What Delays Student Graduation

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Abstract

In recent years pressure has increased on public universities to improve their four and six year graduation rates. There are some obvious factors influencing these graduation rates. Many students attending urban universities are non-traditional students who work in order to pay for their education. Some entering freshmen are not prepared for college courses and begin with remedial courses. In a structured degree program such as engineering, students are required to satisfy prerequisites in order to proceed through the curriculum. Lack of course offerings can delay progress towards graduation. This study expands on a previous study conducted on a single engineering program in one public university. In this study several engineering programs in two large public universities in Texas were included. Senior engineering students were surveyed to determine the causes delaying their graduation. In responding to a survey questionnaire, students provided such information as whether they started at a 4-year university, if they had changed their major, if they started their college math below calculus, if they attended school full-time or part-time, the total number of years of college study needed to complete their engineering degree, the factors that caused delay in their graduation, and other questions related to length of study for the degrees being offered. Engineering students studying a variety of engineering programs participated in this survey. The results presented in this paper provide useful information to guide the development of programs and plans for improving graduation rates for students enrolled in engineering.

Introduction

In recent years there has been a major discussion on the time it takes for students enrolled in public institutions of higher education to receive a four year undergraduate degree. Four-year and six-year graduation rates are typically quite low for most public institutions that do not have selective admission policies. The graduation rates are as low as 10% in four years and below 30% in six years for many public universities. Pressures from public and state authorities are rising for public universities to increase their four and six year graduation rates[1,2]. Many states are providing incentives for students to graduate in four years and penalizing those students who accumulate a large number of semester credit hours (SCH) before they receive their bachelor's degrees. For example, Texas Education Code, § 54.0065 "The Tuition Rebate Program" offers students who have enrolled for the first time in an institution of higher education in the Fall 1997 semester or later a $1,000 tuition rebate if they have attempted no more than three hours in excess of the minimum number of SCH required for their degrees[3]. For example, if a degree requires a minimum of 120 SCH, students must graduate with no more than 123 attempted hours in order to qualify for a rebate. In some schools, there is an additional requirement for those students who enrolled in college for the first time in the Fall 2005 semester or later. For these students, a four-year degree must be completed within four calendar years. For some degree programs such as engineering that typically require more than four years to complete, the student must graduate within five calendar years.

State of Texas legislatures have established credit hour limitation for funding students enrolled in undergraduate programs in public institutions of higher education. In these cases states do not

provide funds for students who have exceeded the established undergraduate credit limitation. . Section 54.068 of the Texas Education Code was amended during the 76th legislative session to allow institutions of higher education to charge resident students a higher tuition rates for attempting more than 45 SCH above the minimum SCH required for a degree program. The law applies only to new undergraduate resident students who started college in a public institution in Fall 1999 or later. The 79th legislative session reduced the SCH to 30 semester credit hours for all new undergraduate resident students who started college in a public institution for the first time in Fall 2006 or thereafter **(**§ 54.014 of the Texas Education Code[4]). The total attempted hours includes the credit hours of all courses taken by students at any public institution, including all those repeated, duplicated, or those from which a student has withdrawn after the Census date in which the student received a grade of "W." Starting in Fall 2006, The University of Texas at San Antonio (UTSA) has been charging an additional fee of $121 per SCH for students who have exceeded the 30 or 45 hour credit limits.

Depending on the calculation methods used, graduation rates can be strongly influenced by students who initially seek a particular degree but later change their mind and pursue another degree path. The factors that influence a student's decision to leave engineering are linked to both academic and non-academic factors[5]. Academic factors include teaching, advising and curriculum. Non-academic factors include being part of a cohort and having a sense of community. Students who believe they belong in engineering are more likely to be retained in engineering.

The impact of freshmen-level courses on student retention has been studied[6,7]. The freshman level classes do not always have an impact on student retention or graduation rates. This finding is consistent with the understanding that curriculum and instruction have strong impacts on retention. Students who build connections between theoretical academic aspects of the curriculum and professional engineering practice are more likely to be retained in engineering. Likewise, those who build connections with other students develop a sense of belonging and are less likely to change majors.

The American Society for Engineering Education (ASEE) promotes practices and strategies for retaining students in engineering[7]. Based on best-practices submitted by College Deans from many universities, a common theme was found: creating a "community" is important for student retention. There are a number of ways to create such a community, and no single solution is sufficient. The best recommendation is for the university to have a holistic approach employing multiple strategies such as: tutoring, mentoring, learning centers, first-year student programs, at-risk student programs , strong academic advising, and career awareness[7].

Over the years, much has been done to understand and improve the retention of students[8-12]. Universities use problem solving recitations, and the integration of math/science/engineering into more exciting engineering courses with more active design projects for students. Many of these efforts have had limited success and are often overwhelmed by changes in the student body attending the university, changes in faculty teaching key engineering courses, and changes in seemingly insignificant aspects such as classroom scheduling. In many cases, modest changes impact the rate of progress through particular classes and the overall program.

The focus of this study is on students who have succeeded in reaching their senior-year and are

within thirty (30) SCH of completing their undergraduate engineering degrees. These students have succeeded and are soon to graduate. Much of their academic experience is fresh and they should be able to offer unique perspectives on how to improve the system. One can interview these students, ask them to complete a survey directed at retention issues, or one can review their academic path to better understand how they were able to progress to their current level. Through the examination of students' surveys and academic records of this group of students, we have attempted to determine the possible root causes of student graduation delay.

This paper builds on a study conducted earlier when the focus was on the senior-level students enrolled in mechanical engineering at UTSA[13]. The study is expanded in this paper to include another university as well as students enrolled in other engineering disciplines. Two main universities in Texas are involved in the extended study: UTSA and The University of Texas at Arlington (UTA). The undergraduate engineering degrees offered in the first university are Biomedical, Civil, Computer, Electrical, and Mechanical Engineering. The undergraduate degrees offered at UTA are Aerospace, Biomedical, Civil, Computer, Electrical, Industrial, Mechanical, and Software Engineering. The majority of engineering programs in these two institutions are accredited by ABET, except three programs which are so new that BS degrees have not yet been awarded in those disciplines. Plans are underway for requesting ABET accreditation visits as soon as the first degrees are awarded in those three programs. It is expected that the new programs will receive their ABET accreditation within one or two years. The student enrollment and degrees awarded in each program are summarized in Table 1.

