Lessons Learned: Student Perceptions of Successes and Struggles in One-Year Master's Programs in Engineering

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Introduction:

In recent years, more condensed graduate programs (such as one-year Master's programs) have emerged to better enable students to expand their understanding beyond the undergraduate level to aid in potential career advancement. However, limited research has been conducted to understand how the student experience in these programs compares to more traditional graduate programs and the motivators that influence students to enroll in these new programs.

One of the few studies exploring one-year Master's programs is Mohr et al.[1], who explored strategies to effectively recruit students into these innovative programs, including how students discovered the programs and how different recruiting materials influenced students' decisions to enroll in the program. However, the study focused on the strategies used to recruit students over the student's motivation for entering a one-year Master's program in general and how students viewed the program compared to a traditional Master's degree. Additional articles explore the development and implementation of one-year programs[2,3,4]. Gross, Mohr, and Pessiki[2] describe the development of a Structural Engineering professional, 10-month Master's degree program. Initial assessment data from an alumni survey highlighted key elements from the program that alumni found impactful, such as a group design project, field trips, and seminars. Smith and Bailey[3] discuss their "high touch, high value," accelerated, systems engineering Master's degree program. They also reported the results from an alumni survey that highlighted students' general satisfaction with the program. Wuyts et al.[4] developed a one-year, multi-campus biochemical engineering program in Belgium. This program was modular and they focused on the innovative implementation of the modules at multiple campuses and their future assessment plans. Each of these studies highlighted the new curriculum for a one-year Master's program. The student evaluation that was reported was in the form of alumni surveys from after the students had graduated.

The purpose of this study was to better understand why students were enrolling one-year Master's programs (as compared to two-year Master's programs or PhD programs) and how students evaluate their experience in these new programs.

One-year Master's programs at our institution: In the fall of 2015, seven engineering programs at a large, public university introduced new Master's programs designed to be completed in one year rather than the more traditional 2+ years. The administration within the College of Engineering was encouraged by similar program success and challenged each of the engineering departments to develop a one-year program. Fall 2015 was the first semester where the one-year programs were accepting students to participant. This study focuses on the current student experience and their reasons for enrolling in these programs.

Methods

Participants and Procedures: In the spring of the first year of the programs, the graduate students in the innovative one-year programs as well as all other Engineering Master's and Ph.D. students were invited to participate in an online Program Assessment survey. At the time, approximately 1,400 students were enrolled in graduate programs in the College of Engineering. In total, 378 of these students (~27%) participated in this study. Of these 378 students, 374 (98.9%) completed the survey and were included in the analyses.

Respondents were separated in three groups for analysis: One-year Master's students, More-than-one-year Master's students, and Ph.D. students. 214 (56.6%) respondents were Ph.D. students and 164 (43.4%) respondents were Master's students. Of the Master's students, 23 (14.0%) participants were enrolled in one of the seven One-Year Master's programs and 141 (86.0%) were Traditional Master's students. Note, however, that the Traditional Master's category also includes students enrolled in integrated undergraduate/graduate (IUG) programs which typically take 5 years to complete and results in both a BS and an MS.

Measures: This survey was designed to explore student motivations for enrolling in their graduate program, career and research goals, academic perceptions, challenges, and program satisfaction through four rating scales and three open-ended questions. After demographics, the students were first asked to report their motivation for pursuing their chosen degree and about their career plans. Next, students were asked to rate the extent to which they agree with four statements about their graduate program. The ratings ranged from 1 to 5, with 1 meaning 'Strongly disagree' to 5 meaning 'Strongly agree'. A "challenges" rating scale followed, asking students about the level of challenge they had experienced during their graduate program for seven program elements, with ratings ranging from 'Not at all challenging' to 'Extremely challenging'. Students were also asked to share any significant challenges that they had faced in an open-ended question. For the next rating scale, students were asked to indicate the extent to which they agreed or disagreed with six statements regarding their academic experiences in the College of Engineering from 1 meaning 'Strongly disagree' to 5 meaning 'Strongly agree'. The challenges and academic experience rating scales were adapted from a climate survey implemented by the College of Engineering and co-developed with Rankin & Associates Consulting Finally, students were asked to rate their level of satisfaction with eleven elements of their graduate programs.

