Engineering Technology Dropouts: Where Are They Now?

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The question "Where are they now?" is apropos when considering students who started out as engineering majors, but who migrated to other disciplines over the course of their college careers. Attrition among engineering majors begins as early as the first college semester and is justly a concern among engineering administrators, faculty, and advisors [1-4].

In this paper we focus on one group of engineering majors whom we term *near-graduates*. These are students who got ever-so-close to completing their undergraduate engineering degree requirements but who, somewhat surprisingly, left the university without a degree. To our knowledge, this group has not received attention in the research literature. These students posed an interesting puzzle. They had persevered to near the end and presumably were committed to their majors in engineering and hoped for careers in engineering. Was it possible to leave without a degree and still work as an engineer? Thus we asked, "Where are they now?"

Engineering majors who leave engineering early on and move to one or more departments are difficult to track. In contrast, near-graduates typically have complete academic records within the engineering advising office. Data for the present study are for engineering technology majors. Access to relatively complete and reliable data made these students attractive to us for research purposes. We surmised that if the findings here were informative, this project could provide a model for further research at our university as well as for researchers at other institutions.

Students vary in their reasons for leaving engineering [5]. In the present case, the primary advisor in the engineering technology office who was responsible for advising and guiding these students was especially interested in helping near-graduates complete their degree requirements. When students left the university and failed to enroll, the advisor made several attempts to contact these students in order to inform them of options available to complete their degrees and to encourage them to do so. From these contacts, it was anecdotally observed that near-graduates did not complete their degrees for a variety of reasons. These included financial burdens and the need to get a job, marriage, the arrival of new family members, the need to relocate, and offers of jobs in other locations. These are anecdotal suggestions, at best, and we do not have reliable data to document students' reasons for leaving. For these reasons, in this paper we limited ourselves to the following questions:

- Could general ability be a factor in not completing an engineering degree? Specifically, do near-graduates differ from graduates in terms of overall GPA?
- Did near-graduates primarily lack engineering-major or general-education courses for completing graduation requirements?
- What proportion of engineering technology graduates and near-graduates currently held an engineering-related job after leaving the university?
- What are the job descriptions that characterize graduates and near-graduates?
- Are higher-ability near-graduates and graduates, based on overall GPA, more likely to have an engineering job?

Developing Comparison Samples of Students

In this paper we analyzed the graduation profiles of engineering technology majors. The target group of engineering technology students was near-graduates. Students in this specific sample of non-graduating seniors lacked only one, two, or three courses in order to complete all requirements for graduation. For the years of admission of 1997-2008, we recovered 82 academic files of undergraduate engineering technology students who were near-graduates. From this larger sample, we analyzed the academic profiles of the subset of near-graduates who entered the program in the academic years 2001-2004. Given that students in the engineering technology programs at this university typically graduated after five years, these students would have been in the graduating classes of 2006-2009. We chose this subset of near-graduates because they would have been relatively recent graduates. The engineering technology programs were eliminated at the university in 2012, therefore, graduating classes closer to that year might not be representative of the normally-functioning programs.

In order to develop a representative baseline of graduates from the engineering technology programs, we analyzed the profiles of all graduates from these programs in the academic years 2006-2009. The profiles of these graduates were compared to those of near-graduates.

Procedure for Developing a Database

Ideally, in order to answer the question, Where are they now, we could contact students and interview them regarding their current employment. In reality, this could run into several problems, including finding current email addresses or phone numbers, gaining the confidence of

the students for the purpose of the interview, and gathering the data in a uniform manner. Therefore, we chose an alternate method in order to determine current employment of near-graduates and graduates, which was to search a public information source on the web, specifically, Linkedin™. Linkedin™ is currently perhaps the most popular website for professionals and recruiters: see, for instance (http://www.eremedia.com/ere/bullhorn-report-linkedin-most-popular-site-for-social-recruiting/).

Program and university records were searched for the remaining data. These included final grade-point average (GPA) for near-graduates and graduates and the specific courses that near-graduates lacked for graduation.

Results and Discussion

Did near-graduates and graduates differ in overall GPA? To address the first research question, we compared the overall GPAs of near-graduates to graduates (see Table 1). Graduates' mean GPAs were significantly higher than near-graduates' GPAs, based on an independent samples *t*-test [$t(272) = 4.49$, $p < .001$ (two-tailed)]. This suggests that near-graduates struggled more with excelling in their coursework than graduates.