Table 1. SCH degree requirement, enrollment, and degrees awarded in two universities in Texas

University of Texas at San Antonio (UTSA)				
Program	SCH required for degree	Enrollment Fall 2014	BS degrees Awarded 2013-14	Accredited by ABET
Biomedical Engineering	125	128	-	No (New)
Civil Engineering	128	403	84	
Computer Engineering	125	131	3	No (New)
Electrical Engineering	125	383	84	Yes
Mechanical Engineering	128	824	128	Yes
University of Texas at Arlington (UTA)				
	SCH required for degree	Enrollment Fall 2013	BS degrees Awarded 2012-13	Accredited by ABET
Aerospace Engineering	130	324	47	Yes
Biomedical Engineering	127-128*	-	-	No (New)
Civil Engineering	130	395	60	Yes
Computer Engineering	129	230	19	Yes
Computer Science	129	292	28	Yes
Electrical Engineering	125-126*	408	63	Yes
Industrial Engineering	128	156	37	Yes
Mechanical Engineering	130	748	98	Yes
Software Engineering	129	145	15	Yes

*depends on concentration

Analysis of Students Academic Records

In an earlier study[13], the academic records of students who recently received BS degrees in mechanical engineering at UTSA were examined to get some indication of the reasons why it takes some students a long time to graduate. It was soon determined that the academic records of students alone were not sufficient to determine the causes for delays in graduation. Therefore, it was decided to survey students who were within thirty hours of graduation to determine factors that contributed in their graduation delays. The Bachelor of Science degree in Mechanical Engineering (BSME) at UTSA requires 128 SCH of coursework. The degree requirement includes 42 SCH of the University Core Curriculum (or General Education). Courses in general chemistry, engineering physics, and calculus are parts of both the University Core Curriculum and the engineering degree requirements. Ninety eight (98) students completed their degrees between fall 2012 and fall 2013. In examining the transcripts of these students, several observations were made, as summarized below.

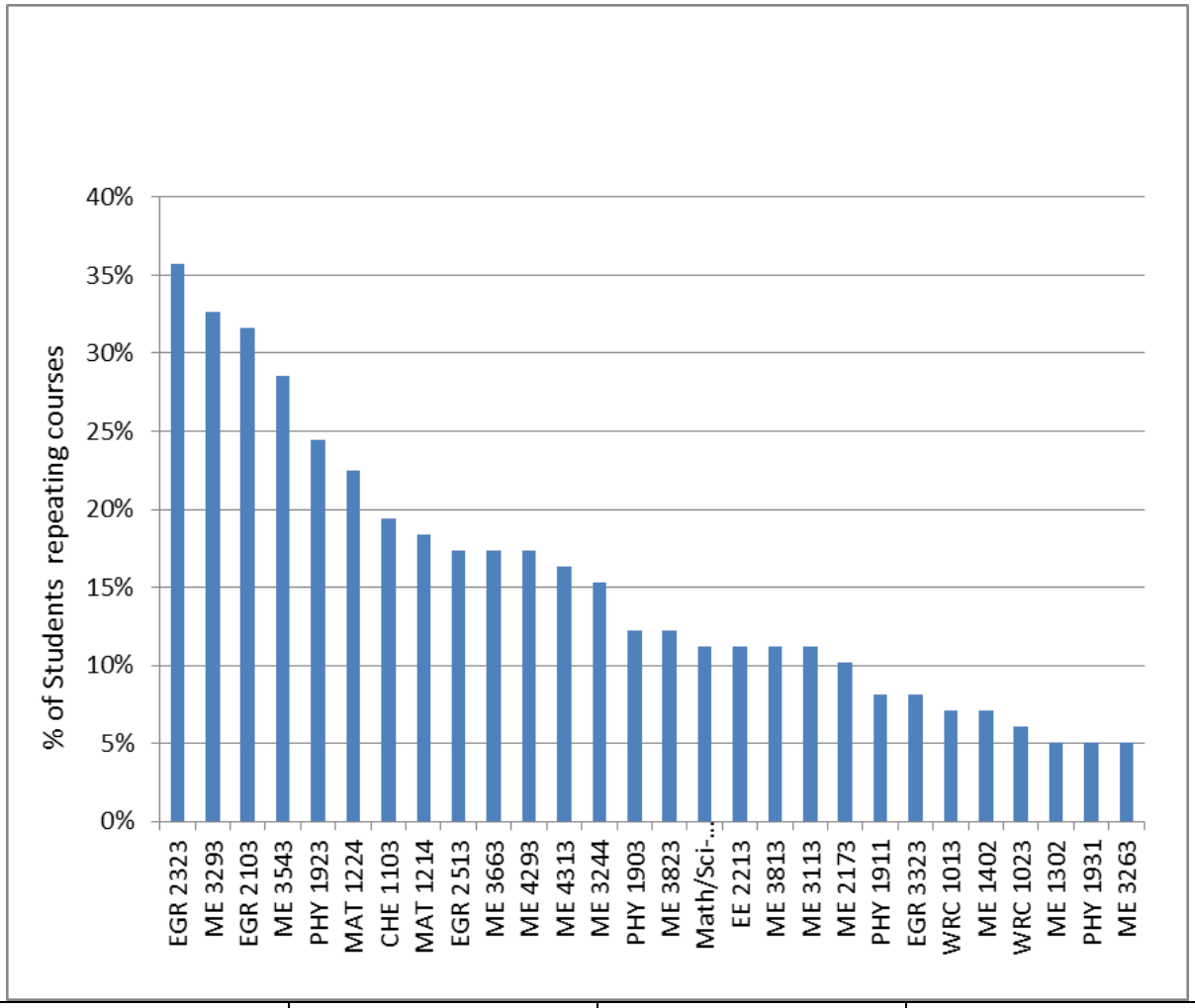
The examination of transcripts revealed that students had attempted as low as 129 and as high as 258 SCH by the time they graduated. On the average these students had attempted 166 SCH for completing their degrees. There were several factors contributing to the excessive number of credit hours attempted by students for the degrees. One student had already completed a degree in communication and was working on his second degree. A large number of students had transferred courses from community and four year colleges to UTSA. Out of the 98 students in this group, 90 (92%) had transfer credits for at least one course. Forty nine (49) students (50%) had more than 30 SCH of transfer courses and 64 students (65%) had at least 15 SCH of transfer courses. One student had transferred 174 SCH. For all academic records examined, students had transferred an average of 10 SCH into the program. In many cases, not all transfer credits applied to the degree requirements. The examination of transcripts also revealed that many students had to take remedial courses in chemistry, mathematics, and physics before they were allowed to take CHE 1103-general Chemistry, MAT 1214-Calculus-I, or PHY 1903-Engineering Physics. Of the 98 students studied, 78 students (80%) had to take between 3 and 20 SCH of additional remedial courses in chemistry, mathematics, and physics during their freshman year. Also, the survey results from the earlier study[13] revealed that twelve (12) graduating students were either double majors (seeking a second degree in either mathematics or business) or took additional courses for a minor. Table 2 summarizes the data presented above.

Table 2. Results of examination of academic records

Total SCH attempted by the time of graduation	129-258
Average SCH attempted by the time of graduation	166
Number of students transferring at least 3 SCH	90 (92%)
Number of students transferring at least 15 SCH	64 (65%)
Number of students transferring more than 30 SCH	49 (50%)
Number of students taking remedial courses in math and science (3-20 SCH)	78 (80%)

Unsuccessful attempts of required courses also delayed student graduation. Figure 1 shows those courses that a number of students had difficulty passing. The transcript analysis revealed that out of 98 students, 35 students (36%) had to repeat EGR 2323-Engineering Analysis-I, 32 students (33%) repeated ME 3293-Thermodynamics-I, 28 students (32%) repeated EGR 2103-Statics, 28 students

(29%) repeated ME 3543-Dynamics System and Control, 24 students (24%) repeated PHY 1923-Engineering Physics-II, 22 students (22%) repeated MAT 1214-Calculus-I, and 19 students (19%) repeated CHE 1103-General Chemistry. Figure 1 shows that some students had difficulties with such freshman level courses as MAT 1214-Calculus I, CHE 1103, PHY 1903-Engineering Physics-I, PHY 1923-Engineering Physics-II. A few students repeated some of the courses shown in Fig. 1 more than once. Four (4) different students repeated MAT 1214-Calculus-I, EGR 2513-Dynamics, ME 3293-Thermodynamics-I five times.



