

How Many Credit Hours Should First Semester Engineering Freshmen Take?

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Abstract

The first semester of a freshman engineering program is a difficult transition even for the best-prepared student. During orientation sessions, most freshmen receive guidance on the schedule needed to establish a solid foundation for the engineering curriculum. Due to differing student and advisor backgrounds, schedule recommendations vary widely. This study quantitatively examined the performance of first semester freshman engineers (N=1274) to determine who performed better: students with light loads (12-14 hours), medium loads (15-17 hours) or heavy loads (≥ 18 hours). Previous research at other large universities indicates that the students who take more hours have the best grade point averages (GPAs). However, these studies did not focus on engineering students, who arguably take a more rigorous series of classes than students in other majors. Also, previous research has not focused on the impact of GPAs and credit hour loads for students with below average SAT scores (i.e. the perceived “weaker” students who might need more time). Using a multiple regression model (SAS), this study showed that the credit hour load was a strong predictor of first semester GPA. This relationship also was true for those perceived “weaker” students with below average SAT scores. Previous research suggests that the student course load is an indicator of perception of ability, motivation, and commitment, and thus those students with more hours will be more dedicated towards successful completion. This study supports this theory.

I. Introduction

The freshman year college experience is arguably one of the most difficult transitions for a young man or woman in today’s fast-paced and competitive world. For most entering freshmen, college represents the departure from the nest, complete with new freedoms, but also unforeseen responsibilities. The Virginia Tech College of Engineering (COE) Fall 1999 class of freshmen boasted an average SAT score of 1224, an all-time high. However, after the first semester concluded, the average grade point average (GPA) was a 2.49. This is not a phenomenon particular to Virginia Tech though; the average freshman GPA is comparable for first year students enrolled in similar U.S. schools.¹ Clearly many factors contribute to the failure of engineering freshmen to reach their potential. One area of debate, which this paper addresses, is the effect that the number of credit hours taken in the first semester of an engineering curriculum has on the students’ GPAs.

All freshmen accepted into the Virginia Tech COE are highly encouraged to attend orientation in the month before school starts. This program is not only critical for campus acclimation, but also is the first exposure incoming students have to the scheduling and advising process. Students meet with their summer engineering advisors who recommend schedules based on the students' advanced placements, transfer credits, and/or any other potential problem areas such as substandard test scores or a lack of particular prerequisites. At Virginia Tech, some orientation advisors are professional advisors while others are professors from varying backgrounds. All advisors receive instruction prior to the orientation sessions, but the recommendation of the number of credit hours that each student should take is left to the discretion of the individual advisor.

Because experiences of these summer advisors vary greatly, often the recommendations for credit hour loads differ. Some advisors feel that students should take 18 hours because taking a heavier load will allow students to get ahead. Other advisors feel that since the first semester for engineering freshmen is an especially difficult transition period, students should take a maximum of 15 hours. Still other advisors recommend that students who have either below average SAT scores or are considered weak in math should take only 12 credit hours to allow for more study time in these areas. With so many different opinions and recommendations circulating, a quantitative inquiry was conducted to determine if a relationship existed between the number of credit hours attempted in the first semester of an engineering program and the first semester GPA.

II. Method

To determine if any significant relationship existed between credit hour load and first semester GPA, data from the Fall 1999 Virginia Tech COE freshmen ($N = 1274$) were analyzed using a multiple regression model with backward elimination (SAS). In addition to credit hour load, math SAT score, verbal SAT score, gender, and race were considered as possible GPA prediction factors. Furthermore, the effect of a lower than average SAT score (1224) was analyzed.

III. Results

An analysis of the Fall 1999 COE freshman class indicated a strong relationship between the number of hours attempted and the GPA at the end of the first semester. The overall first semester average GPA generally increased with increasing credit hour load, as illustrated in Figure 1. The results of the multiple regression analysis indicated that of the independent variables considered, SAT score and credit hour load had the most significant effect on GPA. These results are presented in Table 1. The F-ratio is a measure of the confidence of the relationship between the dependent and independent variables. The P-value is the probability that the relationship, if it exists, occurred by chance.

