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Graduate Recruiting for Emerging One-Year Professional Master's Programs

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Abstract:

Students pursuing a Bachelor's degree in engineering are typically presented with a number of lucrative career options upon graduation. Traditionally, they are in high demand for industrial jobs with attractive starting salaries and are actively recruited by engineering graduate schools offering a "free" education to pursue a research-based M.S. or Ph.D. In actuality, the average number of engineering students who opt for the latter hovers around 30%. Consequently, the pool of highly qualified engineering prospective graduate students is already relatively small.

In more recent years, a surge of a new type of master's degree program has been flooding the market, which has opened up a whole new set of challenges for program directors recruiting students. These so-called cutting-edge professional engineering master's programs focus on specific industry needs, preparing students for leadership roles in areas such as energy systems, healthcare operations, structural engineering, and entrepreneurship. These graduate programs are designed for both recent graduates and working professionals. The curricula of professional master's programs are typically organized to be completed in a one year time period. Such programs attract students with diverse backgrounds that not only represent challenges in teaching but also in recruiting. For example, one major difference is unlike traditional research-based master's programs, students are expected to pay for such unique, fast-paced experiences. How do you create a value proposition to convince a soon-to-be graduate to either turn down a high paying job or a fully-funded M.S. position?

This paper will identify the unique recruiting challenges encountered in four such professional master's programs, which have slightly different set-ups. In addition, the paper will describe what each program has done to overcome these challenges. Example topics include but are not limited to, the challenges encountered when recruiting traditional graduate students directly out of their undergraduate institution versus working professionals, recruiting for a strictly in-residence program versus a hybrid program (on-campus and online options), and recruiting for a more narrowly focused disciplinary program versus a highly multi-disciplinary program. Broad reaching informational marketing campaigns versus more in-depth marketing approaches to a selective audience will be discussed. Statistics on the effectiveness of the practices will be presented. Results from this paper can be used by Universities to focus their recruiting practices.

Background:

About a decade ago, leadership within the P.C. Rossin College of Engineering and Applied Science (RCEAS) at Lehigh University recognized an emerging trend amongst our graduating engineering seniors. A number of these students expressed interest in graduate school, through which they could obtain more in-depth technical knowledge within their field of study, garner higher starting salaries, and launch advanced tracks to leadership positions within the industry. While these individuals acknowledged the value of a graduate engineering degree, many of these students were deterred by the research project with thesis requirement of the traditional Master of

Science degree offered. As a result, many of these students would forego their graduate education for a good paying job.

At the same time, the engineering college was approached by our contacts from various different industries requesting our help in filling major gaps in their recruitment targets. They were finding that many of their recently graduated new hires were not quite ready to hit the ground running following their Bachelor's level education. As such, they were seeking candidates with a more advanced technical education, some knowledge of project management, and ideally some practical experience.

In response, to these demands, Lehigh's RCEAS began focusing on developing a portfolio of practice-oriented master's degree programs in select, market-driven areas. These so called professional master's or Master of Engineering (M.Eng.) degrees are designed for the individual who is seeking a competitive edge upon embarking on a career in industry, but is not interested in completing an in-depth research project and publishing. Students entering these programs are anxious to enter the work force, as such the programs are typically designed to be completed in-residence, in one year or less. While it is not impossible to do so, the large majority of these individuals will not continue on to complete a Ph.D. upon graduation from these programs. As such, the M.Eng. degree is often viewed as a terminal graduate degree.

The professional master's degree is of course not a novel concept. Around the turn of the century the Sloan Foundation had launched the Professional Science Master's (PSM) initiative, which encouraged the development of this new type of master's degree aimed at providing students with advanced mathematical and technological knowledge, while developing practical skills valued by industry[1]. This initiative has since been taken over by the Council of Graduate Schools (2006). Since its inception, close to 350 programs have received the PSM affiliation, including three of our professional master's programs (e.g. structural engineering, energy systems engineering, and healthcare systems engineering). The significant growth of such programs nationwide indicates their acceptance by institutions of higher education as an integral part of graduate studies and supports the need for graduates of such programs.

Thus far, Lehigh's RCEAS has developed and launched four new professional master's programs in engineering. These include M.Eng. programs in Structural Engineering (2008), Energy Systems Engineering (2009), Healthcare Systems Engineering (2011), and Technical Entrepreneurship (2012). Distinguishing features of these programs include leadership by a full-time, in-residence professor of practice, industry-focused curricula and projects, guidance by an external industry advisory council, and abundant networking opportunities available to students throughout the program. Because these are practice-oriented graduate programs and are therefore not supported by external competitive research grants, students enrolled in these programs are expected to be self-funded. The cost to complete a 30-credit program and cover living expenses in such a condensed time frame places a very significant financial burden on these students. Consequently recruiting for these types of programs is not an easy task and presents a number of challenges above and beyond those encountered when recruiting for traditional research-based M.S. and Ph.D. programs.

General Recruiting Practices:

Before delving into the specific recruiting challenges encountered in each one of our four M.Eng. programs, it is important to identify the common elements that are essential to recruiting for any graduate program. These include positive word of mouth, an informative, up-to-date website, an effective means to market the program to a defined applicant pool, and creating the value proposition. These practices are employed for all programs in different manners by both the college of engineering and the individual program directors.

Word-of-Mouth

Once a program is established, word of mouth is perhaps one of the most critical means to make or break the program. You cannot recruit students to a program with a bad reputation, as prospective students will find out through word of mouth. We focus on three avenues to establish positive word-of-mouth.

The first step is to create and offer a high-quality, meaningful program to ensure current students are satisfied with their investment into their education. Having satisfied students is critical to hosting effective prospective student campus visits. If current students are dissatisfied with the program, they will inform prospective students of the program's drawbacks. Furthermore, accomplished students typically yield highly successful alumni in the work force. These are your program ambassadors after graduation, who can inform interns at their place of employment about your program.

The next step is faculty outreach. Undergraduate students typically seek advice from their faculty members regarding which graduate programs would help them achieve their career goals. Educating faculty members internal and external to your academic institution is critical to broadcasting your program. This can be achieved through sending literature about your program, which should include program details, updates, and alumni success stories. The outreach should be both broad reaching to expand your reach (e.g. purchasing faculty contact lists through companies such as MDR) and narrowly focused to create personal relationships with a smaller group (e.g. sending thank you letters with a note about your program to the recommenders of current students in your program and contacting personal colleagues or your university's alumni on the faculty at other academic institutions).

Lastly, recruiting a proactive Industry Advisory Council (IAC) is key to spreading the word about your program. As with your program alumni, IAC members are in direct contact with engineering undergraduate students completing internships at their companies. When IAC members are well-informed of the benefits your program has to offer students and are also very satisfied with the graduates they have hired from your program, they are well-positioned to promote your program in a positive light to their interns.

Program Website

As many prospective students locate graduate programs through the common web search, creating and maintaining an engaging, up-to-date website is a critical component of the recruiting process. Program websites should clearly articulate admissions and program requirements and provide an easy way for prospective students to request additional information, with a timely

follow-up process in place. Additional options to consider include alumni success stories, current student project details, student blogs, and information on financing their education.

Marketing the Program

Effectively spreading the word about your program to a large audience of prospective students is not the easiest task to accomplish on traditionally limited recruiting budgets. Thus, defining your applicant pool and determining the most cost-effective way to reach these students are critical.

When considering the four professional master's programs, the applicant pools vary significantly. As shown in Figure 1, the Structural Engineering M.Eng. program draws students with very focused backgrounds, traditionally in civil, structural, or architectural engineering. Whereas the Healthcare Systems Engineering and Energy Systems Engineering programs recruit students having earned predominantly engineering or other STEM degrees. Lastly, the Technical Entrepreneurship program accepts students with any background, so long as they bring a highly creative and ambitious approach to the program.

The opposite ends of the spectrum can be viewed as both advantages and disadvantages in the recruiting process. Recruiting for a focused program is relatively easy to do; simply target students with specific backgrounds. However, the applicant pool is small. On the other side, in recruiting for a broad program, the challenge is how to effectively reach a large population of students on a limited budget?

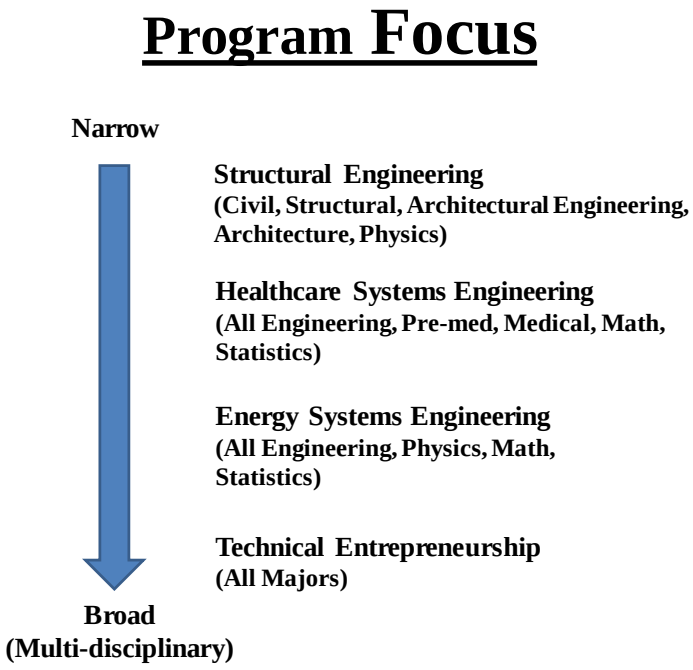


Figure 1: M.Eng. Program Focus Comparison

Another challenge surfaces when comparing the differences in program flexibility of our professional master's programs. As shown in Figure 2, our four M.Eng. programs vary slightly in how they are delivered. The Technical Entrepreneurship program can be completed on-campus in one year and has perhaps the most rigid scheduled curriculum. As such, there is currently no

part-time option for working professionals. Thus, recent graduates who are seeking a graduate degree before either starting their own company or heading into industry are the primary target for this program.