CHE 1103-General Chemistry	MAT 1214-Calculus-I	ME 3263-Manufacturing	PHY 1903-Engr. Physics-I
EE 2213-Electrical Circuit	MAT 1224-Calculus-II	ME 3293-Thermodynamics-I	PHY 1911-Engr. Physics-I Lab
EGR 2103-Statics	ME 1302-Intro to Engr.	ME 3663-Fluid Mechanics	PHY 1923-Engr. Physics-II
EGR 2513-Dynamics	ME 1202-Engr. Graphics	ME 3813-Mech. of Solids	PHY 1931-Engr. Phy-II Lab
EGR 2323-Engr. Analysis-I	ME-2173-Num. Methods	ME 3823-Machine Design	WRC 1023-Writing Core II
EGR 3323-Engr. Analysis-II	ME 3113 Meas.& Inst.	ME 4293-Thermodynamics-Ii	WRC 1023-Writing Core II
Math/Science Elective	ME 3244-Material Engr. &lab	ME 4313-Heat Transfer	

Fig. 1. Percentage of students repeating courses required for the BS degree in mechanical engineering[13]

Survey

It is well-known that faculty members have varying notions about retention. These ideas are reflected in the curriculum and in the assignment of instructors to particular classes. There is less information about the beliefs of students concerning their progress toward graduation, especially their thoughts on impediments to their earning an engineering degree in 4 years. A survey was conducted in the earlier study to assess the UTSA mechanical engineering students' perception of the reasons for the delays in their graduation. The results of that study were reported earlier[13]. The survey questionnaire was modified in this study to obtain more realistic feedback from students. In addition to mechanical engineering students at UTSA, students from other disciplines enrolled in both UTSA and UTA also participated in the new survey. Questions used in the new survey are presented in Table 3.

The new survey was conducted in spring semester 2015 in capstone design courses or other senior level courses in various programs. Only students who were within 30 SCH of their graduation were asked to respond. A total of 442 engineering students from both UTSA and UTA participated in the survey. Participants included students from UTSA majoring in Biomedical Engineering (BME), Civil Engineering (CE), Computer Engineering (CPE), Electrical Engineering (EE), and mechanical Engineering (ME). The participants from UTA included students majoring in Aerospace Engineering (AE), Computer Science and Engineering (CSE), EE, Industrial Engineering (IE), and ME. Sixty six percent (66%) of respondents were UTSA students and the remainders were from UTA. All student responses were included in database for analysis. The largest group participating in the survey were ME students (48%), followed by CE (16%), AE (11%), EE (10%), CSE (6%), IE (5%), and BME (4%). The low participation by some majors are due to either the size of program or the instructor of a senior design course not returning the completed surveys on time to be included in this study. For example, The BME program has the lowest enrollment in the college of engineering at UTSA. The CPE and EE programs at UTSA, together, have the second largest enrollment in the college. A two course-sequence capstone design courses are common for both program. The instructor of the capstone design courses in EE did not conduct the survey in his courses on time to be included in this survey. Instead a senior level required lab course was used to survey students in the CPE and EE programs. The results of their responses to survey questions are discussed below.

In the first question, the participants were asked whether they started their college education at the current university, another 4-year university/college, or a community college. The results of responses are shown in Fig. 2. About 52% of the participants at UTSA responded that they had started college in the current university; 27% started their college education at a community college before transferring to the current university; and 21% began their studies at another four year institution. At UTA, 48% of the participants responded that they had started college in the current university; 37% started their college education at a community college before transferring to the current university; and 16% began their studies at another four year institution. The result shows that UTA has a larger percentage of transfer students from community colleges as compared to UTSA.

Table 3. Survey questionnaire completed by senior engineering students (within 30 semester credit hours of graduation)

1. You started college at (circle one)
   current 4-year University
   other 4-year University
   community college

2. You started college as (circle one)
   current engineering major other engineering major non engineering major

3. First math course you took in college was (circle one)
   below college algebra college algebra pre-calculus calculus I above calculus I

4. You will complete your engineering degree in a total of ____ years of college (circle one)
   less than 4, 4, 5, 6, 7, more than 7

5. What is the SINGLE most important issue that has slowed down your progress towards graduation. (circle one)
   financial difficulties transferring courses
   starting in low-level math changing majors
   poor study habits failing/withdrawing from courses
   lack of seats in classes lack of summer classes
   lack of on-campus jobs lack of on-campus study space
   personal issues outside of school other: _____

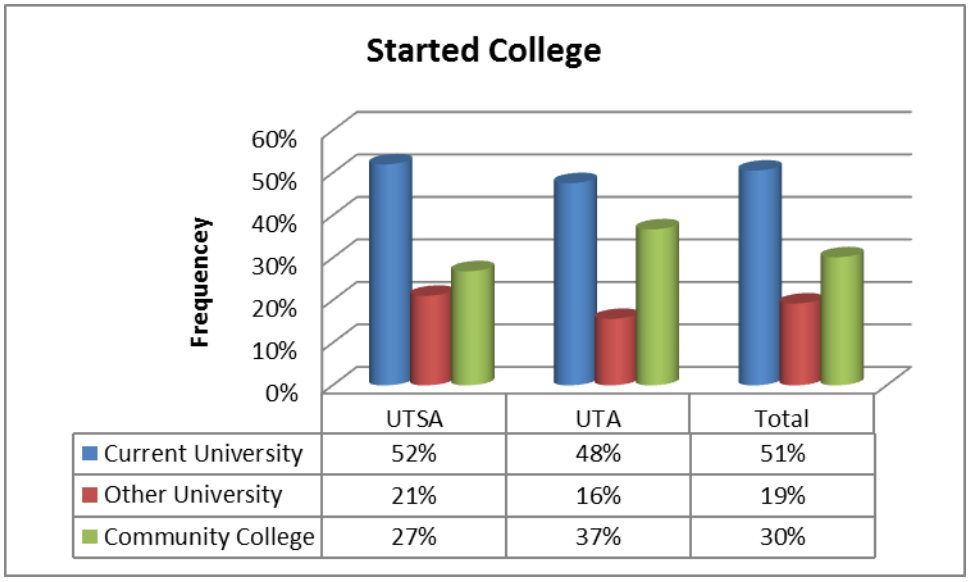
6. What is the SECOND most important issue that has slowed down your progress towards graduation. (circle one)
   financial difficulties transferring courses
   starting in low-level math changing majors
   poor study habits failing/withdrawing from courses
   lack of seats in classes lack of summer classes
   lack of on-campus jobs lack of on-campus study space
   personal issues outside of school other: _____

