

Grade Forecasting as a Motivational Tool for Freshmen Engineering Students

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Abstract

One of the greatest obstacles to many Engineering Freshmen students' academic success is their misconception regarding the amount of study time required. Frequently, even after receiving a low first exam or quiz score, they are not sufficiently concerned and motivated as to change their study philosophy and habits quickly enough to recover. Their unrealistic optimism comes about in many cases by their relatively easy success as high school students. That experience too often serves as a poor reference for what is required of them at the college level. To counter this complacency, tools are sought to instill in the students a sense of appropriate urgency where needed. Grade forecasting is examined and considered here as one such tool.

The Problem of Complacency

Complacency among students is difficult to overcome, and is a large obstacle to retaining students in colleges of engineering. Unfortunately, many aspects of complacency are beyond our influence as educators. Such factors as the student's personality, upbringing in regard to work ethic, and natural drive are formed long before they arrive at a university.

Complacency can stem from many other causes, and some are simply the result of misperception on the part of the student. Of these, perhaps none are more damaging than that regarding the actual amount of study time necessary to be successful [1]. In orientation programs, incoming freshmen engineering students are typically told they should expect to spend 2 or more hours studying out of class for each hour in class. But there is evidence that the majority of students simply do not believe that.

This was illustrated by a survey the author took 10 weeks into Fall semester 2000, in which 145 freshmen students were asked what they believed was an adequate amount of study time out of class per each hour in class. Before answering the question, the students were instructed to give a response on what they *truly believed* was adequate study time, not what they had been told or what they thought their instructor wanted to hear. The answers ranged from 15 minutes to 4 hours. The most common response, making up 38% of the answers, was that one hour should be spent out of class for every hour in class. The average study time was found to be 1.40 hours. Only 40% of the respondents indicated they actually believed 2 or more hours of study for each hour in class was necessary.

Many students wrongly believe, for whatever unfortunate reason, that they are "special" and therefore the degree in engineering should come about easily [2]. Similar to this is their overestimation of their own academic abilities as compared with their peers [3]. Many mistakenly conclude their superior abilities, and not work, will make them successful. This attitude develops from their experience in high school, where the number of "A's" awarded has climbed from 12.5% in 1969 to 31.6% in 1997 [4]. This increase is not due to better study habits. Surveys show there is a

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worsening trend of students expecting to work less and yet get higher grades. While 44% of High School students said they spent six or more hours per week doing homework in 1987, that number dropped to 31.5% by 1999 [5]. Many of my own students have stated that in high school they had to do little more than listen in class, without studying outside class at all, and still make high grades. These same students often express bewilderment when their experience is so different at the college level.

Still another misconception is the belief that a college education is not a privilege, but rather an entitlement [6]. This can not only lay the groundwork for students to be complacent about studying, it can also encourages their discontent with the instructor or the institution when grades do not turn out well. It is perhaps because of these and other factors that cheating is on the rise on college campuses in general, with the problem even making the February 19,1999 edition of *The NBC Nightly News* [7]. Cheating should be of special concern to those in engineering, because studies have shown it is higher among engineering and business majors than in any other discipline [8].

While many of the above reasons for student complacency might be debated as to their cause or remedy, many students need help becoming motivated. Perhaps a major element to the problem of student motivation would be the "urgency" factor. When there is no real sense of urgency about studying, few students feel highly motivated to do so. But when the sense of urgency is there, that can make a difference for many. This is witnessed by the increased visits to our offices, the increased number of questions, all-night "cramming" sessions, and the increased anxiety shown by students as exam time draws near. For many, if they consistently demonstrated that same sense of urgency on a daily basis, their grades would have undoubtedly been better.

Grade Forecasting as a Potential Motivator

Students do not get feedback on their performance until they receive their first quiz or exam results. Until then, they could rationalize that they might be progressing well, when actually poor study habits have them on the road to failure. Yet, even when the first exam results are in, a misleading sense of security could still persist. This is because many students tend to look only at their mathematical position after receiving the first grade.

Let us take the example of a student who makes a 70 on the first of three exams equally weighted. We will assume the typical grading scale of 90-100 for an "A"; 80-89 for a "B"; 70-79 for a "C"; 60-69 for a "D"; and below 60 for an "F". After the first exam, the student with the 70 is still mathematically capable of earning an "A" with an overall average of 90 in the course--assuming his test performance is perfect from then on. With an average of 85 on the two remaining exams, he could earn a "B". If he only maintains his current scoring trend, he will at least earn a "C". Considering this, the student might not be very concerned, as his chances of making a "C" or better seem fairly favorable. Yet there is more to it than that. His score almost certainly indicates a trend, and may indicate he should be quite concerned.

For instance, it may be that the first exam from that particular instructor is less difficult than his subsequent exams for the course. This could be due to the nature of the subject matter, or to the instructor's tendency to go easier at first on new freshmen students, or some other reason. And a student scoring 70 on such an exam may be misled as to how much work is needed to maintain that grade. If he continues with the same effort, he will very often make a "D" or "F".

This is how grade forecasting could help a student: by informing him exactly where his likelihood of success stands, based on other students' experience before him who had the same exact grade at the

same point in the same course. With this information, the student could assess for himself whether he needs to put more time into the course or not, and could better measure whether or not his study habits were adequate.