On the other end, the Healthcare Systems Engineering program has both on-campus and online options. In addition to actively recruiting recent graduates, we are now able to expand our recruiting efforts to attract working professionals into the program. While hybrid programs provide a much larger pool of prospective students to recruit from, the challenge is how to effectively market to both traditional students and working professionals on a limited budget?

The Structural Engineering and Energy Systems Engineering programs fall somewhere in the middle. Currently, neither of the two programs offer a distance education option. However, there is enough flexibility in the programs' curricula to allow for working professionals to complete the program over two years, on a part-time basis. Given the fact that a large number of our graduate engineering courses are not offered in the evenings or on weekends, working professionals must be local and have some flexibility in their work schedules to attend courses during the work day.

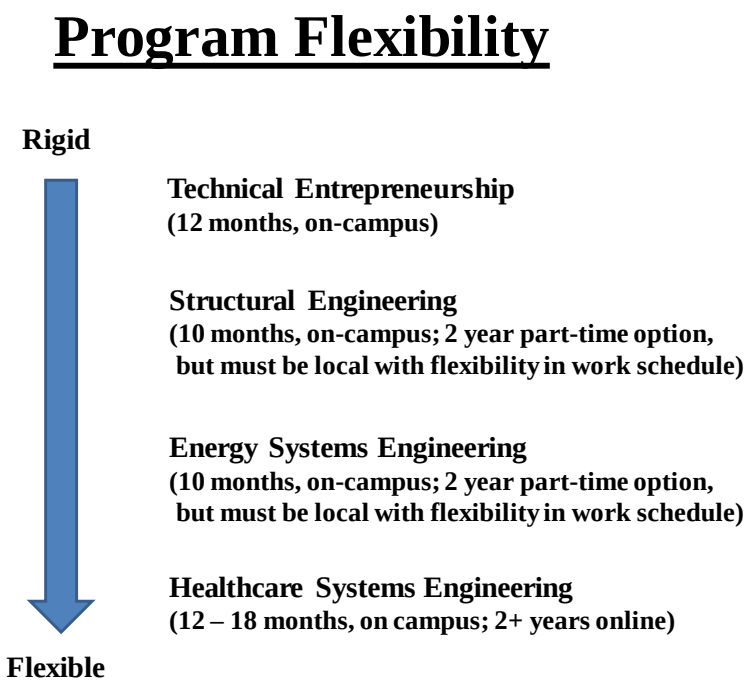


Figure 2: M.Eng. Program Flexibility

Once the applicant pools have been appropriately defined, there are many ways to market your program. These include email campaigns, webinars, graduate school/career fairs (in person and virtual), program presentations at regional schools, social media outlets, advertisements in career guides, featured stories in various print outlets, and faculty outreach (as discussed earlier).

Broad-reaching email campaigns are the most cost-effective means to disseminate program information to a large group of students whom you would typically not have had the opportunity

to meet in person. Also, it is typically easy to track the effectiveness of such campaigns, as we are able to view who opened the email, what links were clicked, and who opted out of the campaign. Overall, our email campaigns yield an approximate 26% open rate, which is actually very high for these types of campaigns. Prospective student lists are obtained from a variety of sources, including the ETS GRE search service, the newly formed ENGINE consortium database, and graduate school fair student contact lists. Typically, an initial email campaign is sent in early fall advertising our portfolio of professional master's programs, to introduce both the University and the concept of professional master's programs to the students. Later in the fall, we send program focused messages to students based on their academic backgrounds.

As an example of a more narrowly focused email campaign, we target students who applied to our undergraduate program four years ago, but opted not to enroll at Lehigh University. These students are now set to graduate at their current academic institution and may be looking for graduate school options.

For the past few years, we have delivered a professional master's webinar series. These are typically held mid-fall and have proven to be a relatively cost-effective means to reach a large audience. The webinars are approximately 30-45 minutes each, during which the director of the program provides a 20-30 minute overview of the program followed by a question and answer session. Current students are also present to provide their experiences in the program and answer prospective student questions. Webinars are effective at informing participants about the programs; however the challenge is effectively advertising the webinar to ensure a large audience.

Graduate school and career fairs can be costly and difficult to track their overall effectiveness. Visits to your table can vary significantly from year to year. Traditionally, engineering focused fairs (e.g. Tau Beta Pi, Society of Women Engineers, National Society of Black Engineers, etc.) yield better results than broader fairs for all majors. Advertising in the event's program may draw more visits to your table. Virtual fairs are becoming more in the mainstream. In addition to saving on travel costs, an added advantage to participating in a virtual fair is that participants typically receive the names and contact information of everyone who registered to attend the fair.

The return on investment for delivering program information sessions at regional academic institutions can also vary significantly. Attendance at these sessions tends to be dependent on the extent the event was promoted by representatives at the hosting school. To increase attendance at these events, we provide a flyer advertisement which we ask to be printed and posted, in addition to being emailed to junior and senior engineering majors. We find it most effective when faculty members at the school, with whom we have established relationships, verbally inform their students of our visit and encourage them to attend.

Advertising in general can be very costly and difficult to track its effectiveness. As such, we have purchased print ads for our professional master's programs in the career guides of four top regional schools in our area. We also experimented with a limited number of digital ad purchases.

While social networks are an integral part of the college of engineering's undergraduate recruitment process, they are used minimally at the graduate level. Given that a recent report indicated that a number of schools using social media for graduate student recruiting purposes ranked social media as a minimally effective graduate recruiting tool, we do not pursue this mechanism extensively[2].

Creating the Value Proposition

As referenced earlier, the financial burden of a professional master's degree program can be quite significant. As such, it is imperative to identify and communicate a positive and convincing value proposition to prospective students; particularly in areas where students have comparable funded-M.S. options to choose from (e.g. Structural Engineering). Students need to be assured that their investment in their education will pay them dividends throughout their career. A general argument can be made that master's level graduates will have a competitive edge in the job market over their bachelor's level competition, and can expect an average 5-15% increase in starting salary. Furthermore, M.Eng. graduates are employed in the workforce earning a large salary one to two years before their M.S. colleagues. Figure 3 show a rough financial comparison of potential earnings for a B.S., M.Eng., M.S., and Ph.D. degree recipient over a 20 year period. This comparison was initially created to justify a graduate education in general. The data assumes a 3% annual raise, with a periodic 10% increase in salary. While M.S. students may not acquire any additional debt to complete their degree, our analysis suggests that their earning potential remains just below that of the M.Eng. graduates. A similar comparison appeared in an official engineering income and salary survey report conducted jointly by the American Society of Civil Engineers and the American Society of Mechanical Engineers in 2012[3].

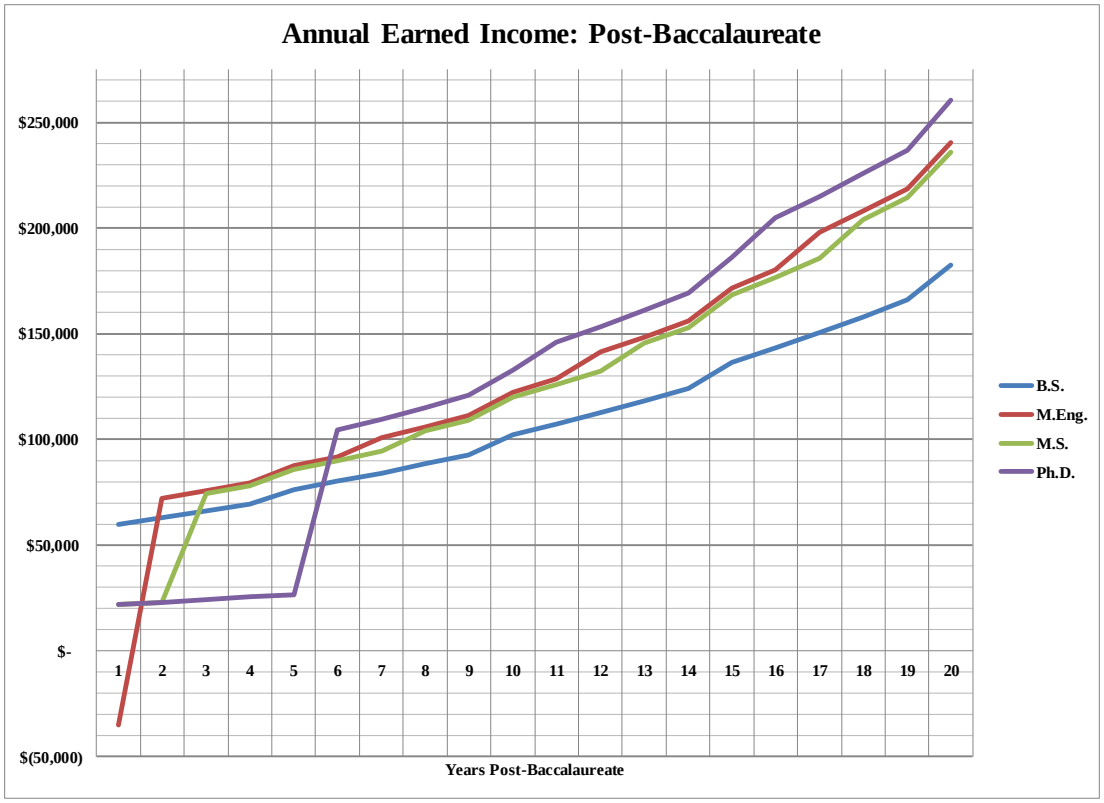


Figure 3: Estimated earning potential comparison across graduate degrees.