7. What is the THIRD most important issue that has slowed down your progress towards graduation. (circle one)
   financial difficulties transferring courses
   starting in low-level math changing majors
   poor study habits failing/withdrawing from courses
   lack of seats in classes lack of summer classes
   lack of on-campus jobs lack of on-campus study space
   personal issues outside of school other: _____

8. If you selected "failing/withdrawing from courses" in questions 5-7, why was this item selected by you (circle one)
   poor instructor poor study habits I didn't select this reason

9, If you selected "failing/withdrawing from courses" in questions 5-7, when did you realize you would not pass the class? (circle one)
   early in the semester mid way through the semester
   after the final exam I didn't select this reason

10. If you selected "failing/withdrawing from courses" in questions 5-7, how could the University have helped? (circle one)
   replacing the instructor tutoring opportunities
   I didn't select this reason other _____

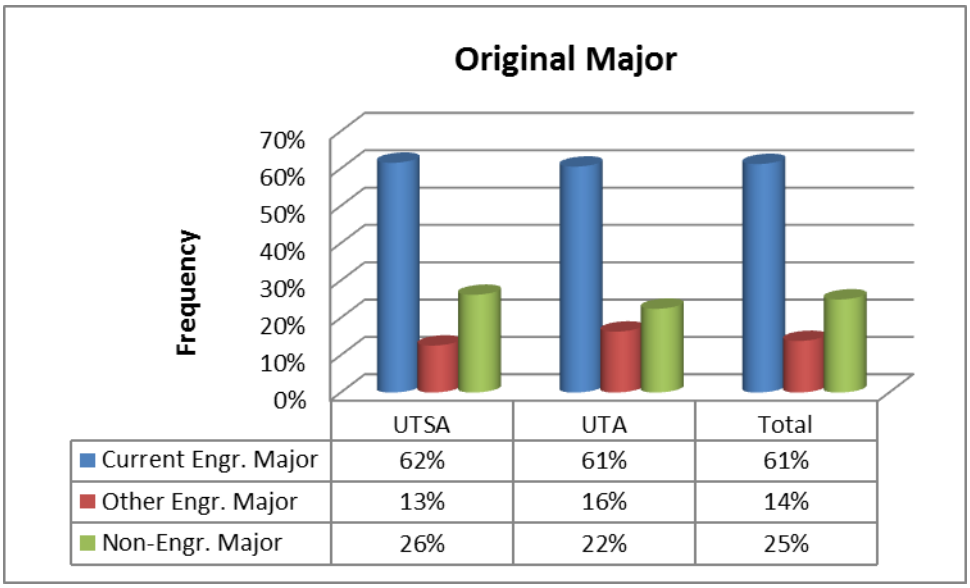


	UTSA	UTA	Total
Current University	52%	48%	51%
Other University	21%	16%	19%
Community College	27%	37%	30%

Fig. 2. Where survey respondents started college

The overall results in Fig. 2, show that 49% of respondents transferred from other institutions to the current university. This is a surprisingly high number. It contradict ideas held by some faculty that additional attention in the freshman year improves student retention. The perception is that retention is an issue at the freshmen level. Retention initiatives often focus on the development of cohorts in freshmen classes. It is just as important that transfer students be integrated into the university that accepts them. Likewise, some faculty have the attitude of building hurdles that transfer students must overcome, instead of bridges to allow a smooth transition between institutions. Both UTSA and UTA have active transfer articulation agreements with local junior colleges. These agreements can be either strong or weak, based on the standardization of the first two years of engineering curriculum. Some faculty members advocate for unique prerequisite courses that aren't offered at junior colleges. The result is they can't be earned in the first two years of college. This then makes a 2+2 program more of a 2+3 program, hence 5 years are required to complete a degree. Over the years, one can see changes to courses and prerequisites that shift back and forth between being more or less accommodating to transfer students, often based on the attitude of the current department chair or key faculty.

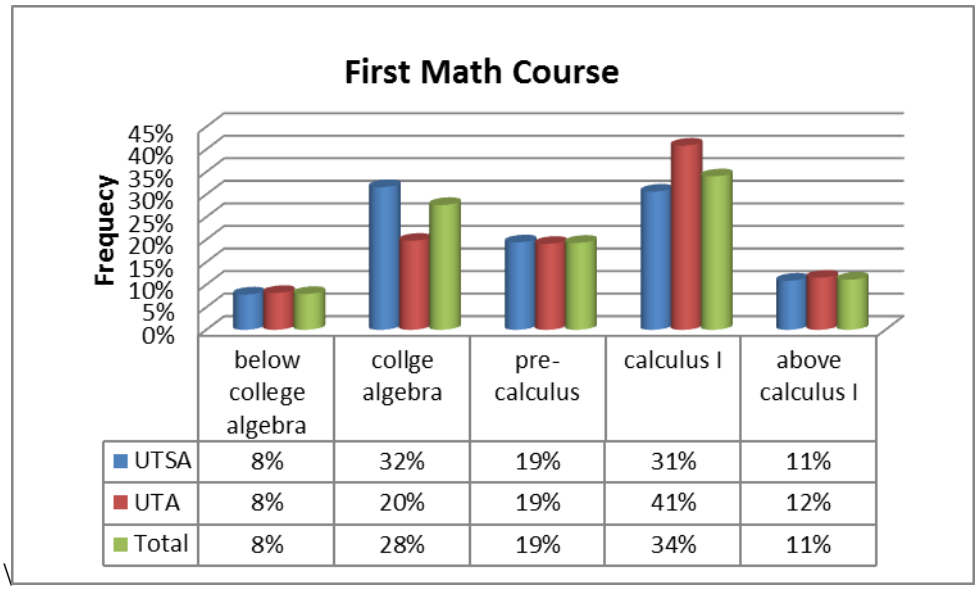
The second question on the survey asked the participants to identify their major when they started college. The choices were: current engineering major, other engineering major, or non-engineering major. Results are shown in Fig. 3. The frequencies of responses from students both UTSA and UTA are very similar. Overall, 61% students surveyed indicated that they started college with the current major and 39% of the respondents indicated that they started college in a major other than their current engineering major. Surprisingly 25% of participants responded that they started college as non-engineering major. This is relatively a high number which is not consistent with the perception of many engineering faculty. Most faculty members believe that some students start in engineering and then decide to transfer out of engineering. The results of this study show that a good percentage of students choose to transfer into the engineering programs. However, it may be that many of these students began as "undeclared" majors before selecting engineering major.



	UTSA	UTA	Total
Current Engr. Major	62%	61%	61%
Other Engr. Major	13%	16%	14%
Non-Engr. Major	26%	22%	25%

Fig. 3 Respondent's majors when they started college

The purpose of the third question on the survey was to determine what fraction of respondents were "Calculus ready" when they started college. In order to complete an engineering degree within four years, it is expected that students take and pass the first calculus course (differential calculus) during their first semester in the college. If this is not done, it delays taking the important chain of prerequisite courses required in the engineering programs. This was explored further in the survey questionnaire. Participants were asked to list the first math course they had taken in college, with the choices being: below College Algebra, College Algebra, Pre-Calculus, Calculus I, Calculus II or Above Calculus II. The results are shown in Fig. 4.



	below college algebra	collge algebra	pre-calculus	calculus I	above calculus I
UTSA	8%	32%	19%	31%	11%
UTA	8%	20%	19%	41%	12%
Total	8%	28%	19%	34%	11%

Fig. 4. Response to "The first math course you took in college was".

