Interships, Other Employment and Academics

Dr. Simeon Ntafos, University of Texas, Dallas

Dr. Ntafos is Professor of Computer Science, Associate Dean for Undergraduate Education and Director of the Office of Student Services in the School of Engineering and Computer Science at the University of Texas at Dallas. He received his B.S. degree in Electrical Engineering from Wilkes College in 1974 , the M.S. degree in Electrical Engineering and the Ph.D. Degree in Computer Science from Northwester University in 1977 and 1979 respectively.

Dr. Maria Hasenhuttl, University of Texas at Dallas, Jindal School of Management

Dr. Maria Hasenhuttl received a PhD from the University of Texas at Dallas. She received her Masters Degree from Karl-Franzens University in Graz, Austria. Dr. Hasenhuttl is currently a Senior Lecturer in the Organizations, Strategy and International Management Department of the Jindal School of Management at the University of Texas at Dallas. Her research interests are in the area of corporate governance, success factors in higher education, and positive organizational scholarship.

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Abstract

The traditional view is that academics should be the primary focus of full-time university students, especially in demanding majors like Engineering and Computer Science. Internships are widely touted as great ways to add practical experience, connect theory with practice, motivate, and help produce well-prepared, ready-to-contribute graduates. We report on a work-study survey of seniors at a large School of Engineering and Computer Science that challenges these traditional views and suggests that, among internships, other employment, and academics, "other employment" may be the centerpiece of the undergraduate experience.

Introduction

Internships play an important role in helping students support the cost of their education, improve problem-solving skills[9], gain self-confidence and self-esteem and often motivate students to complete their degree thus acting to improve retention and graduation rates[3,7]. While usually an attractive option for undergraduates, some universities require internships[6,8] and other allocate to them a significant role in critical activities like accreditation[1,2]. On the other hand, balancing the demands of work and study in a demanding engineering program can be difficult for a young student; trying to do too much is a common trap that often leads to academic trouble resulting in switching to a less demanding major or withdrawal from the university thus acting to reduce retention and graduation rates.

We use the data collected on a survey of students enrolled in the capstone senior design classes, placement data from the internship program and academic performance data to form a fairly complete map of the work-study question. We document that the majority of student job placements do not directly involve the university services dedicated to support such activities and that holds even if we only consider placements that are related to Engineering and Computing. The senior design survey gathered work histories of about 80% of the enrollment in these classes which we contrast with academic performance.

We consider issues arising from attempting to actively manage the total workload for students. We look at the role of industry who desires access to undergraduate talent on one hand but laments the shortage of degreed professionals in the job market on the other (a shortage that industry practices partially cause). We also discuss the role of internships in the curriculum and contrast how the School of Engineering and the School of Management take different approaches to this issue with one moving towards requiring work experience for its students while the other severely limits the use of experiential credit.

Background

The School of Engineering and Computer Science currently offers 7 undergraduate degrees and has experienced tremendous growth in the past few years. This growth has been achieved while also improving the quality of the incoming freshman class (albeit at a much slower rate than the enrollment growth). Figure 1 shows freshman retention in the School for the past 14 years. Figure 2 shows four-, five-, and six-year graduation rates for the school for the past six years. Generally, these rates are viewed internally as low, and especially so in view of the fact that the

school brags about the quality of its freshman class (in terms of SAT scores, National Merit finalists, Terry Scholars).

Student services in the School include a program that assists students with internships (from resume preparation, to coaching for interviews, to career fairs, internship database). In terms of placements, the program is among the largest in the country. Employers provide feedback on every placement and they generally are very happy with the quality of the interns (e.g., more than 90% rated the performance of the students interning with them as very good or excellent). Internships are viewed as a very important contributing factor to the growth experienced by the