Results

Demographics: The 374 survey participants were enrolled in a variety of engineering programs representing all of the programs offered in the College of Engineering (see Table 1). Of the 23 One Year Master's students, 69.6% reported their gender as male, 26.1% as female, and 4.3% as 'prefer not to say'. 34.8% consider the United States to be their home country and 34.8% of the students completed their undergraduate degree in the United States. For the 141

Traditional Master's students, 63.8% reported their gender as male, 33.3% as female, 1.4% as 'prefer not to say', and 1.4% chose not to respond. 48.9% consider the United States to be their home country and 58.2% of the students completed their undergraduate degree in the United States, those these values are skewed by the inclusion of students in connected undergraduate/graduate programs who inherently must have attended a US undergraduate institution. Finally, the 214 Ph.D. students included 71.0% male, 25.2% female, 3.3% 'prefer not to say', and 0.5% no responses. 43.9% consider the United States to be their home country and 44.9% of the students completed their undergraduate degree in the United States.

Program	One-year Frequency	Percent	Traditional Master's	Percent	Ph.D.	Percent
Aerospace Engineering	6	26.1	11	7.8	10	4.7
Chemical Engineering	2	8.7	0	0.0	19	8.9
Civil Engineering	2	8.7	9	6.4	8	3.7
Computer Science and Engineering	6	26.1	8	5.7	24	11.2
Electrical Engineering	2	8.7	17	12.1	27	12.6
Engineering Mechanics	2	8.7	1	0.7	2	0.9
Environmental Engineering	3	13.0	3	2.1	3	1.4
Acoustics			3	2.1	9	4.2
Architectural Engineering			29	20.6	9	4.2
Bioengineering/Biomedical Engineering			9	6.4	14	6.5
Engineering Design			4	2.8	0	0.0
Engineering Science and Mechanics			3	2.1	16	7.5
Industrial Engineering			22	15.6	24	11.2
Mechanical Engineering			17	12.1	39	18.2
Nuclear Engineering			5	3.5	10	4.7
Total	23	100.0	141	100.0	214	100.0

Table 1. Program enrollment for one-year and traditional master's and Ph.D. participants.

Students across all three groups reported their career goals following their program. As expected (Figure 1) in all three levels of programs a majority of students reported planning on a career in industry. The groups diverge on their second most common goal, however, with Master's students (both One-year and Traditional) reporting goals involving continued graduate school while Ph.D. students report plans to join academia. Even with this variation, the majority of students across all three groups rated conducting research as moderately, very, or extremely important. While students who planned on a career in industry rated research as less important than their peers, this difference was not significant for One-year Masters students planning a career in industry (mean rating = 2.93) as compared to those with other career plans (mean rating

= 3.56); $t(21) = 1.291, p = 0.211$ nor for Ph.D. students planning a career in industry (mean rating = 4.27) as compared to those with other career plans (mean rating = 4.38); $t(212) = 0.983, p = 0.327$. Traditional Master's students' ratings of the importance of research to their career- or education-related goals did differ significantly between the students planning a career in industry (mean rating = 3.39) as compared to those with other career plans (mean rating = 4.22); $t(139) = 4.083, p < 0.001$.