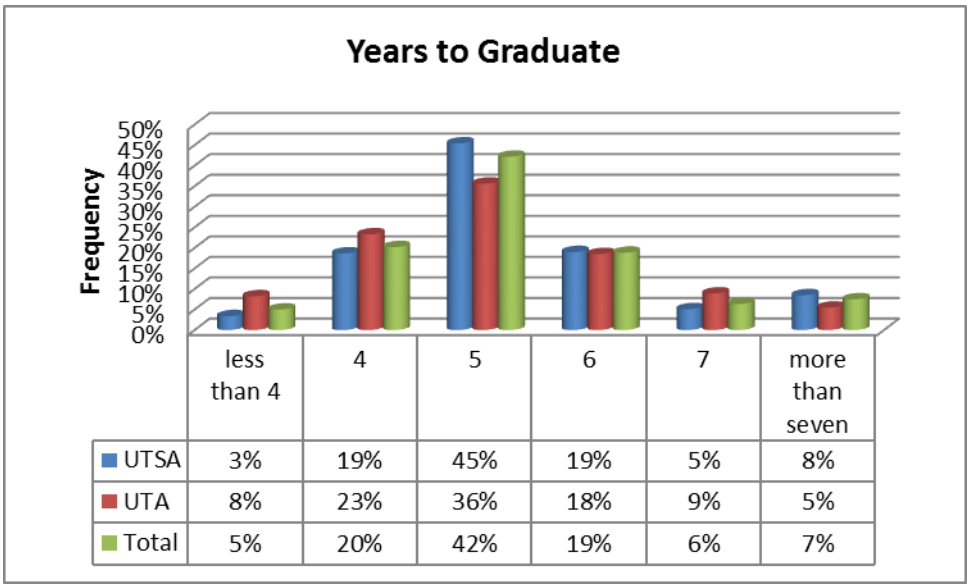
Figure 4 show that only 31% of students surveyed at UTSA stated that their first math course in college was at differential calculus level or at a higher math (11%). Nearly 60% of the senior-level engineering students were not calculus-ready when they started college. For students surveyed at UTA, 41% started their math courses at a differential calculus course, while 12% started at a higher level math course. Still nearly 50% of students started math at a level below differential calculus. Overall, only 45% of engineering students started math at the differential calculus level or higher. Similar results are expected to be true for many other engineering programs at similar universities. If students start in College Algebra, then they must take pre-calculus before taking differential calculus; hence they are one year behind and the engineering degree in reality becomes a 5-year program. Students can take summer classes to catch up, but many freshmen don't recognize the critical importance of math classes. One of the authors of this paper has taught introduction to engineering classes for freshmen students. In the first week, students were strongly encouraged to be enrolled into a math class. The importance of taking math courses during the freshman year was emphasized during the first few lectures, because it was relatively easy for students to add courses during the add and drop period in the semester. After the Census date, the instructor asked the advising office to run a report on the 200+ students in the introduction to engineering class. It was found, in spite of best efforts, that 15% of the students in class were not enrolled in any math classes.

Regardless of the advice from faculty or academic advisors, freshmen sometimes have the misconception that math is optional or it can be delayed with little consequences. The results of the survey presented in this paper support the idea that senior-level students now realize the importance of taking math during the freshman year, and some indicated that it is one of the major reasons they were not graduating in 4 years. As freshmen, they may not have understood this. But as seniors, they understand why their progress was delayed.

The fourth question on the survey explored how many years it took the respondents to complete an undergraduate degree in engineering. Figure 5 presents the summary of the results. Among the UTSA students who participated in the survey, 3% indicated that it will take them less than 4 years to graduate, 19% are graduating in 4 years, 45% are graduating in 5 years, 19% are graduating in six years, 5% will finish their degrees in 7 years, and it has taken 8% of respondents more than seven years to graduate. Among the UTA students participating in the survey, 8% indicated that it will take them less than 4 years to graduate, 23% are graduating in 4 years, 36% are graduating in 5 years, 18% are graduating in six years, 9% will finish their degrees in 7 years, and it has taken 5% of respondents more than seven years to graduate. Overall the survey response results indicate a four year graduation rate 25% and a six year graduation rate of 87% for the students that participated in the survey. These are much higher graduation rates than the official rates reported for both universities. One possible reason could be that some of those students that have been in school for a long time to graduate did not participate in the survey. Or they might have not responded to this question correctly.

The fifth question on the survey asked the participants what was the single most important issue that slowed down their graduation. As shown in Table 3, participants had 11 issues to choose from, or they could add an additional one as "other." Fig. 6 shows the most common single issue selected by the participants (the 7 issues shown in the figure represented the responses from 73% of the

students). Failing or withdrawing from courses was the highest overall choice, seleted by 14% of all participants. Other issues identified by all respondents included: changing majors (13%), losing credits during the transfer process (12%), financial difficulty (10%), starting in low-level math (9%), poor study habits (8%), personal issues (7%), lack of summer classes (5%), and lack of seats in classes (4%). Students at UTA indentified changing major as the the highest single most important issue (18%).



	less than 4	4	5	6	7	more than seven
UTSA	3%	19%	45%	19%	5%	8%
UTA	8%	23%	36%	18%	9%	5%
Total	5%	20%	42%	19%	6%	7%

Fig. 5. Number of years in college for respondents to complete their undergraduate engineering degree

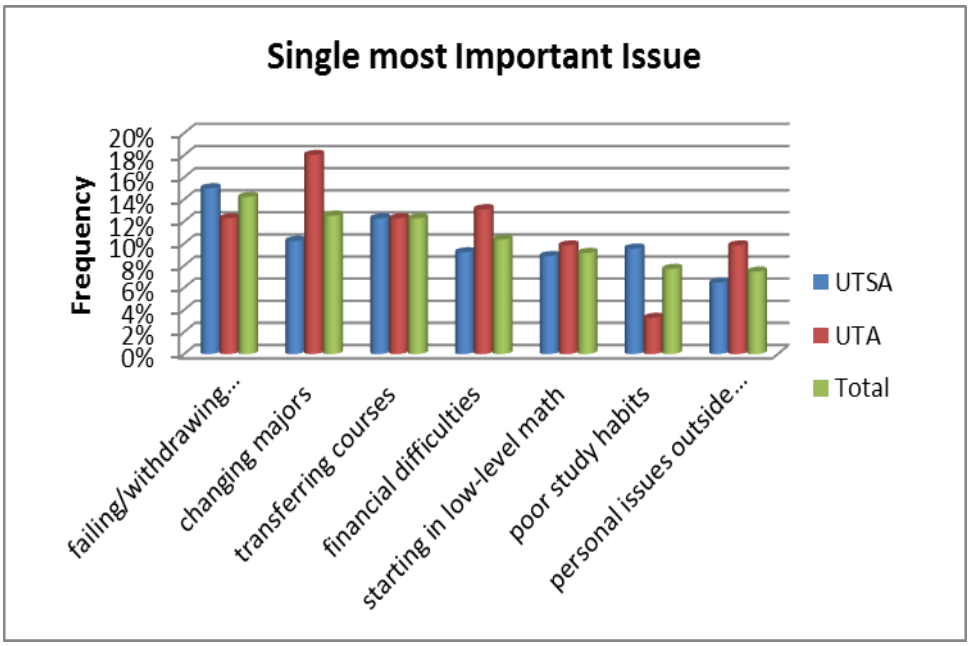


Fig. 6. Most common single issue that slowed down the respondent's progress towards graduation

