

An Examination of the Reasons for Student Failure in Engineering Courses and Attempts to Reduce the Failure Rates

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Extended Abstract

There has been a vast amount of discussion in recent years on how the colleges and universities can improve their graduation rates. Federal and state legislatures are demanding the universities to improve the four and six-year undergraduate graduation rates. There are many factors influencing the time it takes for students to complete their baccalaureate degrees. Attending school part-time while holding a job, changing major, failing courses, or being required to take remedial courses, all contribute to increasing the time required to complete a college degree. 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 also delay progress towards graduation. In the engineering programs at The University of Texas at San Antonio (UTSA), all math, science, and engineering courses which are prerequisite to other courses must be completed with a minimum grade of C-, even though grades of D- and above are considered passing grades. Therefore, grades of D, F, and W (withdraw) are considered unsuccessful attempts in most required courses in engineering must be repeated which are contributing factors in extending the time required for graduation. All engineering programs are focusing on findings ways to reduce the rate of D-F-W grades in courses they offer. The presentation based on this extended abstract will show the results of the observations made by the authors teaching several sections of engineering courses in recent semesters. The presentation will highlight the potential causes that students receive grades of D, F, or W in several engineering courses that include Dynamics, Thermodynamics-I, Thermodynamics-II, and Heat Transfer.

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 federal and state legislatures are increasing for public universities to increase their four and six year graduation rates [1-3]. There are many factors influencing the time required for students to complete their college degrees. Attending school part-time while holding a job, changing major, failing courses, or being required to take remedial courses, all contribute to increasing the time required to complete a college degree. 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 also delay progress towards graduation.

There have been much effort to improve the retention of students in engineering programs [4-12]. Examples included offering problem solving recitations sessions to improve student success; integration of math and science into introductory engineering courses; and making introductory

courses more exciting by including hands on experimentation and having more active design projects for students. Many of these efforts have had limited success.

In order to better understand the root causes of delay in graduation for many engineering students, a survey was conducted in spring semester 2015 among senior students pursuing engineering degrees at The University of Texas at San Antonio (UTSA) and The University of Texas at Arlington (UTA) [3]. Surveys were conducted in capstone design courses or other senior level courses in various engineering 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.

One question on the survey asked the participants what was the single most important issue that slowed down their graduation. Participants had a list of 11 causes to choose from, or they could add an additional one as “other.” Fig. 1 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 one of the highest choices, selected 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 identified changing major as the the highest single most important issue (18%).

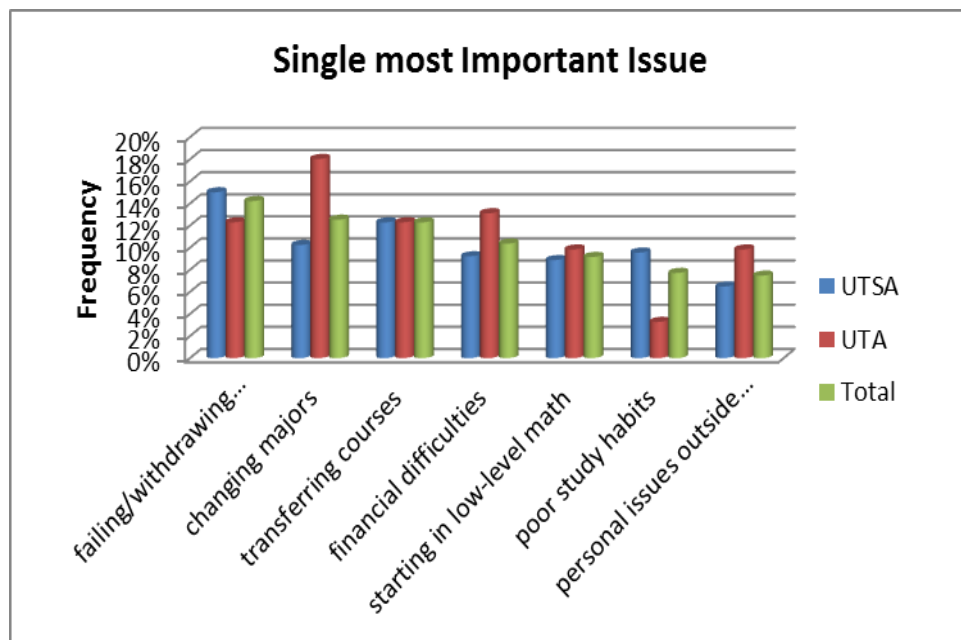


Fig. 1. Most common single issue that slowed down the respondent’s progress towards graduation

A follow up question on the survey asked the participants what was the second most important issue that slowed down their graduation. The most common cause selected by 76% of the participants was again, failing or withdrawing from courses was the highest choice, selected by

16% of all the participants. A second follow up question on the survey asked the participants what was the third most important issue that slowed down their graduation. Once more, failing or withdrawing from courses was the highest choice, selected by 13% of the participants. Figure 2 shows the overall importance of issues identified by all the responses to questions 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, selected by 14% of the respondent.