Engineering Technology Students	Mean (Standard Deviation) GPA
Near Graduates ($n = 49$)	2.65 (.43)
Graduates ($n = 225$)	2.95 (.43)

Table 1. Mean GPA for Engineering Technology Students (Note: There were 12 graduates with missing GPA data.)

Which courses did near-graduates lack? In order to address the second research question, we compiled a list of courses that each near-graduate lacked for graduation, and then separated the courses into engineering-major courses, like a senior-level mechanical technology course, and general education courses, like a course on multicultural differences. On average, near-graduates required over twice as many engineering-major courses than general education courses (see Table 2). This difference was significant, based on a *t*-test for paired data [$t(48) = 3.08$, $p = .003$ (two-tailed)]. Although near-graduates lacked more engineering-major courses than general education courses, it is worth noting that 22 of the 49 (45%) near-graduates needed at least one general education course. Eight of the 49 near-graduates (16%) needed only one general education course (e.g., multicultural differences) for graduation. These data suggest that both kinds of courses are impediments for near-graduates, but especially striking is the fact that general education courses may be an impediment for graduation for engineering students, even in their senior year.

Type of Course	Mean (Standard Deviation)
Engineering-Major Courses	1.18 (.93)
General Education Courses	0.55 (.71)

Table 2. Mean Number of Engineering and General Education Courses Needed for Graduation

by Near-Graduates

What proportion of engineering technology graduates currently held an engineering-related job after leaving the university? To answer this question we searched Linkedin™ for profile pages for graduates. As shown in Table 3, 136 out of 237 (57%) graduates had engineering-related profile pages on Linkedin™. What proportion of near-graduates currently held an engineering-related job after leaving the university? As shown in Table 3, 18 out of 49 (37%) near-graduates had engineering-related profile pages on Linkedin™. As might be expected, the proportion of graduates with engineering-related profiles on Linkedin™ was significantly greater than the proportion of near-graduates with engineering-related profiles on Linkedin™, based on an independent-samples *t*-test: [$t(284) = 2.66$, $p = .008$ (two-tailed)]. However, it is also the case that if we simply consider the proportion of near-graduates who have Linkedin™ profiles (.37), the proportion is significantly greater than zero, based on a one-sample *t*-test using zero as the reference value: [$t(48) = 5.28$, $p < .001$ (two-tailed)]. This latter statistic suggests that a significant proportion of near-graduates are employed in engineering-related jobs.

Year of Graduation	Graduates	Graduates on Linkedin™	Near-Graduates	Near-Graduates on Linkedin™
2006	60	29	9	1
2007	62	38	19	5
2008	54	31	9	5
2009	61	38	12	7
Totals	237	136	49	18

Table 3. Total Number of Graduates and Near-Graduates Appearing on Linkedin™, by Graduation Year

What are the job descriptions that characterize graduates and near-graduates? Table 4 shows general job labels and areas for graduates and near-graduates. In most cases, near-graduates hold jobs that are similar to those of graduates. However, the level and quality of the jobs may be a factor here, which we cannot assess from the present data.

Job Descriptions	Graduates' Frequencies	Near-Graduates' Frequencies
Applications Engineer - Construction	1	
Applications Project Manager - Energy	1	
Business Development - Construction	1	
Commissioning Engineer	1	
Completion Consultant - Energy	1	
Construction	3	
Construction Foreman - Energy	1	
Construction Manager - Energy	1	
Construction Professional	3	
Corporate Sales - Construction	1	
Designer - Energy	1	
Director - Information Technology	1	