Furthermore, exposure to industry-related projects and a plethora of networking opportunities with employers throughout the program provide M.Eng. graduates with a stronger advantage when entering the job market. High employment rates before and within three months after graduation are also very typical of these programs.

Overall Effectiveness of Recruiting Practices for Professional Master's Programs

Current students and alumni of all four of the RCEAS professional master's programs were surveyed to assess how they learned about our programs and to identify which mechanism was most influential in convincing them to apply to Lehigh University. Thus far, 188 students (42%) have completed the survey. The distribution of survey responders according to M.Eng. program is shown in Figure 4. The large majority of responders (177) completed their program full-time, while only eleven of the responders completed their program part-time.

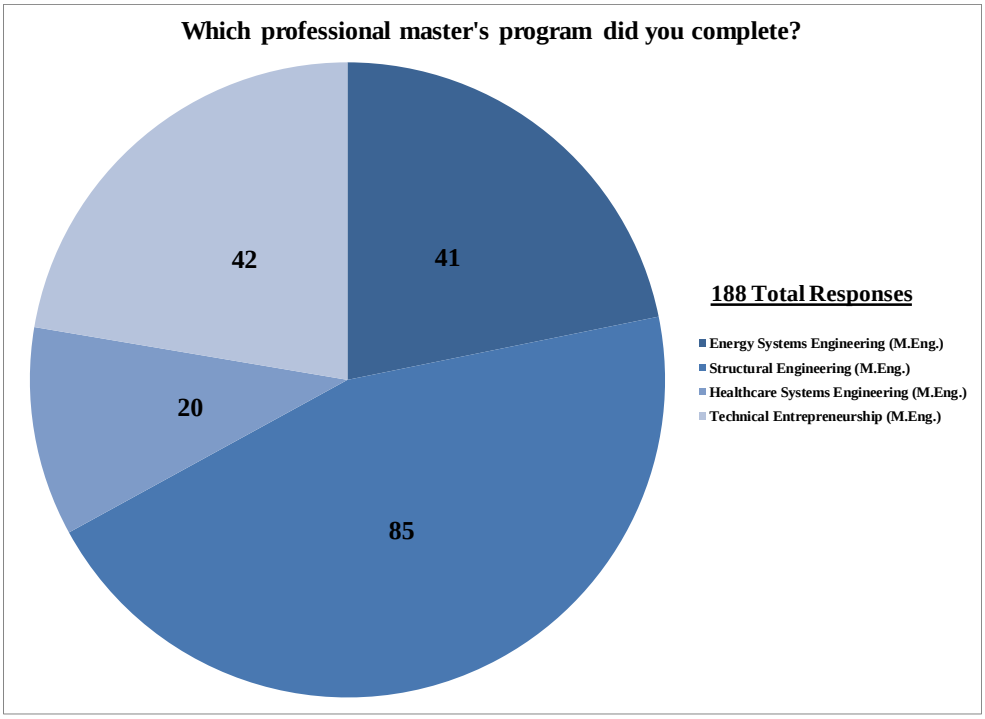


Figure 4: Distribution of Survey Responders by M.Eng. Program

Considering that all four professional master's programs share the same general recruiting challenges, we will first take a look at the survey data as a whole. In the case study sections, we will break out the data by program to determine if certain methods are more effective given the different nature of each program.

Figure 5 represents the responses to the question, how did you learn about Lehigh University's professional master's programs. Survey participants were encouraged to select multiple answers, if applicable. Not surprisingly, top choices include as an undergraduate student at Lehigh University (69 responses), from a faculty member at their undergraduate school (53 responses), and internet search (47 responses). Email campaigns and advertisements appear to be somewhat

effective, while webinars and graduate school fairs are minimally effective. For the responders who selected "other", a number of their responses overlapped with the existing choices. Recruiting mechanisms cited that differed from these options include program information sessions, research experiences for undergraduates (REU) participation, and Lehigh's alumni magazine.

Figure 5: Distribution of how students learned about our M.Eng. programs.

Survey participants were then asked to identify which recruiting mechanism they viewed to be the most influential in making their final decision to apply to one of our professional master's degree program. In this circumstance, they were asked to only select one answer. Of the total 188 survey responders, two individuals did not complete this question. The results to this question are shown in Figure 6.

The top responses are in line with those of the previous question and include as an undergraduate at Lehigh university (30%), from a faculty member at their university (18%), and internet search (18%). For those survey participants who selected "other", influential factors that did not overlap with choices provided, included poor job market, family legacy, local resident, Lehigh University's overall reputation, receipt of Lehigh's Presidential Scholarship (5th year free for qualifying students), and direct interactions with M.Eng. program directors during the recruiting process.

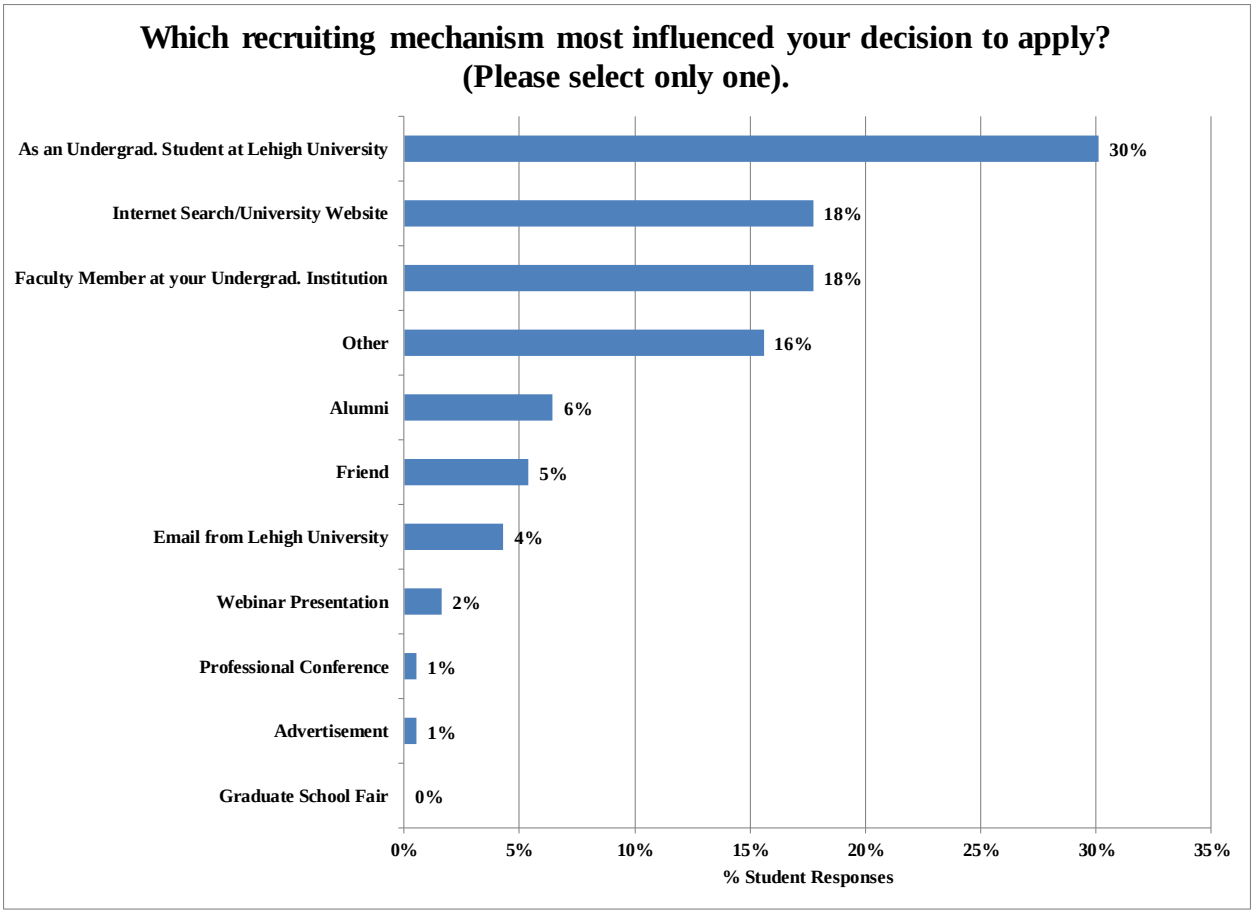


Figure 6: Distribution of the effectiveness of each recruiting mechanism.

A few conclusions can be drawn from analysis of the responses to these two questions. First and foremost, the responses emphasize the importance of investing time and resources in educating your own undergraduates about the options available to them at their home academic institution. As reflected in the data, a number of students will opt to stay an additional fifth year to obtain a master's degree especially when they are not considering continuing on to a Ph.D. Furthermore, keeping faculty informed of your programs will pay dividends during the recruiting season. Even in this advanced technological age, quality students continue to reach out to faculty members for advice on where to attend graduate school. The combined response totals for interactions with friends or program alumni as a significant factor in their decision to apply to one of our programs, validate the importance of generating positive word of mouth about your program. The data also affirms the need to ensure program websites are user friendly, informative, and up-to-date. While the remainder of the cited recruiting practices is not quite as influential in a prospective student's thought process, these efforts are still generating interest in the program and subsequently applications to the program.