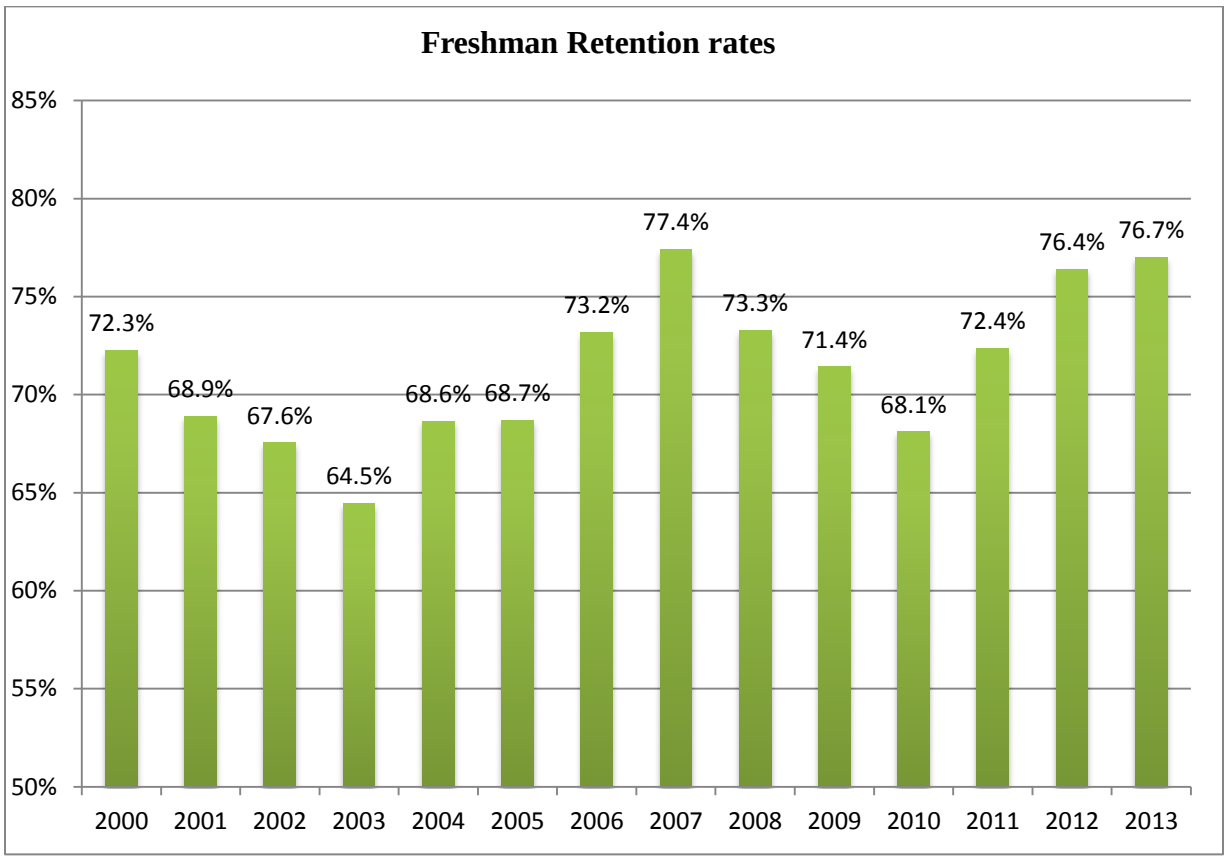

Figure 1. A 14-year history of Freshman retention rates.

School, the reputation of its programs, and the career-readiness of its students. Students also view them as an important factor in their job search. Industry participation in capstone Senior Design projects is becoming the rule rather than the exception. All is not uniformly rosy however; the most commonly reported reason for students in academic trouble is that they tried to do too much by working while going to school and doing one (and often both) at levels they could not sustain (in terms of working hours and credit hours enrolled in).

The university developed guidelines for work and study a couple of years ago and those guidelines have been used in advising students in the School. Roughly the guidelines amount to keeping the number of hours a student works per week plus three times the number of credit hours the student is enrolled in (two hours outside class for each hour attending class; maybe too

high[5]) below 60 (with adjustments depending on the student's grades), Students that pay attention to the guidelines and adjust their work/class schedule are in the minority; more often students argue that some of their classes are very easy and/or their employer is very flexible. Another factor that complicates tracking of this problem is that much of the work students are involved in turns out to not be an official internships arranged through the School/University.