Question 6 on the survey asked the participants what was the second most important issue that slowed down their graduation. The list of options were the same as those in question 5. The most common issues selected by 76% of the participants are presented in Fig. 7. Again, failing or withdrawing from courses was the highest choice, selected by 16% of all the participants. Other issues identified by the respondents included: poor study habits (11%), starting in low-level math (11%), financial difficulty (10%), losing credits during the transfer process (8%), personal issues (8%), changing majors (8%), lack of summer classes (7%), lack of seats in classes (6%), and lack of on-campus jobs (2%). The following issues were added by some respondents as other: work/family (2%), scheduling conflicts (1%), and advising/prerequisites (1%).

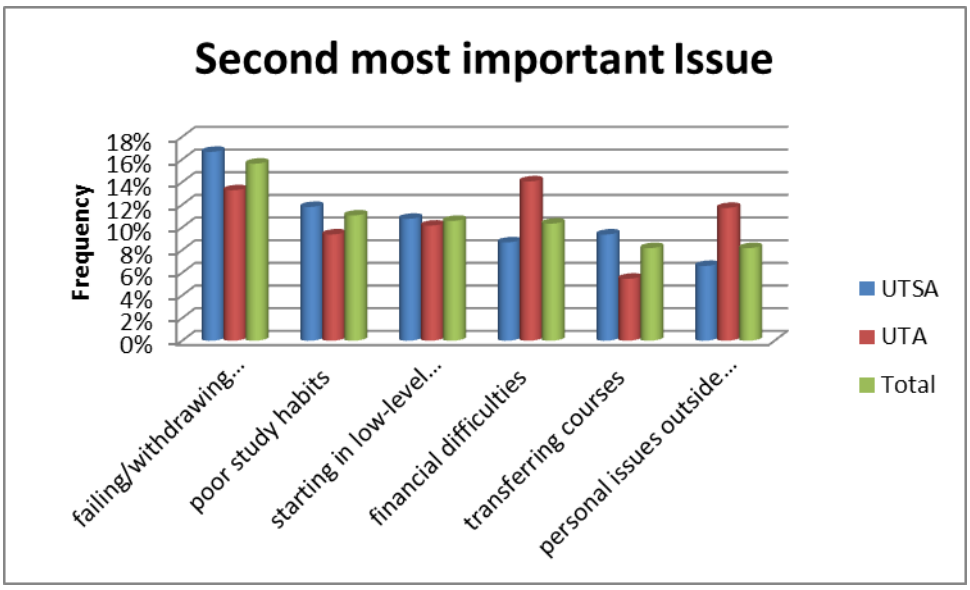


Fig. 7. Second most common issue that slowed down therespondent's progress towards graduation

The seventh question on the survey asked the participants what was the third most important issue that slowed down their graduation. The list of options were the same as those in questions 5 and 6. The most common issues selected by 61% of the participants are presented in Fig. 8. Once more, failing or withdrawing from courses was the highest choice, selected by 13% of the participants. Other issues identified by the respondents included: personal issues (12%), poor study habits (9%), financial difficulty (9%), lack of summer classes (9%), losing credits during the transfer process (9%), lack of seats in classes (8%), starting in low-level math (6%), changing majors (4%), lack of on-campus study space (3%), and lack of on campus jobs (2%). The respondents added the following as other issues: work/family (3%), lack of on-campus study space (2%), scheduling conflicts (2%), and advising/prerequisites (2%).

Figure 9 shows the overall importance of issues identified by all the responses to questions 5 through 7 as the most, second and third important issues that had contributed to the slowdown of their progress towards graduation. Failing or withdrawing from courses was the highest choice, seleted by 14% of the respondent. Other issues identified included: financial difficulty (10%), losing credits

during the transfer process (10%), poor study habits (9%), personal issues (9%), starting in low-level math (9%), changing major (8%), lack of summer classes (7%), lack of seats in classes (6%), lack of on campus jobs (1%), and lack of on-campus study space (1%). Other issues identified were; outside work/family (3%), advising/prerequisites (2%), and class scheduling (2%). The result having the strongest positive response is understandable: if a student fails or withdraws from a class, this often delays their graduation. Senior-level students know this either by experience or by seeing the effect on fellow students.

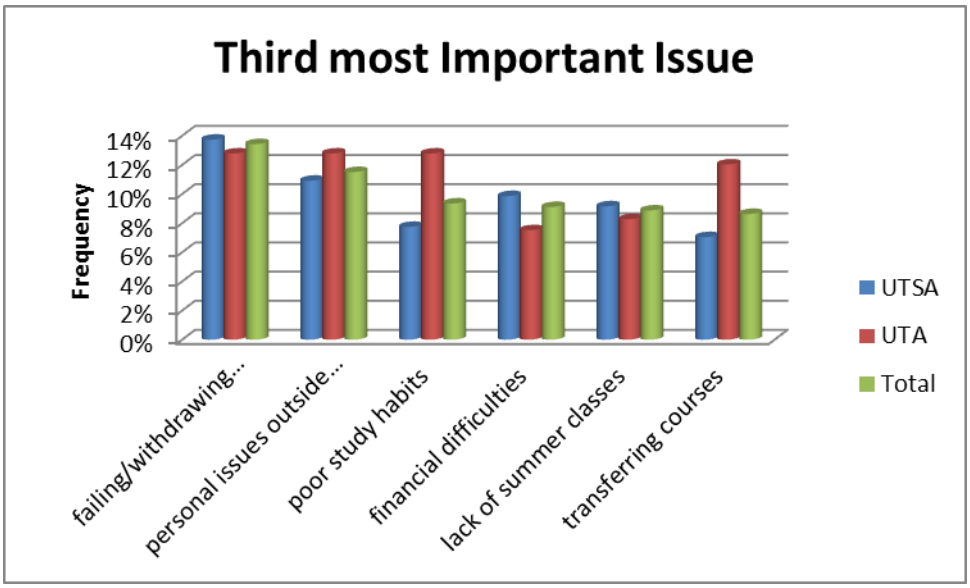


Fig. 8. Third most common issue that slowed down the respondent's progress towards graduation