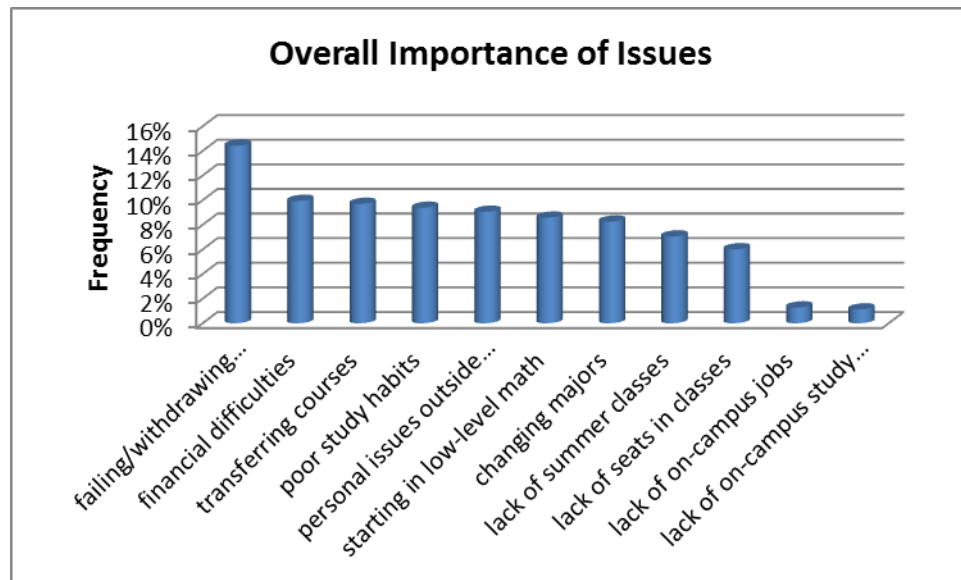


Fig. 2. Combined frequency of responses by survey participants identifying the first, second, or third most important issues that slowed down their progress towards graduation

The authors have taught general engineering and mechanical engineering courses such as dynamics, thermodynamics-1, thermodynamics-II, and heat transfer in many years. They have examined some of the issues that cause students failure in the engineering courses. The presentation will discuss the correlations of the following items as related to student success:

- Class attendance
- Submission of class attendance
- Use of solution manuals
- Preparation in earlier courses
- Owning a textbook
- Increase in enrollment

The discussion will be supported by data. Figures 3 through 6 are samples of the data that will be presented. The presentation also discusses the efforts made to improve student successes. For example both formal and informal recitations sessions have been attempted to improve student success. For a period of time, formal recitations were scheduled for large classes. For large classes, all students registered in a given course attended a common lecture, but students had to also register for recitation sessions which limited to 25 students. With an increase in student enrollment, it became difficult to schedule recitation hours. Therefore, the recitation

sessions were dropped for many courses. Now some instructors offer recitation sessions which the attendance is voluntary. The presentation will include the effect of recitation session on student success.