In this paper we report on a study we undertook to better understand the work/study issue and its implications. The goal of the study was to gather work histories of students and determine how the amount and type of work and their academic load affected their performance. We started

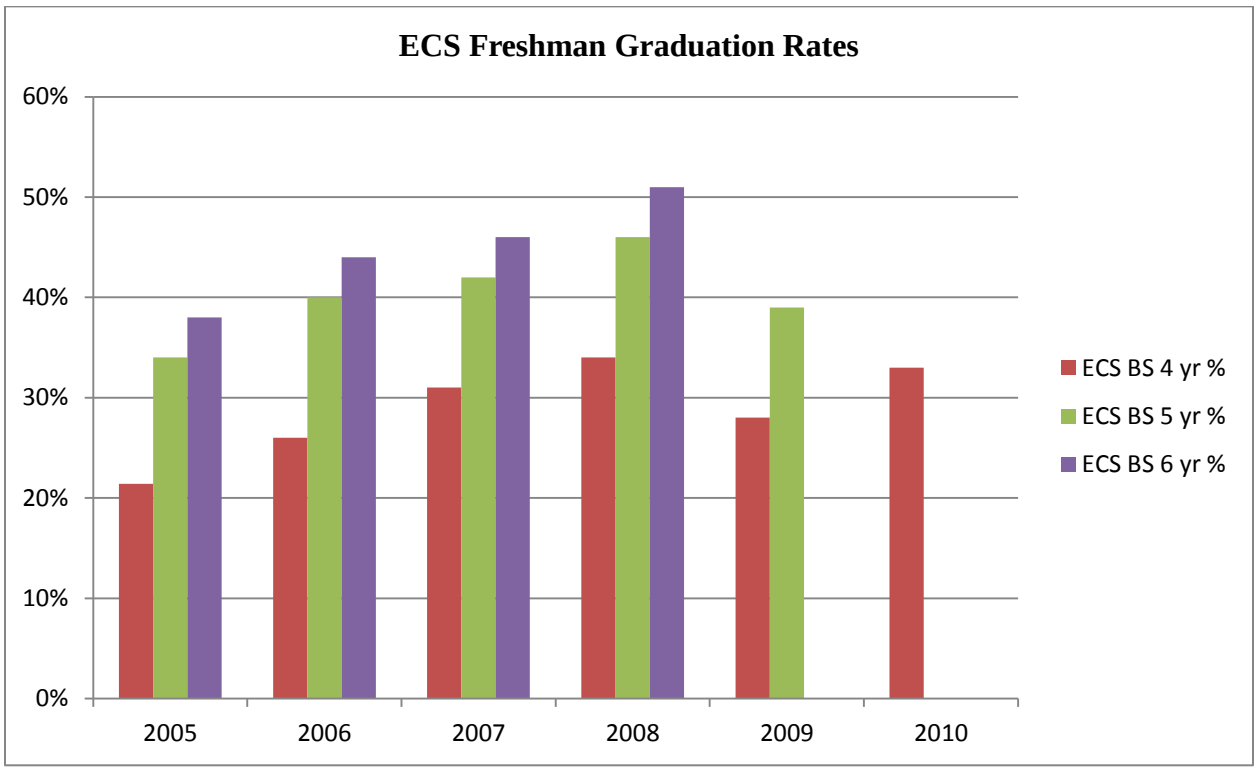

Figure 2. Graduation rates for the School of Engineering for the classes of 2005 to 2010.

with an on-line survey distributed to the graduating seniors; we managed to gather only 25 responses and that after two reminders. We then tried hardcopy surveys in the Senior Design classes and that had a much better response rate; we gathered 224 surveys out of 282 enrolled for a response rate of 79.4%.

The Work Survey

The survey had three questions for each semester the student was enrolled at the School; they asked for the number of weeks the student worked during the semester; the average number of hours worked per week; and where the student worked. The survey ended with a few general questions asking how many students the responder knew work, why they work, and how well they balance the demands of work and study.

Table 1 shows the percentage of responders that worked each of the past 16 semesters and the average number of hours worked per week. The last two columns capture the type of employment; we classified employment into three groups: working at the university (e.g., research lab, tutoring at the Success center, library), working at an office/company (e.g., industry internships, professional offices) and the rest (i.e., working outside the university in restaurants, private tutoring, etc.). The employment patterns are what one would expect with more students working and working more hours per week in summers, higher percentages working in professional settings with more academic experience.