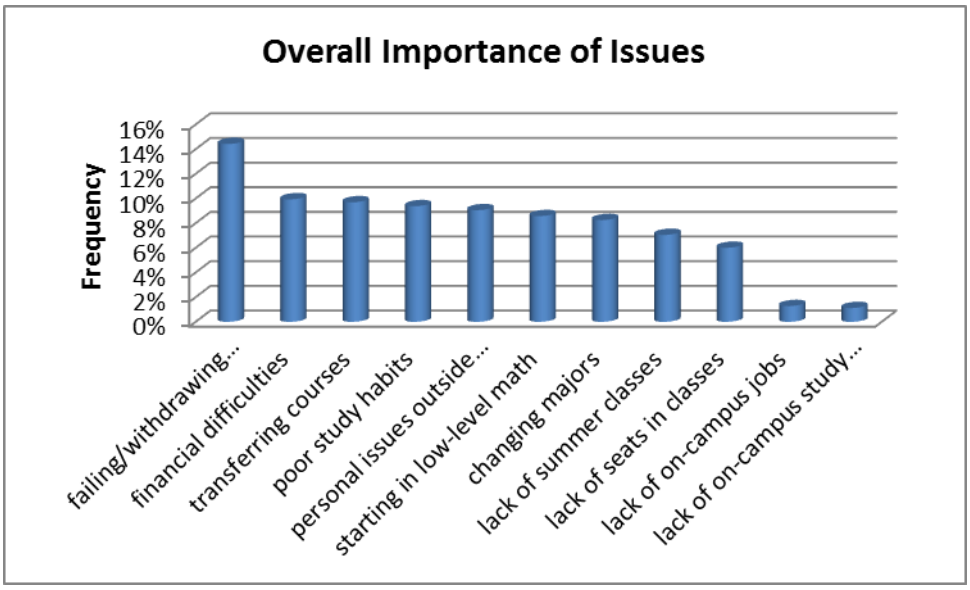


Fig. 9. Combined frequencey of responses by survey participants identifying the first, second, or third most important issues that slowed down their progress towards graduation

In the survey question 8, the participants were asked to identify the reason for selecting "failing/withdrawing from the courses" in questions 5 through 7as one of the three most important reasons that delayed their graduation. The choices were: poor study habits or poor instructor. The results of the responses to this question are summarized in Fig. 10. Fifty one percent (49%) of all respondents selected poor study habits and 51% selected poor instructors. The percentage of responses identifying poor instructors as the cause of failing/withdrawing from courses is unexpectedly high. This answer needs more exploration in the future. Good instruction can help some students to succeed. Motivated students find ways to succeed in courses, even if the instruction is not very good. Further study is necessary to find out why such a high percentage of respondents blamed failing classes on poor instruction. More questions are necessary to seek student feedback to explain in more detail the reasons why they considered the instruction to have been poor, and in their opinion what the instructor could do to help students succeed.

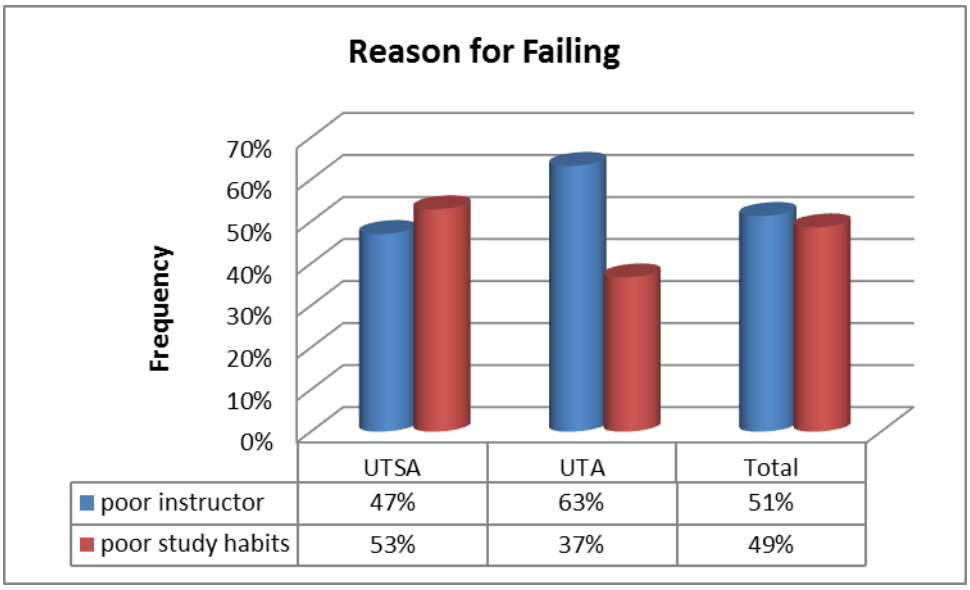
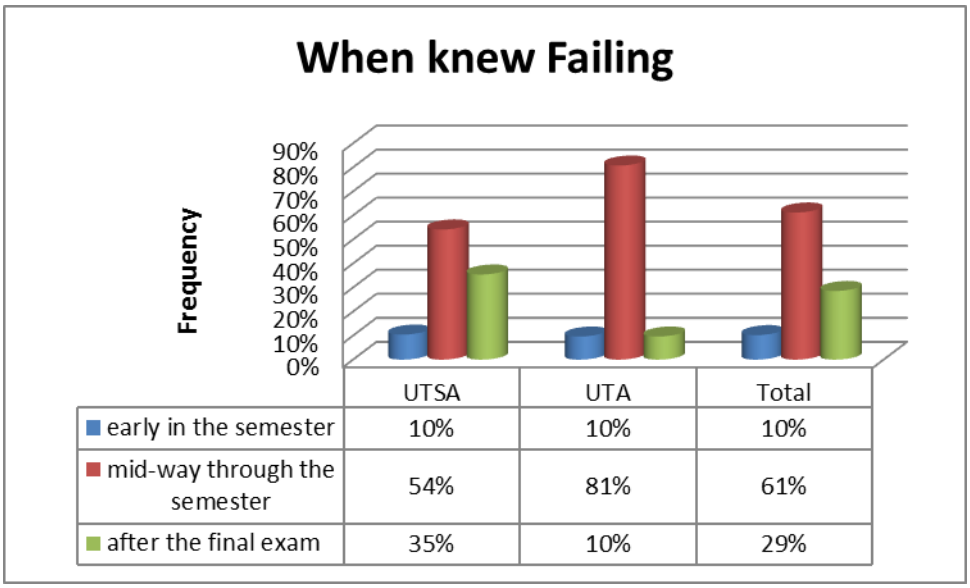


Fig. 10. Reasons for failing/withdrawing from courses, as identified by respondents