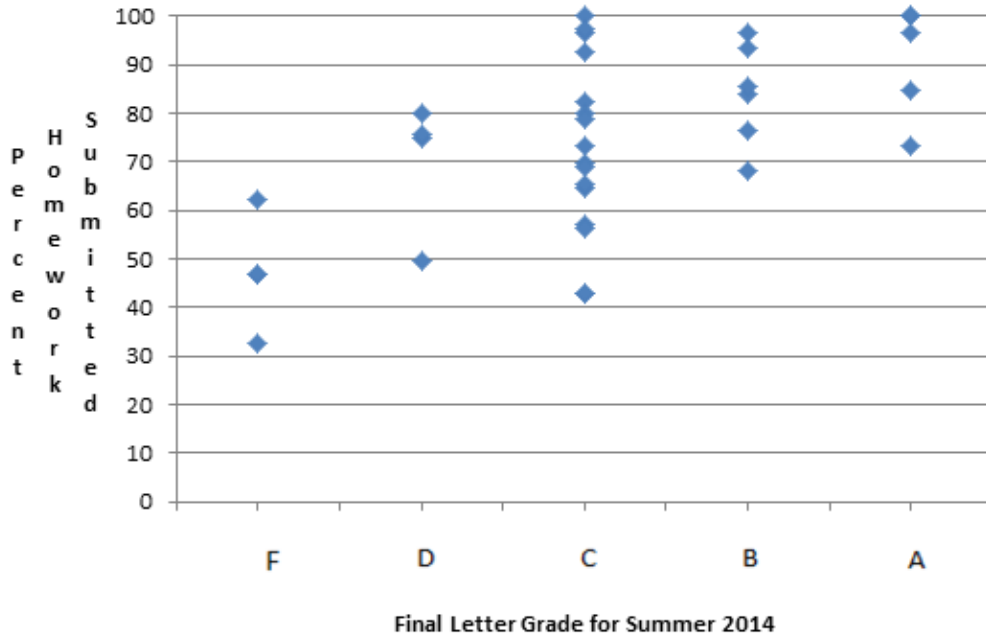


Figure 3. Influence of Homework Submitted by Students on the Final Semester Grade for the summer 2014 Section of EGR 2513, Dynamics