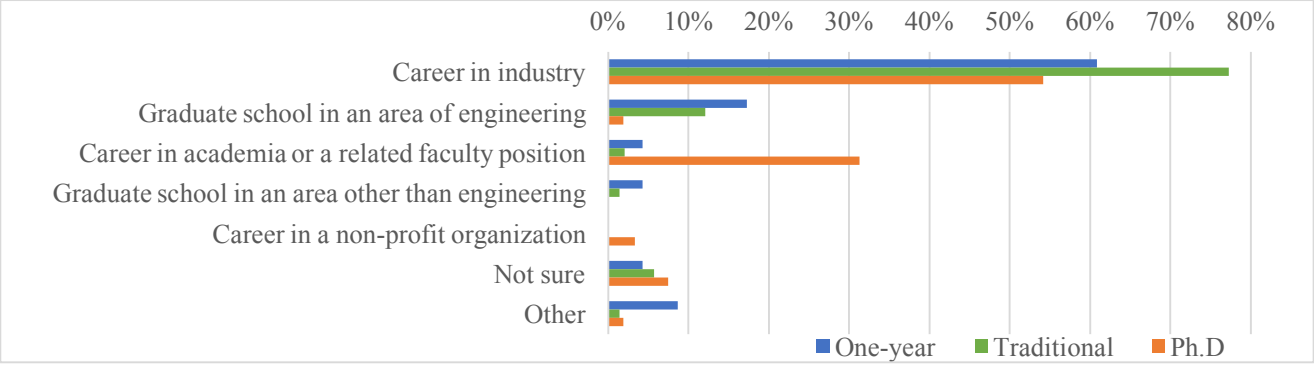

Figure 1. Career goals for one-year and traditional master's and Ph.D. participants.

The students reported a wide range of motivations for pursuing their graduate degree. Students in the one-year master's program consistently referenced the speed of the one-year program (45.5%), career related goals (27.3%), a lower application requirement for the one-year program (22.7%), and lower cost (9.1%). For students in the traditional master's programs, career-related goals (43.6%) were also reported as motivation, along with academic interest (58.4%), research opportunities (16.8%), because of an integrated undergraduate/graduate program (8.9%), and as preparation for a Ph.D. (5.9%). Students in the Ph.D. programs reported many of the same motivations as their traditional Master's degree peers, including career-related goals (50.3%), academic interest (36.1%), research opportunities (33.0%), and continuing from a previous degree or project (14.7%).

Rating Scales: The survey contained 4 rating scales that required participants to respond to statements about the overall program, challenges, academic experiences, program satisfaction. The 28 rating questions were analyzed for mean differences between the One-year and Traditional Master's groups. Three questions had significantly different mean ratings.

The 3 items came up significantly different were all on the Challenges rating scale, where students were asked: "Have you experienced any challenges with any of the following during your graduate program?". The three challenges that had significantly different mean ratings between the one-year and traditional master's groups were 'completing coursework and course-based requirements' $(t(162) = 2.533, p = 0.012)$, 'managing the course load and requirements

of the graduate program' ($t(162) = 2.615, p = 0.010$), and 'experiences with instructors/faculty outside of coursework' ($t(162) = 2.238, p = 0.027$). As you can see in Figure 2 and 3 below, more One-year Master's participants rated each statement Extremely or Moderately challenging than did the Traditional Master's participants, while more Traditional Master's participants rated each statement Slightly or Not at all challenging.