Semester	%working	avg-hrs/wk	%university	%office/prof.
14F	57.6%	20.5	24.0%	48.8%
14U	71.9%	31.8	13.0%	59.6%
14S	53.1%	19.9	30.3%	41.2%
13F	49.6%	19.4	24.3%	44.1%
13U	57.6%	30.4	15.5%	52.7%
13S	42.0%	19.4	29.8%	34.0%
12F	37.9%	20.2	25.9%	32.9%
12U	43.8%	28.5	19.4%	37.8%
12S	23.2%	22.4	17.3%	32.7%
11F	22.8%	22.9	11.8%	29.4%
11U	26.8%	28.1	5.0%	33.3%
11S	18.3%	24.3	0.0%	29.3%
10F	15.6%	23.4	0.0%	20.0%
10U	17.0%	27.0	0.0%	21.1%
10S	10.7%	26.4	0.0%	16.7%
09F	11.2%	26.0	0.0%	16.0%

Table 1: Employment Statistics (Fall 2009 to Fall 2014; F=Fall, S=Spring, U=Summer).

Table 2 breaks down how much students worked each semester. The five columns show the percentage of students (among those working that semester) that worked up to 25% of full time, up to 50% of full-time (not including the previous group), up to 75% of full-time (not including the previous two groups), up to full time (not including the previous three groups) and those working overtime.

The urban setting and the density of high technology companies in the area contribute to the rather high levels of employment among students.

Official Internships vs. Other Employment

Student Services at the School include an office that assists students with internships. Official internships have some entry requirements including good standing and completion of certain classes (students need to have some background in the major as placements are related to the students major; generally, second semester sophomores and higher qualify). Both the School

Semester	to 25%time	to 50%time	to75%time	to fulltime	overtime
14F	23.3%	36.4%	28.7%	10.1%	1.6%
14U	10.6%	11.8%	16.1%	52.8%	8.7%
14S	19.3%	44.5%	23.5%	12.6%	0.0%
13F	20.7%	45.0%	22.5%	11.7%	0.0%
13U	8.5%	17.8%	14.7%	52.7%	6.2%
13S	21.3%	44.7%	19.1%	13.8%	1.1%
12F	16.5%	50.6%	16.5%	14.1%	2.4%
12U	10.2%	15.3%	27.6%	41.8%	5.1%
12S	19.2%	32.7%	23.1%	23.1%	1.9%
11F	25.5%	25.5%	21.6%	21.6%	5.9%
11U	8.3%	20.0%	25.0%	41.7%	5.0%
11S	19.0%	21.4%	28.6%	26.2%	4.8%
10F	20.0%	20.0%	37.1%	20.0%	2.9%
10U	15.8%	13.2%	28.9%	34.2%	7.9%
10S	16.7%	20.8%	29.2%	29.2%	4.2%
09F	24.0%	12.0%	32.0%	28.0%	4.0%

Table 2: Employment levels per semester (Fall 2009 to Fall 2014; F=Fall, S=Spring, U=Summer).

and the University organize career fairs that are not limited to graduating seniors looking for permanent jobs; these attract both a large number of companies and students; typically every

hallway/open space in the building is jam-packed. In addition, student organizations (e.g., student chapters of ACM, IEEE, ASME, Societies of Women, Black, Hispanic Engineers) regularly bring in industry representatives for talks (and pizza) and organize mock interviews. Students use these and other venues to look for work opportunities[4].

It is generally accepted within the School that most of the students that work, even if one limits this to working in places that could be official internships, do so outside the official university programs. This was confirmed by the survey. Among the 224 responders to the survey, the number of official internships over the full span covered by the tables was a grand total of 56 students and 78 total placements. If we consider the "office/professional" jobs reported in table 1 for the past two years only (back to and including Fall 2012 to account for the eligibility requirements in the official program), we had a total of 385 job placements; the 78 official internships are only 20% of the total.

Factors that contribute to the relatively low number of official internships likely include the status of internships in the student's degree plan. Students on official internships may enroll in a 1-credit hour or a 3-credit hour class associated with their internship; these classes require a report/paper and successful completion of the internship. The hours earned can only be used towards free-elective requirements in the student's degree plan; this is a serious limitation as some of the programs in the School have very limited free elective slots (one has none). It is

interesting to contrast this academic policy with the School of Management which allows the use of such classes towards major requirements; going further the School of Management will make work experience a degree requirement starting next Fall. Also the School of Management officially recognizes completed internships by listing them in the student's transcript.

In the School of Engineering, industry involvement in Senior Design classes has increased over the past few years to the point where all the senior design projects in Computer Science and Software Engineering were industry sponsored last year. The setup for industry participation is that industry proposes a project which is scoped and approved by faculty; a team of 3-4 students then takes the project; an engineer from the company together with a faculty member participate. In many ways, these senior design projects could be viewed as internships and the Senior Design classes are major degree requirements. However, awarding major credit for standard internships has not gathered much (if any) support among faculty (the typical concern expressed is lack of control over educational objectives and impact on accreditation; issues that others have resolved[2,6].