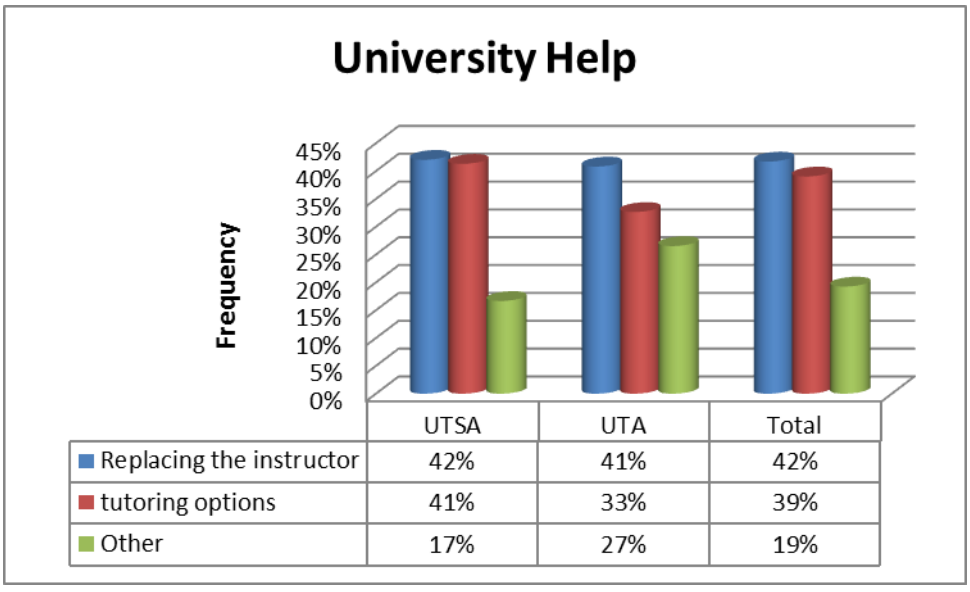
In question 9 the participants were asked when they found out that they were failing a course or courses, if they selected "failing/withdrawing from the courses" in questions 5 through 7as one of the three most important reasons that delayed their graduation. The choices were: early in the semester, midway through semester, or after the final exam. The results of the responses are summarized in Fig. 11. Nearly 71% of respondents knew they were failing the course midway through the semester, 29% of all respondents indicated that they found that they failed the course after the end of semester, and 10% knew that they were failing the course early in the semester.



	UTSA	UTA	Total
early in the semester	10%	10%	10%
mid-way through the semester	54%	81%	61%
after the final exam	35%	10%	29%

Fig. 11 When participants realized they were failing a course or courses

On the last question on the survey the participants were asked how the university could have helped, if they selected "failing/withdrawing from the courses" in questions 5 through 7as one of the three most important reasons that delayed their graduation. The choices were: replacing the instructor, tutoring opportunities, or other. The results of the responses are summarized in Fig. 12. Replacing the instructor was selected by 42% of all respondents and tutoring opportunities were selected by 39% of students as to how the university could have helped to prevent respondents from failing or withdrawing from courses. The remaining respondents (17%) recommended other means.



	UTSA	UTA	Total
Replacing the instructor	42%	41%	42%
tutoring options	41%	33%	39%
Other	17%	27%	19%

Fig.12. How the university could have helped to prevent the respondent from failing or withdrawing from course.

Comments included by respondents as other included the following:

- In some cases the instructor needed to be replaced, but mostly could have used better advising. Too much focus on graduation in a certain time instead of taking all things into account and selecting the best path ie: going to school part time, taking certain classes at the same time etc.
- Simplify prerequisite system
- Little help available for upper level engineering courses
- None, my fault
- Do not offer overlapping class schedules
- put in the time, don't treat college like a party
- Core classes; needed better motivation, not necessarily school's problem
- Get rid of prerequisites
- Prerequisites; the amount of classes I take per semester; failed one class because of poor instructor, another because of study habits; replacing the instructor would help for some courses, but not always; [usually fails] because I spend my time studying info that doesn't end up appearing on the exam, so practice exams with info you can expect to see on exams would be my suggestion
- I understand that engineering courses should be challenging, however some of the courses in the civil engineering program at UTSA are planned to have a low passing rate. With all the other courses we have to balance these unnecessarily difficult classescause low graduation rates and more pointless money spent. If professors in this program could better plan their schedules of exams, assignments and coordinate more with other professors, I believe students would accomplish more effective learning instead of constantly stressing out about multiple classes at once.
- Impossible to take 5 hard classes every semester and get good grades while working, so I take less hours so I can do good and not rush because I don't want to fail; it is really difficult to keep a really high GPA in engineering, so financial aid offices should consider it if it is not as easy as art or other easy majors; extend withdrawing date because some engineering classes only have two tests and it is hard to see if dropping classes is a good idea at that stage.
- my bad
- nothing, it was all on me
- Simply returning graded work in a timely manner is often very helpful but is also an area where instructors falter
- motivate students and discuss importance of completing classes because a failing/withdrawal can push back graduation by a semester
- Monopolies by professors teaching same classes; offering more professors
- Applied Engineering Analysis-Makes this degree impossible
- changing tutor/instructor hasn't helped, changed my study habits
- Don't think anything could have helped
- Change instructors style of teaching
- Give more instructors to choose from
- Student issue not the university
- Inconsistent teaching/grading by professors
- Classes only offered in spring/fall semester, not both, time

Summary

Senior-level engineering students were surveyed in two main universities to identify issues important to their timely completion of a BS degree program. There is increased emphasis on institutional accountability and the need for universities to track and improve graduation rates. The survey highlights some key areas. After having identified the key reasons for students to have slow progress toward graduation, a university is better prepared to address the most meaningful issues and improve its graduation rates. Student feedback indicates that failing or withdrawing from a course is the most important issue in delaying graduation. If this is true, then a university should focus on things like (1) instructor effectiveness, (2) early detection of at-risk students, and (3) intervention strategies for at-risk students. Students often give valuable feedback to identify unreasonable impediments to their progress through the program. It is less common for engineering programs to have active mechanisms to detect problems during the semester and follow-up action which prevent students from failing a class. Universities have mentoring and tutoring programs, but this survey suggests that a university should seek to do more to prevent students from failing or withdrawing from a course.

Changing majors and losing credit when transferring were identified as major causes for delaying graduation. Students often change majors in the first year of attending college. This is natural, yet few programs take this into consideration in designing their curriculum. It is common for each engineering program to have unique courses in the freshmen/sophomore year. The survey conducted in this study suggests that the first two years of an engineering program should be as generic as possible. This gives students flexibility in transferring credits among engineering programs. More emphasis should be on building curriculum bridges to ease the transfer of courses between colleges within an institution and between institutions, especially the local community colleges.

Being "Calculus Ready" is another important issue that delays graduation in an engineering program. Many high school graduates have not been prepared to take a differential calculus course as a freshman student. This has been a persistent problem and is expected to continue to be so. If students are not ready to take Calculus, they typically start in College Algebra or below, and the program becomes a de-facto 5-year program because the student needs one year to remediate math deficiencies.

Lack of summer classes was identified as an issue that does not help students to graduate on time. Since many students work while attending school, they are unable to take 16-17 SCH of coursework during the fall/spring semester course. Therefore, they are unable to take all prerequisite requirements during those semesters in order to progress smoothly though the curriculum. Overall, our finding suggest that universities should consider treating the summer as equivalent to spring/fall semesters. Students seek more opportunities to take classes during the summer to either get ahead or catch up.

Other issues were mentioned. Students did identify poor study habits and time management skills as being important. Developing these skills is essential to becoming a successful student. Introductory courses often cover these topics, but they must be embraced by the student. Once students realize the importance of strong study habits and good time management, they have often mastered these skills

and find challenging engineering classes a little less overwhelming.

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