Case Study Overview

General recruiting practices have been established and their overall effectiveness surveyed. The remainder of the paper will focus on more specific challenges encountered for each of our four professional master's programs. In each of the four case studies we provide a brief program

description and identify the program's applicant pool, recruiting challenges, and recruiting efforts. Responses to the two questions addressed earlier, regarding how students learned about the program and which mechanism was most influential in their decision to apply to Lehigh University are broken out by program. The goal is to determine if there are any correlations between the specific recruiting challenges realized by each program and the effectiveness of our recruiting efforts.

Case Study 1: Structural Engineering, M.Eng.

Brief Program Description:
Launched in summer 2008, the Master of Engineering in Structural Engineering program is a rigorous 10-month, practice-oriented graduate degree. Led by a professor of practice, the 30-credit in-residence program focuses on teaching students structural engineering design versus theory. This is primarily accomplished through a group design project. To fulfill this requirement, groups of three to five students team up to design a major structure over the course of the 10-month program. Each year students work on a new project, selected by the professor of practice with guidance from the program's industry advisory council. Students formally report their work through written reports and formal presentations periodically throughout the program to the IAC and faculty.

Value Proposition:
The M.Eng. in Structural Engineering (SE) program allows students to gain a practice-based master's degree in the shortest time possible. Students with a master's degree can earn a starting salary anywhere from 5% to 20% higher than students with a bachelor's degree, but more importantly the master's degree provides the necessary knowledge in this complicated industry and entry to high profile firms that perform highly complex work and only consider applicants with master's degrees or higher. Master's degrees also provide one year of experience toward a Professional Engineer's (PE) license. Furthermore, graduates with an M.Eng. degree typically enter practice a year prior to students with an M.S. degree and can start earning money, gaining experience toward their PE license, and advancing their career sooner. Career advancement is directly related to performance, and typically engineers with graduate degrees advance higher and faster than engineers with bachelor's degrees.

Applicant Pool:
Given the highly focused technical content of the SE M.Eng. program, qualified students typically possess undergraduate degrees in Civil Engineering, Structural Engineering, or Architectural Engineering. Students with a Math, Physics, or Architecture background may also be admitted to the program; however they are required to take a year of undergraduate structural engineering courses prior to enrollment in the graduate program.

Recruitment Challenges:
Size of Applicant Pool:
While there is an advantage to knowing exactly who you want to recruit for a program, searching for students with a narrowly focused background significantly limits the size of the applicant pool. Thus, forming your recruitment plan is relatively easy (e.g. target students and faculty in Civil Engineering, Architectural Engineering, and Physics Departments across the country);

however there is only a small percentage of the students in these departments seeking a graduate degree in structural engineering.

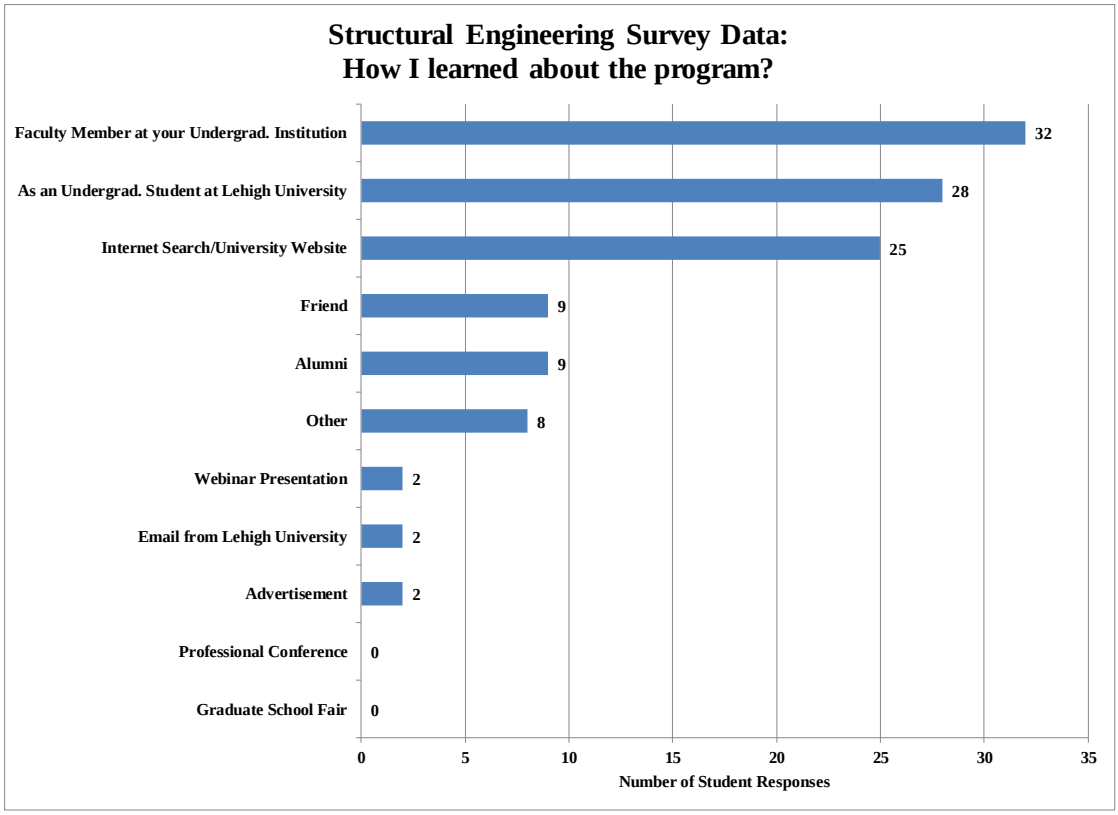
Competition with Funded MS Programs:

In the field of structural engineering, a strong argument can be made to achieve a master's level degree. First and foremost, the American Society of Civil Engineers (ASCE) requires a master's degree or the equivalent of 30 credits beyond a bachelor's degree as part of the minimum body of knowledge to obtain a PE license[4]. Additionally, a large number of top-tier structural engineering firms are requiring a master's degree to be even considered for employment. An internal survey of the SE M.Eng. IAC conducted in 2011 indicates that they do not necessarily have a hiring preference when considering an applicant with an M.S. degree versus an M.Eng. degree. Survey data suggests that M.Eng. students were better prepared to "hit-the-ground-running" as compared to their M.S. hires. However, students may still opt to pursue the M.S. degree, given the potential of having their education funded by a research grant.

SE M.Eng. Recruitment Efforts:

- Program Website - Continual updates are time consuming, but necessary.
- Letters to Applicant Recommenders – This effort is more effective with faculty members and industrial representatives who are already familiar with our institution's strength in structural engineering, and with whom we have developed working relationships.
- Program Webinar – Delivered in early fall and overall a good recruiting tool. On average, 24% of webinar attendees enroll in the program.
- Information Sessions (internal) – Attendance has been declining as the program has become more established and our students are more aware of its existence.
- Information Sessions (external) – Attendance at these events varies significantly. As discussed earlier, these visits are time consuming and are most effective when the host institution proactively encourages students to attend the information session.
- REU Webinar Presentation – This is a brief presentation delivered to participants in a network of summer REU structural engineering programs. This effort has typically yielded one to two applicants per year.
- Prospective Student Campus Visits – This effort allows Lehigh University's world-renowned structural engineering laboratory facilities to shine.
- Information Sessions (at top structural engineering firms across the country) – Students from surrounding universities were invited to attend the information session and meet with industry professionals. This initiative was completed at the start of the program, but has not continued due to low attendance at the events. While in theory this was an excellent mechanism to engage both industry representatives and prospective students in our program, we found it a challenge to get students to leave campus and travel to the companies.
- Professional Science Master's (PSM) Affiliation – Since receiving this affiliation, the program receives additional promotion through the PSM website and branding.
- Department Open House (late winter) – This is an effective tool for encouraging accepted applicants to enroll, but this effort does not help to recruit new prospects.