An Example of Grade Forecasting

As an example of how this would work in an actual class, Table 1 represents a grade chart for the author's engineering graphics course taught fall semester 2000.

Table 1. Grade Distribution based on Exam 1

| Hour Exam 1 Grade | Number of Students With That Score | Resulting Course Grade Distribution | | | | | |
|----------------------|---------------------------------------|-------------------------------------|---|---|---|---|---|
| | | Dropped | F | D | C | B | A |
| 100 | 6 | | | | | 2 | 4 |
| 99 | 3 | | | | | 1 | 2 |
| 98 | 7 | 1 | | | 3 | 2 | 1 |
| 97 | 4 | | 1 | | 2 | 1 | |
| 96 | 10 | | | | 1 | 4 | 5 |
| 95 | 2 | | | | 1 | 1 | |
| 94 | 1 | | | | | | 1 |
| 93 | 1 | | | 1 | | | |
| 92 | 4 | | | | | 2 | 2 |
| 91 | 5 | | 1 | | 1 | 3 | |
| 90 | 3 | | 1 | | | 1 | 1 |
| 89 | 8 | | 1 | 1 | 4 | 1 | 1 |
| 88 | 7 | | | 1 | 2 | 2 | 2 |
| 87 | 4 | | | | | 4 | |
| 86 | 2 | | | | 1 | 1 | |
| 85 | 2 | | | 1 | | 1 | |
| 83 | 7 | | 1 | 1 | | 4 | 1 |
| 82 | 3 | | | 1 | | 2 | |
| 81 | 2 | | 1 | | 1 | | |
| 80 | 3 | | | 1 | | 2 | |
| 78 | 3 | | | 1 | 1 | 1 | |
| 77 | 6 | | 2 | 1 | 2 | 1 | |
| 76 | 3 | | 1 | 1 | | 1 | |
| 75 | 6 | | | 5 | 1 | | |
| 74 | 2 | 1 | 1 | | | | |
| 72 | 3 | 1 | 1 | | 1 | | |
| 71 | 2 | | 1 | 1 | | | |
| 70 | 3 | | 2 | | | 1 | |
| 68 | 4 | 1 | | 1 | 2 | | |
| 67 | 2 | | 1 | 1 | | | |
| 66 | 3 | | | 2 | 1 | | |
| 65 | 2 | | 1 | | 1 | | |
| 64 | 1 | | 1 | | | | |
| 61 | 2 | 1 | 1 | | | | |
| 60 | 1 | | | 1 | | | |
| 59 | 2 | | 2 | | | | |
| 58 | 2 | | 1 | 1 | | | |
| 57 | 1 | | | 1 | | | |
| 55 | 2 | | | 1 | 1 | | |
| 54 | 2 | 2 | | | | | |
| 53 | 1 | | | 1 | | | |
| 52 | 1 | | | 1 | | | |
| 50 | 1 | | 1 | | | | |
| 46 | 1 | | 1 | | | | |
| 0 | 5 | 1 | 2 | 2 | | | |

From Table 1, future students can see the forecast for making a certain grade, based on their first exam score and compare that with the experience of their colleagues before them. They could note, for example, that only one student making less than 88 on Exam 1 went on to make an "A" in the course. This might come as quite a surprise to the students, in view of the fact that four exams were given and the lowest exam was dropped!

As another example, a student who scores a 68 on the first hour exam could look at the chart and see that his chances are only 50% that he will make a "C" in the course--if his performance parallels his predecessors. He has a 25% chance of making an "F", and there is a 25% chance he will drop the course. This of course is not to imply a student with a score of 68 should take a fatalistic approach, but rather that he should quickly realize he is going to have to devote more time and effort to the course if he wishes to make a "C" or higher

In a similar manner, a student scoring 100 on the first exam can see from the chart that he is 66% likely to make an "A" in the course. This tells him he cannot coast to an "A", as 1 in 3 of his colleagues slipped to a "B" from that same position in earlier semesters. Seeing this, hopefully his goal would be to strive hard to see that he does not fall into that same 33% category.

It would be recommended a forecast chart be distributed to the students early in the semester so it would have its maximum effect to motivate them early enough to have impact. Provided it is not too late in the term, a second chart forecasting the grades based on the results of a second exam might possibly provide even better accuracy. Releasing that chart after the first hour exam could yet motivate some students to improve their position while there remains time. A third chart, taking into consideration the average of the first two exams, might provide still greater accuracy in forecasting, as the course heads into the last part of the semester.

Conclusion

Grade forecasting need not be limited to basing on exam scores. Attendance and participation in optional help sessions might also be plotted and used as predictors. If one wanted to take this a step further, grades based on SAT or high school performance could also be referenced and charted for evaluation. These might combat the complacency of those students who have been known to have high SAT scores and yet end up performing poorly due to gross overconfidence.

Obviously, for the exam-based forecasting described here to be reasonably accurate, it is essential the instructor be consistent from one semester to the next. The exams must be very similar in content and degree of difficulty, and the presentation of the course material must be the same. Using the same exam over and over is not recommended, however, as when copies get out among the students, it can skew the results. But if these consistencies are maintained, the accuracy of the forecasting should only improve over time. For the example cited, 145 students from one semester is not such a dependable sampling base, but over three years that base would grow to almost 900, and that should make the forecasting much more reliable. Hopefully such reliability could make grade forecasting a helpful motivational tool for our students.

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