Academics and Employment

A main goal of the employment survey was to determine the connections between employment and academic performance. Since the survey was distributed to students enrolled in Senior Design classes (i.e. students that were graduating or close to graduation), we automatically have a biased sample as these students are the ones that "made it" or will likely do so soon. As indicated by Figures 1 and 2, there are plenty of students that do not reach this point; the problem is that they are not a captive audience for a hardcopy survey and email surveys have a very low return rate. Still, one would expect to see effects of work on academics (e.g., lower grades, delayed graduation, etc.).

Of the 224 survey participants, 74 actually graduated in Fall 2014 providing a group that shares a common outcome. In terms of academic origin, we have two main groups: those that started as First-Time-in-College Freshmen (FTIC) at the School and those that transferred (including some that changed major) with significant academic work at a Community College or another University. Focusing on the first group, we have 36 graduates and there is a wide range of start times (one in Fall 2007, one in Fall 2008, four in Fall 2009, ten in Fall 2010, eighteen starting in Fall 2011 and two in Fall 2012).

Taking a close look at the two students that started in Fall 2007 and 2008, both graduated with GPAs barely above the good standing mark. The first never worked, the second worked most of the time. The Fall 2007 FTIC student enjoyed a 230 point advantage in SAT scores, enrolled in all long semesters, never enrolled in Summer and took one more year to graduate. Looking at the one that worked semester-by-semester we have: the student completing 28 credit hours prior to Fall 2009 with a 3.2 GPA (did not report on work during that period); the student worked full-time in Fall 2009, enrolled in 16 credit hours, earned 11 with a 2.7 GPA; the student worked half-time in Spring 2010, enrolled in 13 hours, earned 3 with a 1.3 GPA; no classes in Summer 2010; did not work in Fall 2010, enrolled in 14, withdrew from 10, failed 4; did not attend in Spring 2011and Summer 2011; worked full-time in Fall 2011, enrolled in 14 hours, earned 4 with 1.9 GPA; worked full-time in Spring 2012, enrolled in 7 hours, earned 4 with 1.7 GPA; worked full-time in Summer 2012 enrolled and earned 7 hours with 2.8 GPA; worked half-time

in Fall 2012, enrolled in 16 hours, earned 7 with a 2.2 GPA; worked nearly full-time in Spring 2013, enrolled in 17 hours, earned 4 with 0.6 GPA; worked overtime in Summer 2013, enrolled and earned 3 hours with 1.7 GPA (on warning – one step from suspension); worked half-time in Fall 2013, enrolled in 14 hours, earned 11 with 2.14 GPA; worked 75% in Spring 2014, enrolled in 12 hours, earned 6 with 1.5 GPA; and the turnaround occurred in Summer 2014 when, while working overtime, the student enrolled and earned 6 hours with a 3.34 GPA and followed that with working half-time in Fall 2014, enrolling and earning 18 credit hours with a 3.17 GPA. Other than proximity to graduation serving as a motivating factor, it seems that unknown factors (besides work, study) were at play (Figure 3 shows total load and GPA semester by semester).