Effectiveness of SE Recruitment Efforts:



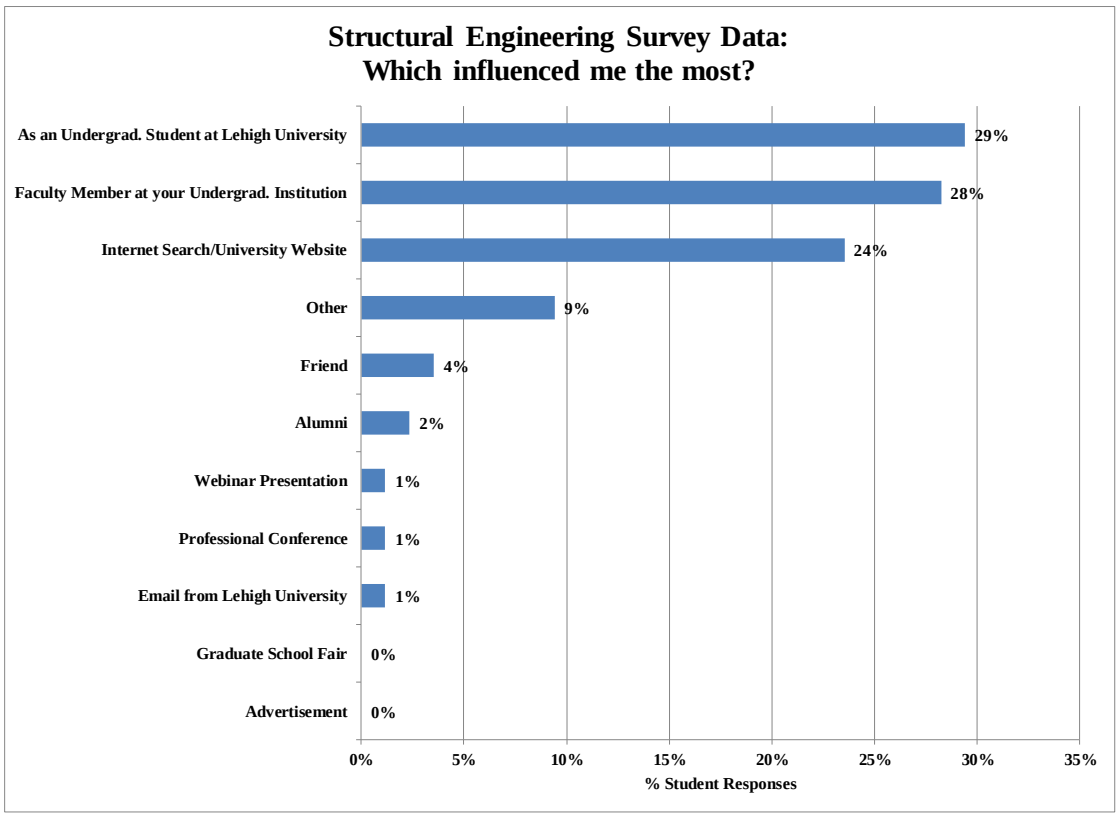


Figure 7: Effectiveness of Structural Engineering recruitment efforts.

Survey responses from individuals associated with the SE M.Eng. program are shown in Figure 7. Similar to the overall recruiting survey results, faculty outreach and maintaining an informative, up-to-date website are the most effective tools for recruiting students from other academic institutions into our SE, M.Eng. program. Thus, developing strong relationships with faculty at other schools is key to recruiting students. Attracting our current undergraduate students is also important. Broad reaching email campaigns are not as effective for this program as they are for other professional master's programs. Most likely this is due to the narrow focus of the program. As such, most prospective students are enrolled in a civil engineering program and will ask their professors for graduate program recommendations. However, broad reaching recruiting campaigns are still necessary and instrumental in marketing this program.

Case Study 2: Energy Systems Engineering, M.Eng.

Brief Program Description:

Launched in summer 2009, the Energy Systems Engineering (ESE) M.Eng. program is a 10-month, industry-focused graduate degree. Led by a professor of practice, the mission of the 30-credit in-residence program is to provide the tools and training necessary for young scientists and engineers to develop themselves into leaders in the emerging challenges of the energy and power industry; creating a pipeline of talent interested in pursuing energy-oriented careers. Students enrolled in the program receive a broad overview of the energy industry through the core energy systems curriculum (e.g. energy generation, energy transmission and distribution, energy and the environment, and project management). Students customize their curricula through the selection of technical electives, based on their undergraduate education and their ultimate career goals. An industry-focused project completes the curriculum.

Value Proposition:

Energy is one of the most significant challenges of the 21st century. A perfect storm is looming on the horizon for the energy and power industry; the potential to lose 50% of technical leaders due to retirements of "baby-boomers" over the next decade at a time when innovative thinking, technology and systems in the energy field impacts issues of national security and economic growth. Graduates of this program will have acquired a level of specialized knowledge and experience such that they are readily able to tackle the challenges facing the U.S. utility infrastructure, its operations, and its environmental impact. As such, graduates of the Energy Systems Engineering program are perfectly positioned to fill this looming workforce void.

Applicant Pool:

Given the broad nature of the ESE, M.Eng. program, students of all engineering backgrounds are eligible for the program. Students with a Physics or Mathematics background may also be admitted to the program, with the completion of minimal to no undergraduate engineering prerequisite courses. While working professionals may complete the program on-campus over a two year period, they are not actively recruited at this time.

Recruitment Challenges:

Defining Energy Systems Engineering:

When the ESE program was first launched, very few programs existed in the area of energy systems engineering. Furthermore, companies were not listing jobs for "energy systems engineers". Consequently, prospective students were not even aware to look for such a program.

One of the biggest challenges encountered was explaining to prospective students the concept of energy systems engineering and how completing a degree in this area could help advance their careers. In recent years, this terminology has become much more in the mainstream, as evidenced through the emergence of competing ESE programs across the country. While one problem was solved, another challenge has emerged.

Increased Competition:
As energy systems engineering has become more in the mainstream, the number of competing programs has also increased. Consequently, prospective students interested in this area have many options available to them.

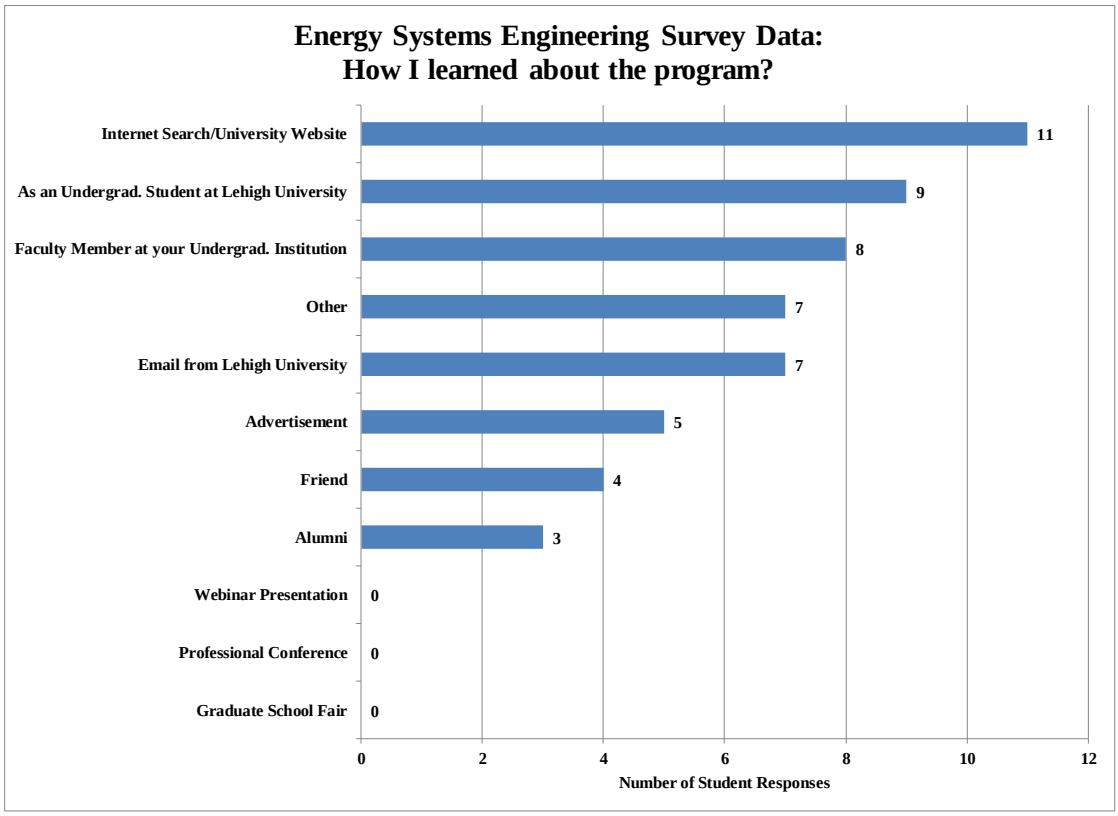
Broad Applicant Pool:
The opportunity to recruit such a wide range of student backgrounds is certainly an advantage, as it significantly increases the size of the applicant pool. However, marketing to a much larger audience is more costly.

Limited On-campus Offering:
Due to the broad nature of the program, a lengthy list of technical electives crossing engineering departments and even colleges is available to students enrolled in the program. A very large number of these courses are not offered via distance learning. While it would be quite feasible for us to offer the core ESE courses online, we cannot offer enough of the technical electives online to justify offering the entire program online. As such, the program's applicant pool is primarily limited to recent graduates who complete the program full-time, in-residence.

ESE Recruitment Efforts:

- Program Webinar (fall) – The presentation is delivered in early fall and targets juniors and seniors. Current ESE students participate on a panel with the program director. Audience participation is good.
- Information Sessions – The program director delivers a presentation about the program at home and peer institutions. When possible, we target student chapters of professional societies, such as the Institute of Electrical and Electronics Engineers Power and Energy Society. Attendance varies at these events, but they have yielded students in the program.
- Graduate School Fairs – Since the program recruits students with any engineering background, broader, engineering-focused graduate fairs are targeted (e.g. Society of Women Engineers and Tau Beta Pi).
- Email Campaigns – In late fall, program specific literature is sent to both prospective student lists and faculty mailing lists.
- Letters to Applicant Recommenders – Thus far, it has been difficult to gauge the effectiveness of this effort for the ESE program. Program leadership changes have caused disruption in maintaining established relationships.
- Professional Science Master's (PSM) Affiliation – Since receiving this affiliation, the program receives additional promotion through the PSM website and branding.