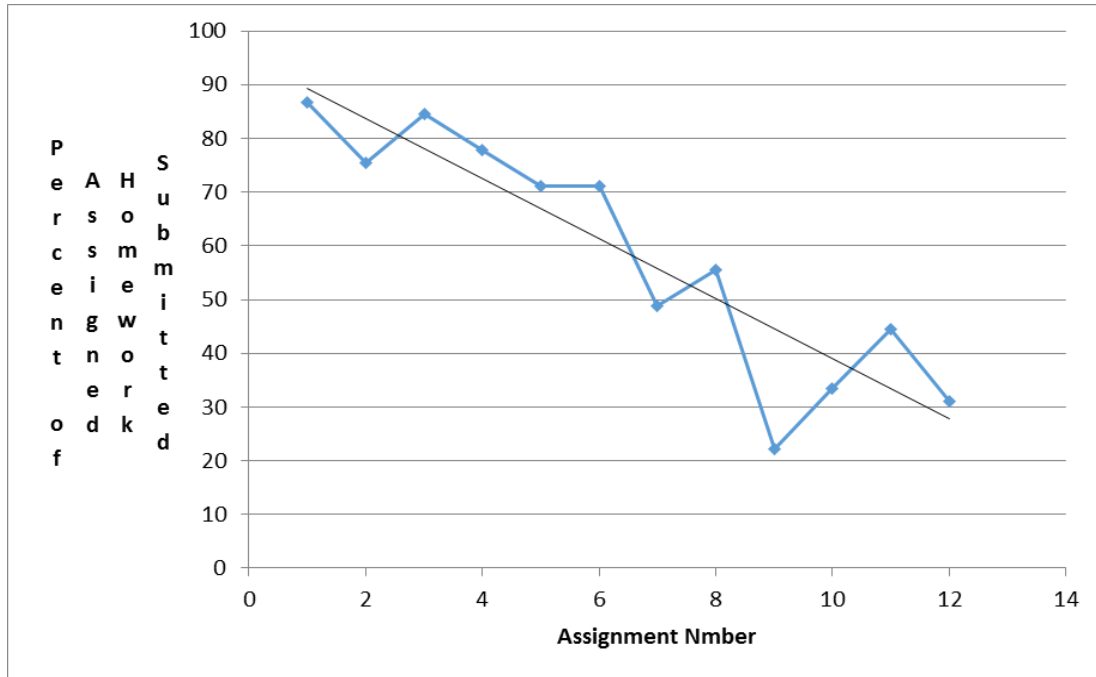


Fig. 4 Student Homework Submission Trend in EGR 2513 spring 2015

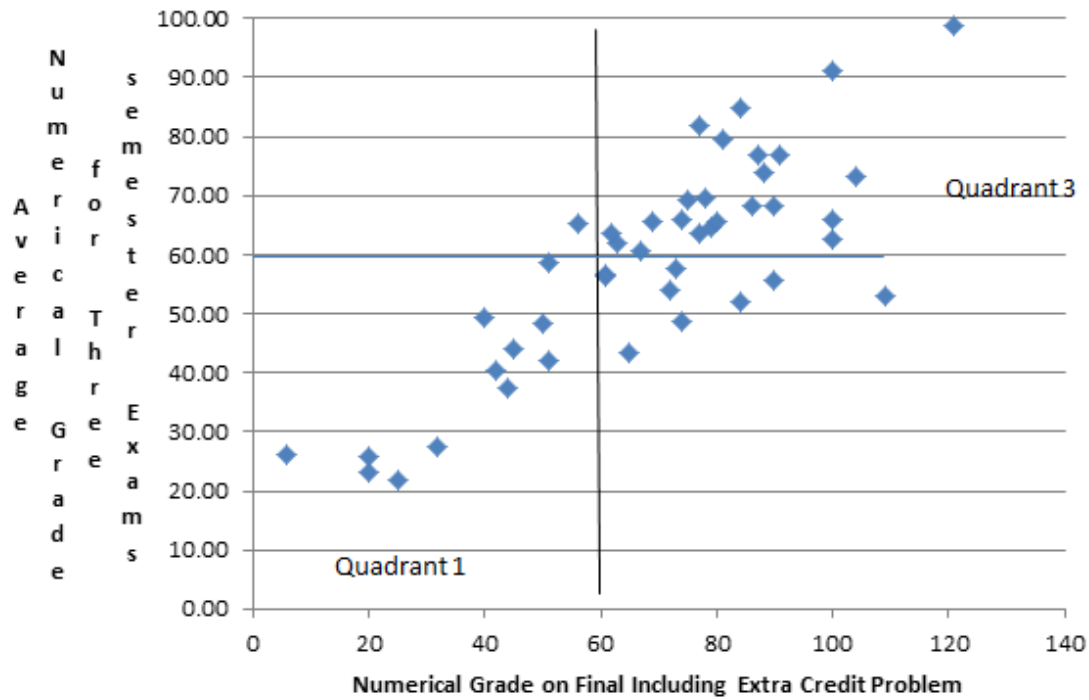


Fig. 5 Correlation of Average of Three Semester Tests with Final Examination Grade for the spring 2015 in EGR 2513, Dynamics

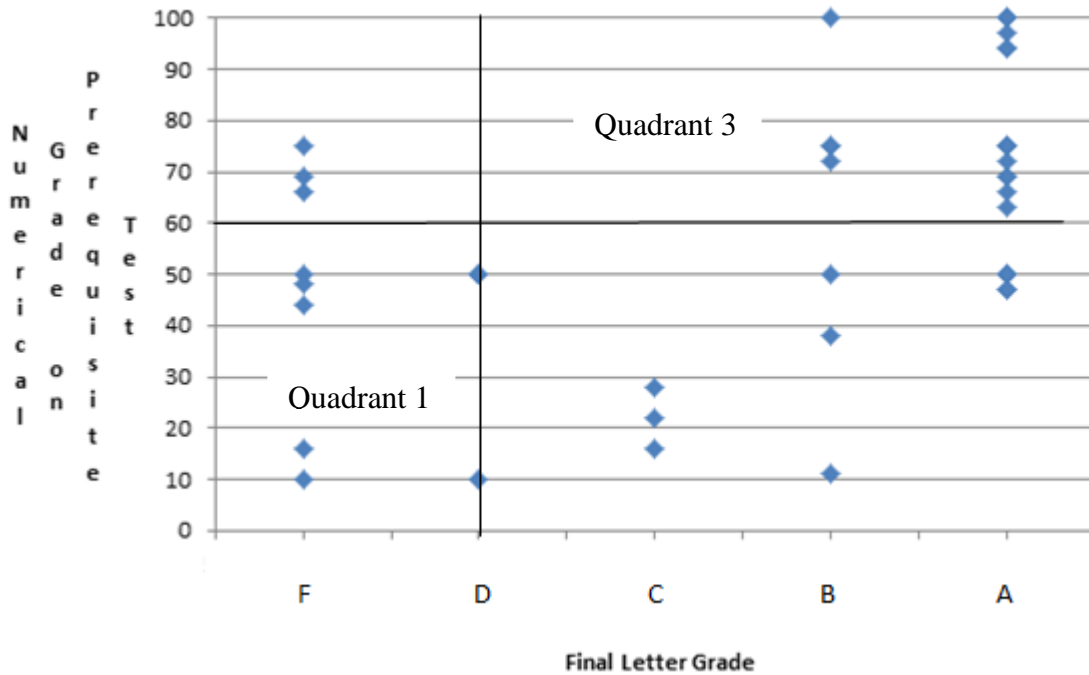


Fig. 6 Correlation of the Numerical Grade on the Prerequisite Examination with the Final Course Grade for the spring 2015 Section 2 of EGR 2513, Dynamics

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