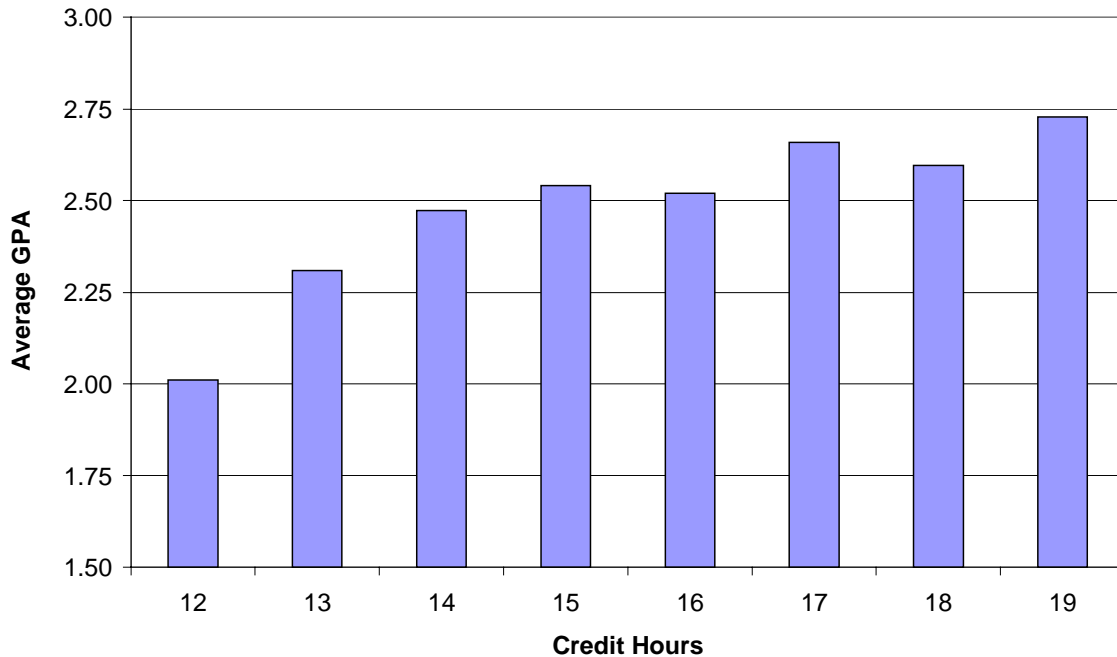


Figure 1. GPA vs. hours attempted for Virginia Tech first semester freshman engineering students.

The multiple regression analysis also indicated that there might be some effect of gender on first semester GPA. The model predicted that for an equivalent male and female student, the male student would be expected to earn a slightly higher GPA by 0.1 on a 4.0 scale. However, the COE overall freshman female average GPA was a 2.58 as compared to the male freshman average of 2.50. In addition, the analysis indicated no effect of race on the GPA.

<u>Variable</u>	<u>F-ratio</u>	<u>P-value</u>
Math SAT	82.29	<0.0001
Verbal SAT	42.69	<0.0001
Credit Hour Load	16.73	<0.0001
Gender	3.54	0.0602

Table 1. Results of the multiple regression analysis for the Virginia Tech COE fall 1999 freshman GPAs.

An additional independent variable was included in the analysis to examine the effect of a below average SAT score. The coded SAT score indicated if a student's SAT score was below the COE F99 class average SAT score of 1224. The interaction between the coded

SAT score and the other variables was also considered. The effect of a below average SAT score on the relationship between GPA and credit hour load was found to be insignificant. Thus, credit hour load was found to be a strong predictor of GPA regardless of a student's SAT score. SAT scores have often been cited as predictors of college performance, but expert opinions conflict.^{2,3} The results of the regression analysis indicated that regardless of race, gender, and SAT scores, those students that take the most hours in their first semester of their freshman year will have the highest GPAs.

The most unexpected result from this data analysis was the significant drop in GPA for those students taking less than 14 hours. Credit hour loads were grouped into low (12-14 hours), medium (15-17 hours), and high (≥ 18 hours) to examine any possible trends (Figure 2). As illustrated in Figure 2, the GPAs for those students who took medium and heavy course loads were within 0.05 of each other. While there was a slight decrease in GPA from a high to medium course loads, for students taking less than 14 hours, GPAs plummeted. As shown in Figure 1, the average GPA for students who took 12 hours was almost an entire half point lower than the average GPA for those taking 14 hours. At Virginia Tech, 12 hours is the minimum allowed for a full-time student. Additionally, Virginia Tech is not a commuter college and the COE enrolls very few part-time freshmen.