Effectiveness of ESE Recruitment Efforts:



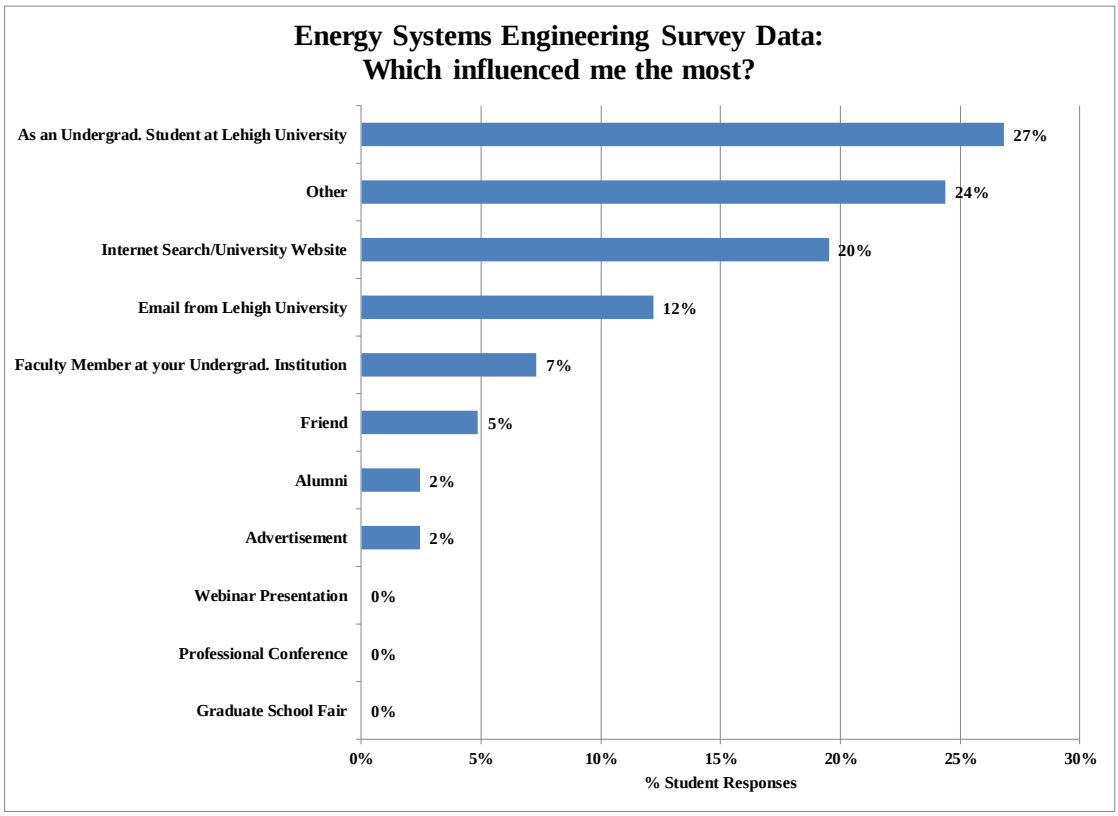


Figure 8: Effectiveness of Energy Systems Engineering recruitment efforts.

Survey responses from individuals associated with the ESE M.Eng. program are shown in Figure 8. When considering the state of the U.S. economy at the time the ESE program was launched and the demographics of the students who enrolled in ESE program throughout the years, the survey results are quite interesting. The program was launched in 2009, coinciding with the stock market crashing and employment rates plummeting. Thus, the first few years of the program, we noted a much larger number of our own undergraduate students enrolled in the ESE program as compared to more recent years. We attribute this to the fact they were well informed about our new program offering and were seeking alternative options when they were struggling to find employment. This hypothesis is to some extent supported by the survey responders who selected "other" and indicated the depressed economy and our University's Presidential Scholarship as strong influencing factors in their decision to apply to our program.

Energy is a very pressing global issue. Thus, it is not surprising to see that a number of students learned about the program searching the internet for graduate programs in the energy industry or through our broad reaching email campaigns. Compared to the other three M.Eng. programs, the ESE program has attracted a greater percentage of international students. A couple of these students cited the Fulbright program as having a great influence in their applying to our program.

Lastly, considering the ESE program's webinar typically attracts the largest audience compared to the other professional master's programs, it is a bit surprising that no one cited this mechanism in how they learned about the program. Keeping in mind that we only received a 34% survey response rate for the ESE program, we are not seeing the entire picture.

Case Study 3: Healthcare Systems Engineering, M.Eng.

Brief Program Description:
Launched in fall 2011, the 30-credit professional master's degree program in Healthcare Systems Engineering (HSE) is designed to provide innovative thinkers with the skills and perspective required to lead health and healthcare organizations in improving the quality and efficiency of healthcare delivery. Every student graduates with a broad understanding of the healthcare industry along with the ability to plan, manage and lead projects. Graduates of the program possess the technical skills necessary to analyze healthcare systems, identify inefficiencies, and propose solutions or new processes to improve the overall quality and efficiency of healthcare operations.

Value Proposition:
The Healthcare Systems Engineering program blends the development of healthcare domain knowledge with the application of industrial engineering best practices. As such, graduates of the program are well suited for understanding and tackling some of the most difficult challenges in healthcare; may they be process and quality improvement related, or IT systems or financially related. For recent graduates, the program provides a structured introduction to different dimensions of healthcare, while helping them develop optimization, simulation, and other analytical skills needed to solve different types of problems. For working professionals with a background in healthcare (e.g. physicians), the program provides them with a different (and often unfamiliar) view of the systems and processes they work with, while also enabling them to address their work environment using industrial engineering tools which they learn through the program. Overall, the HSE program helps differentiate our graduates through their deep

understanding of healthcare systems, as well as their ability to tackle systemic problems in a logical and structured manner.

Applicant Pool:
Given the elevated mathematical content of the curriculum, students entering the HSE program must come from backgrounds in engineering, science, business, mathematics and related STEM disciplines. The delivery of the program both on-campus and online allows us to recruit both recent Bachelor's degree recipients, as well as working healthcare professionals.

Recruitment Challenges:
Defining Healthcare Systems Engineering:
While Healthcare Administration master's degree programs are commonplace, healthcare systems engineering is not yet in the mainstream. Furthermore, while the program has received overwhelming support from the healthcare industry, companies are not yet posting jobs for "healthcare systems engineers." Thus, we are faced with the challenge of first explaining what the degree is and how it can advance one's career. The program is gaining traction, despite the emergence of additional graduate programs in this area.

Recruiting Both Full-time, In-residence & Part-time Distance Students
By virtue of the program finding itself at the confluence of healthcare domain and systems problem-solving, we have two major student populations: recent graduates, looking to enter the healthcare sector and who need to learn both the specifics of the domain as well as the tools to solve the problems; and the working professionals, who are already in the system and are looking to take on bigger responsibilities and differentiate themselves. Thus, recruiting efforts address these two distinct populations differently. The majority of this paper addresses ways to recruit the former; however, how do we reach the latter? For the HSE program, we are primarily targeting healthcare professionals. While the healthcare industry has remained extremely supportive of the degree, opportunities to present the program through an information session at healthcare companies have not been plentiful. Additionally, company representatives struggle to identify current employees who are best suited to complete the program.

HSE Recruitment Efforts:

Traditional Students:

- Program Webinar (fall) – The presentation is delivered in early fall and targets juniors and seniors. Current traditional HSE students participate on a panel with the program director. Audience participation has been limited.
- Information Sessions (internal) – The director presents the program to our current junior and senior students. Audience participation has been increasing, as the word is getting around on campus about the program and students want to learn more.
- Information Sessions (external) – The director presents the program at local universities. Audience participation varies.
- Pre-Medical Student Outreach – As the program matures, we are noticing an increased interest in the program from pre-medical students. These students see the value of completing this degree as a means to bolster their resumes to improve their chances of receiving admission to medical school. To reach these students, the program director

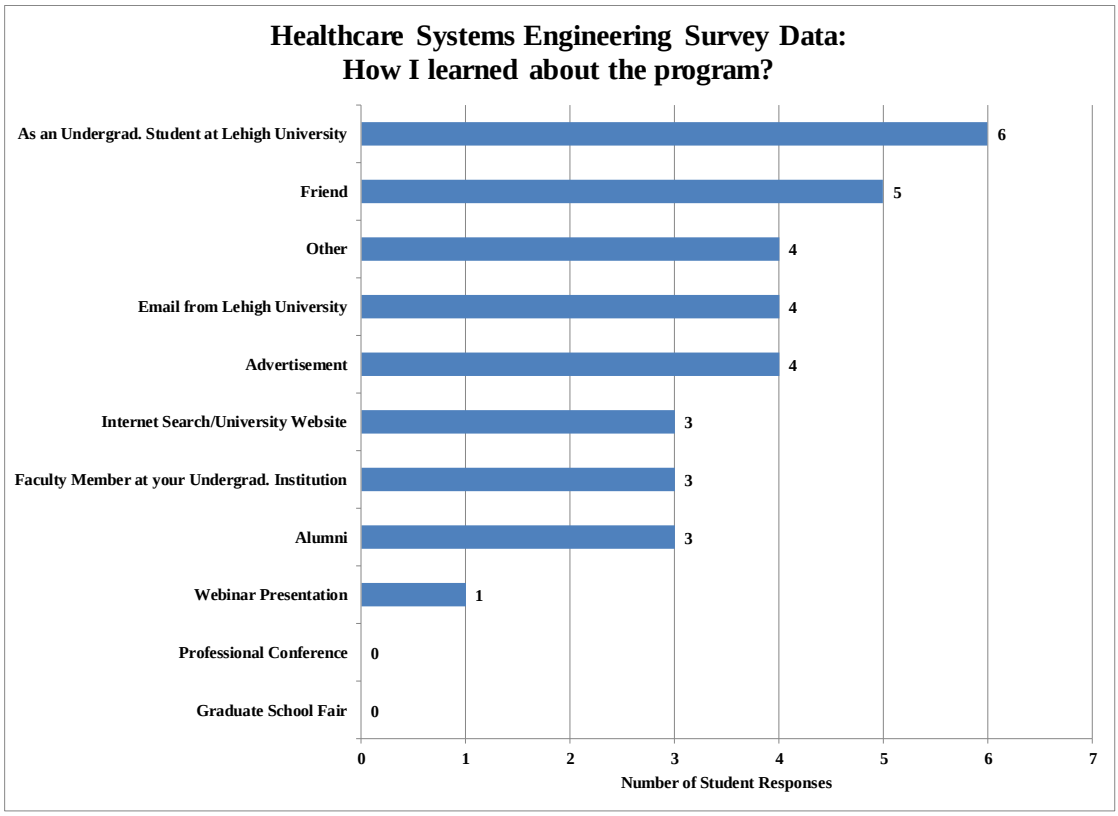
participates in pre-health professions graduate school fairs. The program is also featured in pre-medical publications and on post-baccalaureate pre-medical programs websites.
- Professional Science Master's (PSM) Affiliation – Since receiving this affiliation, the program receives additional promotion through the PSM website and branding.