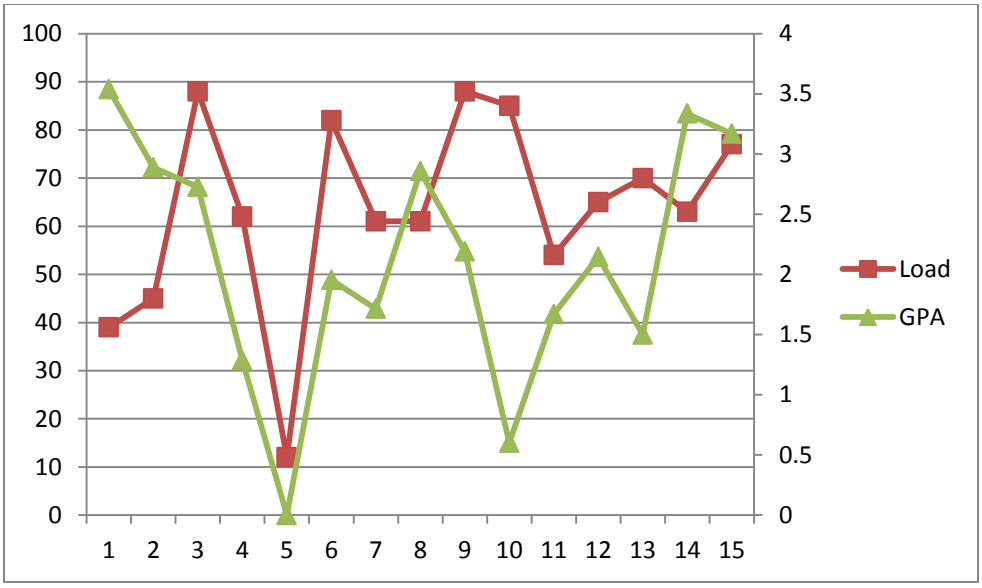

Figure 3. Total load and GPA by semester.

From the group of Fall 2009 FTIC, one student graduated with a B+ average, the others in the C to C+ range; the top and bottom performers shared the fact that they did not work. On average this group took 10 long semesters and 2 summers to graduate and included the second best SAT score among the 33 students that graduated in Fall 2014 (graduated with a C+).

The largest group is the 18 students that started in Fall 2011 and graduated a semester ahead of schedule! The group was generally very successful with 15 of them graduating with GPAs above 3.0 (2.5 was the lowest GPA). A subgroup consisting of the students that worked the most averaged a 3.33 graduating GPA with a minimum of 2.85 and a maximum of 3.96. On the other hand, the real-academic overachievers were the two students that started in Fall 2012 (with a lot of college credit) who graduated with GPAs of 3.67 and 3.95 (but worked very sparingly).

The picture that emerges from this initial look supports the conclusion that working can be both a benefit and a detriment to academic performance; some students are motivated by working, their self-esteem sky-rockets and the world is their oyster; others struggle mightily to balance work and study and do badly in both.

Discussion and Conclusions

On the summary question in the survey, on average students felt that about half of the students they know work. Money was most commonly listed as the primary motivation for working (ranging from "need to pay tuition" to 'taking date to a better restaurant") with gaining experience/boosting resume a close second. About 70% felt that other students manage to balance work and study well with about 20% unsure and 10% feeling that others do not manage the two well.

Actively managing the work-study balance was given serious consideration during the past year with the work-study formula communicated to students through advising and actually enforcing it in limited scenarios (e.g., permission to overload). The effort was generally ineffective as there is no reasonable way to determine the facts about external employment (other than official internships and working for the university). It did not take long for the word to get around and "no, I do not work" become a more and more common answer to any question regarding non-academic loads. Industry representatives in the Industrial Advisory Board for the School, clearly expressed the importance of "access to talent" (pre-graduation) for industry and also expressed great unwillingness to share employment data for students (citing privacy/legal concerns). The most recent meeting of the Industrial Advisory Board concluded that sharing information about balancing work and study loads is the better approach (over trying to enforce limits on total loads).

The typical total load for undergraduates in the School is 15 credit hours per long semester while working about 20 hours a week. This load exceeds the guideline but only by 10%. The number of students that have high loads is a more significant issue. With so many students working, the culture of the university cannot help but be affected. Students take pride in their jobs and are celebrated by their peers more than students are recognized for their academic performance. There is also anecdotal evidence that the curriculum is affected as some instructors avoid certain types of assignments (long reports/papers, team projects) that working students have difficulties in completing. Industry is generally very helpful and very interested in increasing the number of Engineering and Computing graduates but also very interested in access to over-eager, low-cost talent. Industry representatives in a retention committee suggested that the School should not worry about low 4-year, 5-year or 6-year graduation rates; since many students work (to help pay for the cost of their education and/or to gain experience), the school should consider an 8-year degree as a successful outcome for such students. Unfortunately the graduation data do not support that outlook. We tracked several freshman classes for 10 years and the number of degrees awarded past the 6^{th} year is consistently a handful; if a student does not graduate within 6 years, it is very unlikely that the student will ever graduate.

Students on official internships can earn credit (1 to 3 credit hours) through classes administered by the School's internship program or the University's career center. While such classes can be used towards degree requirements in other schools at the university, their use is limited to "free-elective" credit in the School of Engineering and Computer Science. While concerns over the impact on accreditation are usually expressed, there are also concerns over quality control in keeping such experiences at the level of a guided elective in the major.

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