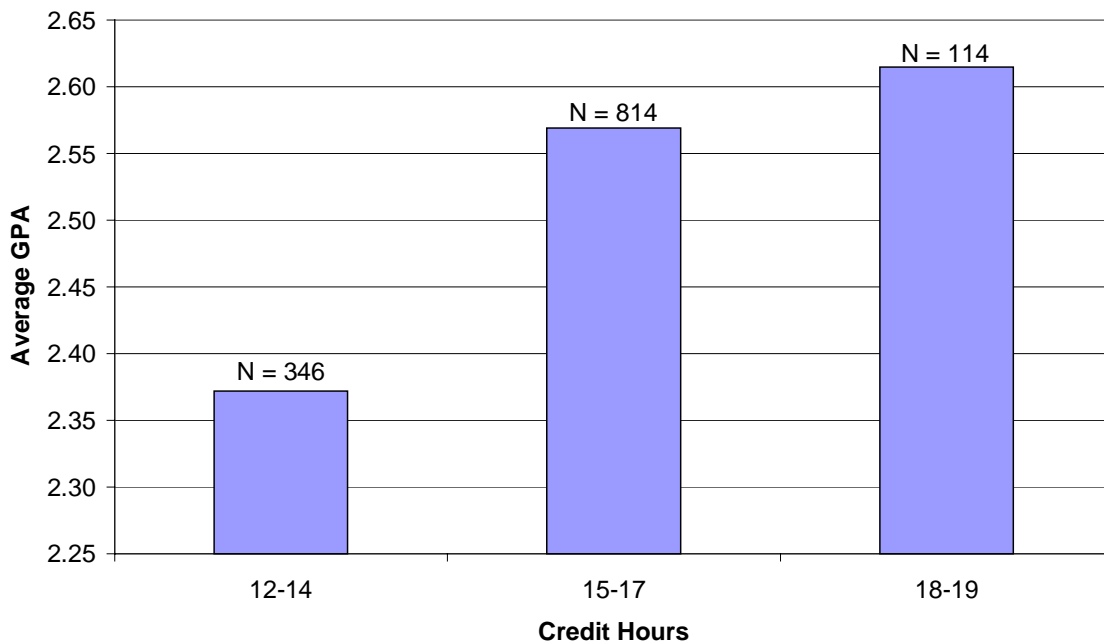


Figure 2. GPA vs. low/medium/high credit hours for Virginia Tech first semester freshman engineering students.

One drawback to this data used for this study was the inability to document the credit hour load at the initial outset of the semester. The credit hour loads used were those that existed after the course drop period was over, which at Virginia Tech occurs at the end of the sixth week of classes. This was an unfortunate but unavoidable limitation, as the

database in use at the time did not archive the initial number of credit hours students attempted at the beginning of the semester.

IV. Discussion and Recommendations

While this study was the first to examine the relationship between credit hour loads and GPAs for engineering students, Oakland University and Northern Michigan University have conducted similar research for their entire student populations, which yielded similar results.¹ As students both in their freshman and later years take more credit hours, their GPAs improve, and conversely when they take light loads, their GPAs decrease. While credit hour load is not in itself the cause of either an above or below average GPA, it is a reliable indicator of student motivation. In addition, as seen from the linear relationship between credit hour load and GPA, a more difficult engineering curriculum does not justify reducing the recommended credit hour load, as there was no trend toward higher GPAs for students taking a medium load of 15-17 hours over a heavy load of 18-19 hours.

First semester course loads are in essence a measure of college students' commitment and involvement in university life. Motivation, persistence, and commitment have long been recognized as critical for academic success. Those students that initially take a full load are making a conscious commitment to college, which sets the pace for their entire college career. In a college student retention study, Cope and Hannah state, "personal commitment to either an academic or occupational goal is the single most important determinant of persistence in college."⁴ In another study that focused on the performance of students who dropped or withdrew from courses, those who did so had lower grades. Students who maintained more difficult schedules received higher grades than those who dropped courses.⁵

Those students who register for light loads in their freshman year often find that they have spare time, and fill it with other non-academic related activities. It is possible that for those students who take light course loads, external factors begin to influence not only their academic motivation, but their general attitudes as well. The Northern Michigan and Oakland researchers found that once a pattern of taking a lighter load is established, it continues throughout a student's college career. Students who initially enroll in 12 credits begin their college careers behind and are likely to fall further behind in terms of their academic progress.¹ Since time management patterns are most likely set during the first year, the initial credit hour load decision is potentially far more important than advisors and professors recognize.

In addition to impacting student motivation and time management skills, taking light credit hour loads have more far-reaching consequences. A leisurely schedule will delay graduation and increase the cost to the student, parents, scholarship donors, or federal government. In addition, if students are advised to take light loads, their self-confidence could suffer. A student that is told to take a light schedule because of some inadequacy that needs special attention can suffer from an inadvertently affirmed perception of weakness and lose self-confidence. Thus, a poor performance in the first semester for a

student with a light load becomes a self-fulfilling prophecy, which is then likely to reinforce the notion that a credit hour load beyond 12 hours is nearly impossible. In addition, a recent study determined that the strongest predictor of success for engineering students is the first semester GPA, so the importance of the freshman first semester cannot be overstated.³

This research supports previous studies that show an important link between credit hour load and GPA. The results of this study do not support recommending a lighter credit hour load for students with lower SAT scores, or due to the difficulty of the engineering curriculum. Advisors and professors who recommend lighter course loads to students for whatever reasons, may be doing their advisees a disservice, and could be inadvertently sending a negative underlying message by doing so. Since college students perform better when they are motivated, students should be encouraged to take full course loads, despite any perceived academic weaknesses. This is especially true for the freshmen year in which so many critical patterns and priorities are set. Especially in this booming economy with the demand for engineers on the rise, colleges and universities need to become more proactive in providing scheduling guidelines that help promote this crucial motivation, persistence, and commitment.

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