunities to undergrads. Have seminars for undergrads to attend.
- Faculty should motivate the undergraduates to be interested in their major.
- Explain why it is important and discuss possibilities for graduate school at their school (research topics etc.)
- Be more approachable toward undergraduates. Encourage communication from undergraduates.
- Nothing it is a personal opinion.
- Talk about how easy it is to get funding with undergrads. Discuss how it's not only the 4.0 students that get in and tell them about how it's different from undergrad. Start at least by the junior year and then again senior.
- Talk about MS and Ph.D. in senior design class.
- Include current research topics in their classes, and show how what they are learning applies to these topics by design homework and projects that demonstrate the utility of the information. Many students/people are unfamiliar with what "researchers" actually do. If research is presented as the fun and fascinating puzzle it can be, then I think more students would be interested.
- Seminar open to undergraduate students
- I think one on one talks with students they feel are quality candidates would help students with this consideration.
- Let them know they don't have to have a 4.0 to get in.
- You don't have to attend graduate school where you obtained your undergraduate degree.

IV. Summary

Many undergraduate students do not consider graduate school as a career option and have misconceptions about graduate school. Today's faculty must be proactive to inform students about research opportunities and the advantages of graduate degrees. This paper discusses some student impressions as well as possible activities faculty members can do to increase your graduate student pool.

V. Biographical Information

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