Drilling Consultant - Energy	1	
Drilling Supervisor - Energy	2	
Electrical Designer - Construction	1	
Electronic Manufacturing	1	
Energy	1	
Engineer - Construction	4	
Engineer - Electrical	4	
Engineer - Electrical Delivery	1	
Engineer - Energy	4	
Engineer - Manufacturing	1	
Engineer Technician - Electrical Delivery	1	
Engineering Analyst - Electrical Delivery	1	
Equipment Engineer Supervisor	1	
Equipment Inspector	2	
Estimating Engineer	1	
Estimator - Construction	3	1
Field Service Engineer	1	
General Manager - Electronics	1	
Land Surveyor	1	
Lead Technician - Electrical Delivery	1	
Manager - Construction	4	
Manager - Energy	1	
Materials Management Specialist - Construction	1	
MEP Engineer - Construction	1	
Mud Engineer - Energy	1	
Network Operations – Information Technology		1
Operations Manager	1	1
Operations Supervisor - Energy	1	
Owner - Construction	1	
Plant Maintenance		1
President - Construction	2	
President - Energy	1	
Process Engineer		1
Production Engineer - Energy	1	
Production Manager	1	
Project Administrator	1	1
Project Coordinator - Construction	1	
Project Engineer	2	
Project Engineer - Construction	7	1

Project Engineer - Energy	2	
Project Engineer - Manufacturing	1	
Project Manager	5	
Project Manager - Construction	20	6
Project Manager - Electrical Delivery	1	
Project Manager - Energy	1	
Project Manager - Engineering		1
Quality Assurance Engineer	1	
Quality Engineer - Energy	1	
Quality Manager - Construction	1	
Regional Manager - Electrical Delivery	1	
Safety Coordinator - Electrical Delivery	1	
Senior Advisor - Energy	1	
Senior Estimator - Construction	1	
Senior Field Engineer	1	
Senior Installation - Energy	1	
Senior Project Engineer - Construction	1	
Senior Technician - Electrical Delivery	1	
Service Engineer	1	
Site Supervisor - Electrical Delivery	1	
Software Architect	1	
Structural Engineer	1	
Superintendent - Construction	5	2
Systems Engineer	2	
Systems Engineer - Energy	1	
Systems Engineer - Information Technology	1	
Systems Specialist - Energy	1	
Technical Professional - Energy	1	
Technical Specialist	1	
Technician - Electrical Delivery	1	
Technician - Energy		1
Vice President - Construction	2	1
TOTALS	136	18

Table 4. Job Descriptions from Linkedin™ and Frequencies for Graduates and Near-Graduates

Finally, we asked if overall GPA relates to getting a job. To address this question we calculated a correlation coefficient between GPA and currently holding a job for graduates. The correlation was near zero and not significant [$r(74) = -0.04$]. The results were similar when calculating correlation coefficients separately for graduates and near-graduates. These results suggest that students' GPAs are not necessarily good predictors of whether engineering technology students

will have an engineering-related job.

Conclusions

When first initiating this project, we assumed that we could simply call or email near-graduates to ask them what they were currently doing. Rather, we found that tracking down phone numbers and email addresses posed a significant challenge. We also realized that near-graduates may not be inclined to discuss their current positions. Linkedin™ provided an alternative. The benefit of using Linkedin™ is that the same tracking method can be uniformly applied to near-graduates and graduates. We also found that the percentages of near-graduates and graduates who appeared on Linkedin™ were robust. Therefore, it appears that Linkedin™ is often used by engineering professionals to advertise themselves to the engineering industry. Therefore, it may be possible to use Linkedin™ more broadly in other engineering majors and for other cohorts of students in order to better understand where engineering students are employed after graduation or near-graduation.

Our first result showed that graduates earned higher GPAs than near-graduates, suggesting that ability and circumstances may have facilitated the academic success of graduates compared to near-graduates. However, calculation of the correlation between GPA and holding an engineering-related job was near zero, indicating that GPA was not necessarily a determining impediment to acquiring an engineering-related job.

An examination of the specific courses that near-graduates lacked in order to complete degree requirements showed a significantly higher proportion of engineering-major courses compared to general-education courses. However, somewhat surprisingly, the latter was a partial or sole impediment for a number of students. In general, more active advising of students, from early on, may be the key to reducing the number of near-graduates. Advising is more than informing students of degree requirements. In part, advisors can help students connect the courses that they are required to take to their academic goals, and assist students in building on their personal strengths in order to reach their career goals [6-7].

Finally, the results here suggest that near-graduation is not a trivial phenomenon. Specifically, if we use 237 as the baseline for graduates in the present cohort, then adding in 49 near-graduates would increase the graduation rate by 21%. If, indeed, near-graduates could be advised and aided in ways that would lead to graduation, it would significantly improve the overall graduation rate for the university. Importantly, it could also significantly increase the sense of accomplishment, satisfaction, and self-efficacy of these students.

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