Working Professionals:

- Email Campaigns (to our alumni and healthcare professional society memberships) – Periodic email campaigns are sent throughout the year to our alumni and to members of healthcare professional societies (e.g. Society for Health Systems Engineering).
- Program Webinar (spring) - The presentation is delivered in early spring and targets working professionals. Current working professionals enrolled in the HSE program participate on a panel with the program director. Audience participation tends to be larger than the fall webinar.
- Professional Conference Participation – The program director and representative students from the program exhibit the program at a number of professional conferences throughout the year. This effort serves to elevate the program's visibility amongst the healthcare industrial leadership, in addition to recruiting students into the program.
- Virtual Career Fairs (Healthcare Information and Management Systems Society) – This is a new initiative, which provided us the opportunity to communicate with a number of industry professionals seeking to advance their careers. We were also able to follow up with participants who did not visit our virtual booth during the fair, as we were provided with the contact information of everyone who registered for the event.
- Graduate School Fairs at Local Hospitals – HSE representatives participate annually in the graduate school fairs a few of our local hospitals host for their employees

Effectiveness of HSE Recruitment Efforts:

Of the four M.Eng. programs presented, the HSE M.Eng. program yielded the lowest response rate (~20%) for the survey we administered. As such, it is difficult to gauge the significance of the data. Also of note, when the survey was administered participants had the option of submitting their responses anonymously. Consequently, we were not able to break out the responses to determine which recruiting mechanisms were more effective for attracting traditional students versus working professionals. Of the total number of HSE students either current or graduated, working professionals only make up about 20% of the population. This number in and of it itself suggests that our recruitment strategy for these individuals is not as effective as our efforts to recruit traditional, on-campus students. Additional factors to consider exist when recruiting working professionals, such as family commitments and employment obligations of the individuals we are recruiting. We may effectively market the program to this population, but some may simply not enroll due to other constraints that may not be affecting traditional students to enroll.



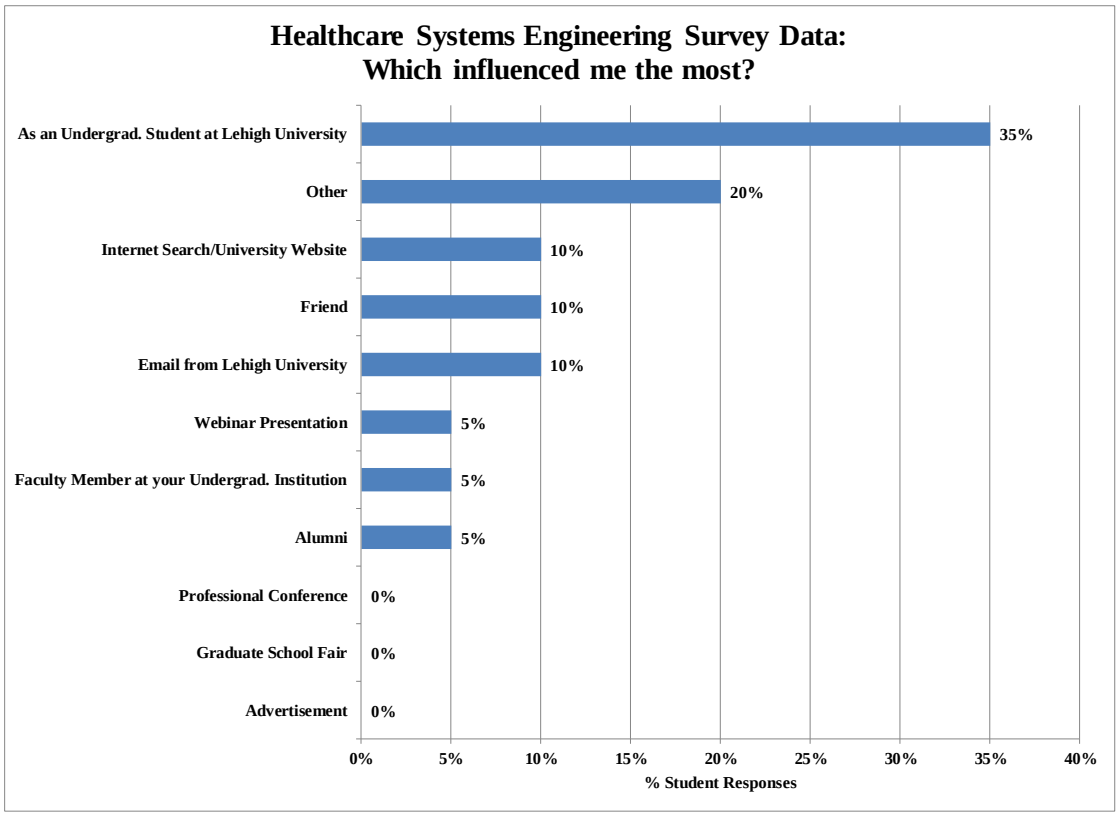


Figure 9: Effectiveness of Healthcare Systems Engineering recruitment efforts.

Analysis of the survey data collected from HSE students and graduates shown in Figure 9, reinforces the importance of keeping your current undergraduate students informed of your program. A number of those who responded "other" for both questions, highlight direct, personal interaction with the program director as a contributing factor to how they learned about the program or why they decided to apply. Consequently, hiring a highly proactive program director who thrives on networking with both industrial representatives and prospective students is critical for a successful professional master's program. Other top choices include internet searches and email campaigns, much like the Energy Systems Engineering program's survey data. Given the similarities in these two programs' recruiting strategies with needing to recruit from a broad set of backgrounds, this observation is not surprising. The data also suggest that we may need to focus more energy in developing stronger relationships with faculty at other institutions. The Structural Engineering, M.Eng. program has met with success in this area, in part due to annual outreach through letters. The HSE program intends to adopt this practice moving forward.

Case Study 4: Technical Entrepreneurship, M.Eng.

Brief Program Description:
Launched in summer 2012, the one-year, 30-credit professional master's program in Technical Entrepreneurship (TE) helps student entrepreneurs create, refine, and commercialize intellectual property through the licensing or launching of a new business. Students in the program learn by experiencing the idea-to-venture process in an educational environment that is hard-wired to support the development of novel, innovative, and commercially viable technologies.

Value Proposition:
Investment in the TE graduate program includes mentoring by experienced mentors (faculty and entrepreneurs) to help students with their success; infrastructure such as work spaces, labs and prototyping equipment to develop their technology and launch their business; access to seed funding and assistance from economic development organizations; and diverse course work tailored to develop entrepreneurial skills and culminate in the launch of their venture. The program is truly experiential, not a mock practice or a case study. As such, students are immersed in real product development that results in launching their company. Today's market demands and rewards an entrepreneurial mindset, contextual problem solving and hands-on experience. Whether graduates are launching their own company or joining an existing one, skills gained through the program differentiate them and equip them for success.

Applicant Pool:
The program recruits students of all majors. Prospective students must possess a high level of creativity and ambition. Recruiting efforts typically target graduating seniors, as the program is delivered full-time, in-residence.

Recruitment Challenges:
Non-traditional Degree Program
Technical Entrepreneurship as a degree program is non-traditional and generally unknown. Typically, entrepreneurship programs are housed in a business college as opposed to engineering colleges, making the program even more difficult for prospective students to find.

Targeting Individuals with an Entrepreneurial Mindset

Unlike other professional master's programs presented, the TE M.Eng. program does not target students with a specific background or with the highest grade point average and graduate record exam scores. Rather, the program seeks highly creative, motivated individuals. These students may be at the top of their class or they may be at the bottom. The challenge is finding individuals with the appropriate mindset to succeed in the program.

Competing Undergraduate Programs

A large number of academic institutions offer entrepreneurship concentrations or integrate entrepreneurship courses into their undergraduate curriculum. Consequently, ambitious students may feel like they received enough of a knowledge base and skill set to start their own companies immediately upon graduation, and therefore forego a graduate education for which they would incur additional debt.