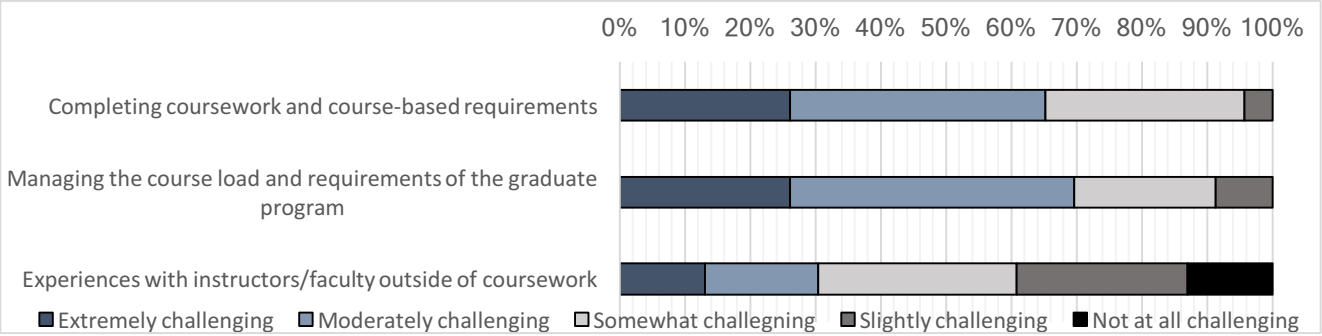

Figure 2. One-year Master's participants' responses

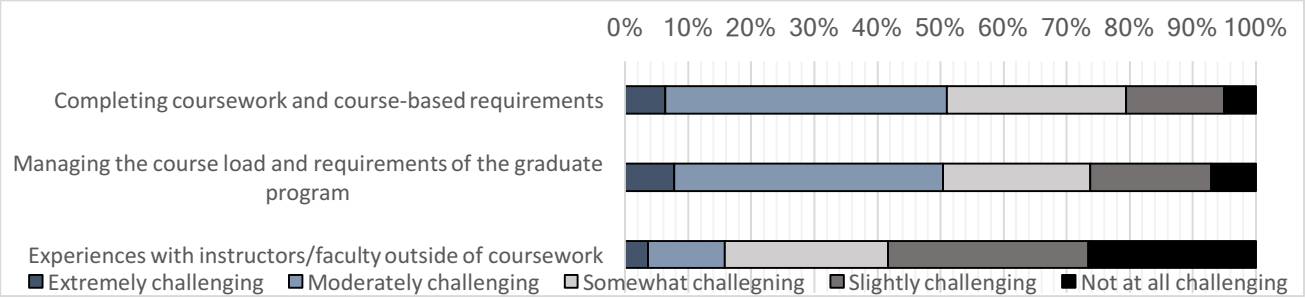

Figure 3. Traditional Master's participants' responses

When asked to expand on any significant challenges faced during their program in an open-ended question, students in the One-year and Traditional Master's programs introduced similar themes: issues with advising, issues with workload, and issues with coursework. Only one theme appeared uniquely in the Traditional Master's participants' answers: research related challenges. Sample comments are presented in Table 2.

Challenge	Example from One-year Master's students	Example from Traditional Master's students
Issues with Advising	"There is not much advising required, but clear communication of concepts such as how to register and what is required to complete the program did not occur until almost too late."	"Advisor has very little time to talk to any individual student because of the number of advisees."
Issues with Workload	"Four core courses in the graduate program was a lot to manage at one time, especially while holding a part-time job."	"The first year course requirements were very challenging when trying to balance research and several courses simultaneously."
Issues with Courses	"Graduate classes are offered on a 2-3 year rotation. Having only a year to complete a degree severely limits the courses available that match our backgrounds and interests… forced to take courses where we lack the background knowledge."	"…for design based classes, there isn't enough faculty with legitimate industry experience. All the education is very theoretical and very little is applied."
Issues with Research	N/A	"Research can be difficult and unclear"

Table 2. Examples of reported challenges for One-year and Traditional Master's students.

Discussion

Demographically, students in the One-Year Master's programs share some surface similarities with their Traditional Master's programs peers; they are majority male and most have the goal of a career in industry. Unlike their Traditional peers, however, the One-year Master's programs enroll a higher percent of international students as well as a higher percentage of students who did not attend undergraduate universities in the US, though that percentage may be skewed by the inclusion of students' in integrated undergraduate/graduate programs. Differences in demographics such as these are important to note as these innovative one-year programs develop, as they can indicate what populations the programs are appealing to and therefore inform program design.

Students also reported different motivations for choosing the one-year master's programs in contrast to the traditional master's programs. The one-year program appealed to students uniquely because of its speed and lower cost. On the other hand, students also perceived the one-year programs as having lower application requirements. Given the accelerated nature and increased challenge of the one-year programs, this perception should be examined more closely in years to come. Interestingly, students' motivations for attending the more traditional master's programs aligned better with the Ph.D. students' motivations than with the one-year master's students' motivations. As they develop further, both the one-year and the traditional master's programs may want to consider the goals and activities offered for Master's students to help determine whether or not they are aiding students in meeting their career goals.

Through the students' ratings of their overall program experiences, academic perceptions, challenges, and program satisfaction, we are able to look closer at the similarities and differences between the one-year and traditional Master's students. These two groups responses were not significantly different for their academic perceptions or program satisfaction ratings, indicating that student's experiences in these aspects are similar across the one-year and traditional programs. However, the One-year students rated the level of challenge of their programs significantly higher than their traditional master's program counterparts, specifically rating coursework, course load, and out of class experiences with faculty as significantly more challenging. These differences are not unexpected as these programs are meant to be accelerated and are new programs being offered for the first time. Yet taken with the perception of lower application requirements for the one-year programs, the difference in perceived challenge may be indicative of a disconnect between the level at which the programs are advertised and the level of performance that they require from students.

Future directions: Future plans include collecting further data in Spring 2017, which will function both to replicate the current results and to reveal the effects of improvements implemented for the second year of the innovative One-year Master's programs.

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