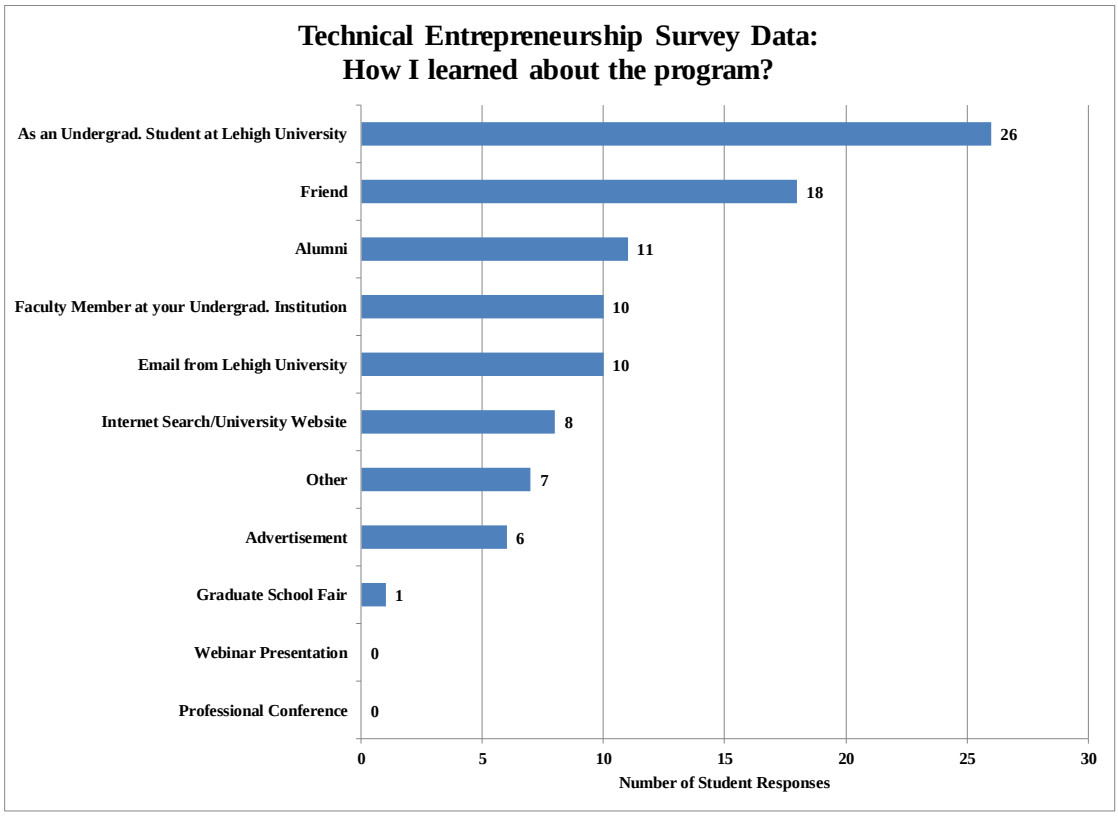
Marketing "Intrapreneurship"

When prospective students hear the word "entrepreneurship", many automatically believe this program is geared solely towards individuals seeking to start up their own companies; a scary concept for some. With this assumption, these individuals are missing a very important benefit of the program and that is gaining "intrapreneurship" knowledge and skills. Understanding all stages of the product development process is an attractive asset employers seek in new hires.

TE Recruitment Efforts:

- Monthly Open Houses – Held during the spring in the program's designated space, faculty and current students are present to interact with prospective students. These events are highly effective at recruiting students from local colleges and universities.
- Program Seminars – TE faculty deliver presentations at targeted schools and organizations, including the 23 Kern Entrepreneurial Engineering Network (KEEN) schools and 50 NSF Epicenter Pathways to Innovation Engineering schools, amongst others. One to one faculty to faculty contact at targeted schools has proven to be the most effective recruiting method for this program. The challenge is maintaining these connections from year to year.
- Program Workshops – TE faculty participate in workshops on Maker Spaces for National Public Radio, the National Science Foundation, and KEEN.
- Professional Conference Participation – Paper, poster, and panel presentations are delivered annually at a number of Innovation and Entrepreneurship (I&E) conferences, such as the VentureWell Open, KEEN, Capstone, American Society of Engineering Educators (ASEE), and the Collegiate Entrepreneurs Organization (CEO) conferences.
- Program Website – The program website is continuously updated to highlight the program's many success stories of our graduates.
- Program Webinar (fall) – The presentation is delivered in early fall and targets juniors and seniors. Current TE students participate on a panel with the program director. Audience participation has been limited.
- Email Campaigns – In late fall, program specific literature is sent to both prospective student lists and faculty mailing lists.

Effectiveness of TE Recruitment Efforts:



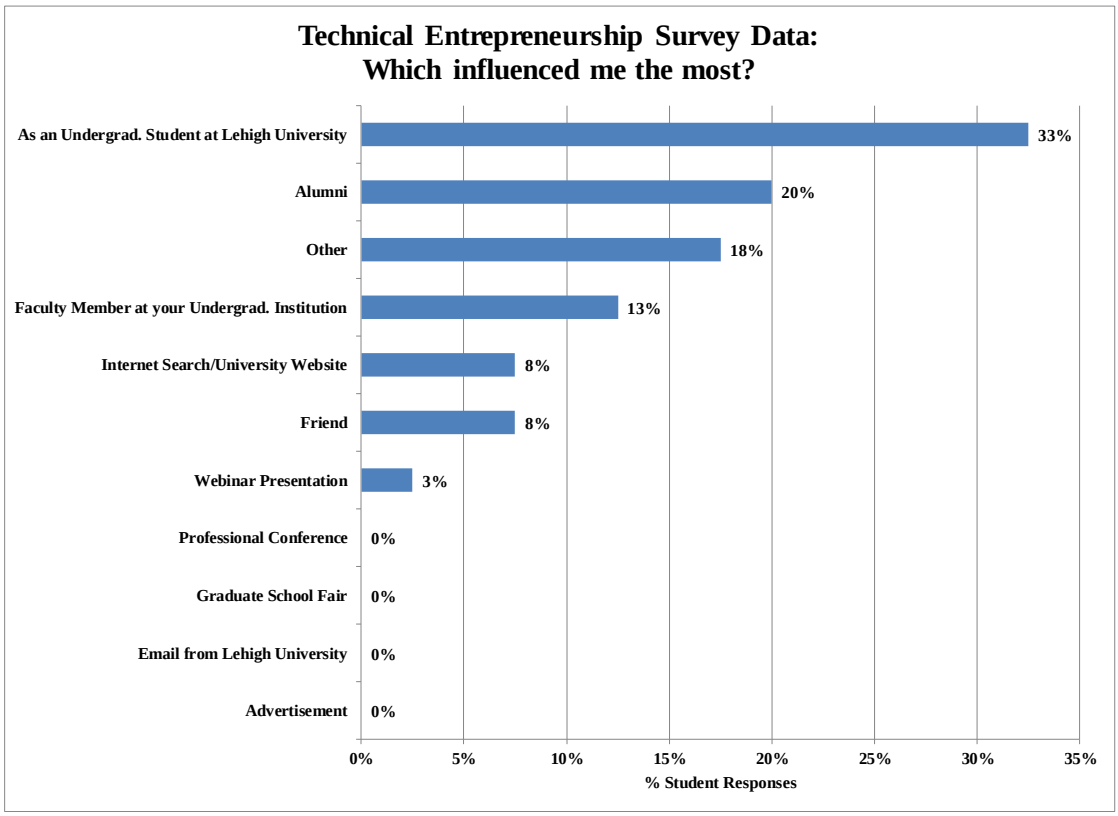


Figure 10: Effectiveness of Technical Entrepreneurship recruitment efforts.

Survey responses from individuals associated with the TE M.Eng. program are shown in Figure 10. Given that the TE master's program draws upon Lehigh University's deep-rooted and powerful ecosystem of programs dedicated to the teaching of business and technology innovation, such as our undergraduate integrated product development program and the Baker Institute for Entrepreneurship, Creativity and Innovation, it is not surprising that our graduate program would draw a significant number of our own undergraduates and alumni. Furthermore, the data confirms the effectiveness of faculty outreach. Those who responded "other" to the two survey questions, emphasized the importance of the program's faculty proactively reaching out to them, as well as, hearing positive feedback about the program from the program's alumni. As noted with the other broad reaching programs, email campaigns and advertising are effective means to educate a large population of prospective students about your program. While participation in program webinars has typically been low, 3% of the TE survey responders selected this choice as the most influential factor in applying to the program. Overall, the data emphasize the importance of relationship building and producing very successful alumni in developing an effective recruiting strategy for this type of program

Conclusion:

In summary, there is a growing demand for professional master's programs and their graduates. Due to the high cost of these programs, along with the novelty of some their topic areas and other challenges, these programs often require an extra focus during the recruiting process. The additional attention required comes in many forms, such as direct outreach from program directors, program specific open houses, and targeting professional societies. Data presented in this paper confirm, an effective recruiting plan must contain a little bit of everything, as the impact of recruiting efforts will vary from year to year based on a number of external factors (e.g. the economy, faculty response rate to your outreach efforts, etc.). Successful recruiting strategies will possess both broad reaching and targeted efforts in order to develop strong relationships with prospective students and faculty internal and external to your academic institution. Furthermore, there is significant value in the continued investment in a program's website, as many recruiting mechanisms (e.g. email campaigns, advertising, etc.) direct prospective students there to learn about the program. Overall, the study performed has provided us with a new perspective regarding the effectiveness of our recruiting efforts for each of our professional master's programs. The results will help guide us in the development of our future recruiting plans.

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