

Positive and Negative Motivators and Their Effect on Engineering Student Success

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Abstract – What motivating factors are effective at driving students to succeed? Most people would prefer positive motivators over negative ones; it is more pleasant to perform a task to earn a reward rather than to have to perform a task in order to avoid a loss. Even so, it may be that negative motivators can actually be more powerful and effective. To explore this question of whether either type of motivator is more related to student success, nearly 300 freshmen engineering students at Tennessee Tech University were given a survey during the first week of classes. The survey listed five positive motivating factors and five negative ones. The students were asked to rate the significance of the factors, and the academic performance of the students through to midterm of the semester was analyzed to see if there were any trends regarding motivator type and student success for the first semester.

Keywords: Student Success Motivation Retention Freshmen

INTRODUCTION

In some ways American engineering colleges face greater challenges than at any other time in modern history. Government funding support has been decreasing while at the same time becoming more difficult to obtain. Institutions of higher learning must compete with their peers to attract students who will stay with their engineering studies and graduate. Under the Board of Regents system in Tennessee, as in many other areas of the country, state funding recently shifted from an allocation model based upon student enrollment to one based upon student graduation rates [13]. This makes it a high priority for colleges to enroll students who will be adequately motivated to work hard enough to stay in engineering to the completion of the degree.

At the same time, many in higher education believe students in general are not as motivated nor work as hard as in times past. It is true almost every past generation tends to feel it worked harder than the current one, but there may be evidence to validate that sentiment here in 2012. For example, forty-five years ago, Saturday classes on university campuses were not uncommon, now they are rare. Students would probably stay away in large numbers from any institution that required Saturday classes.

There are other indications. Up until just twenty years ago engineering students worked on their studies Sunday through Thursday and perhaps enjoyed leisure activities on Friday and Saturday evenings. Those days are gone; now Thursday [9] is the new Friday. Students routinely schedule recreation on Thursday nights and drop any pretense of studying unless an exam or important assignment is due the next day. It is common at many universities that many students have no Friday classes at all [6].

There is no doubt students are studying less. In 1961 the average full-time student at a four-year college in the United States studied about 24 hours per week, while his modern counterpart puts in only 14 hours per week. Students now study less than half as much as universities claim to require [1].

All this means we of higher education have a difficult task; we must work to see that the students meet our own standards, and those of ABET, while engineering only increases in complexity as the years go by, and yet the students we have to work with have less drive and motivation than their predecessors.

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DEFINING MOTIVATION

Defining *motivation* can be a challenging problem. Perhaps the most famous theory is that of Sigmund Freud, who in 1915 postulated that the unconscious is the source behind the motivation for human behavior [14]. There are many other theories on the subject. Author Bernard Weiner has written three texts on motivation in his lifetime, with the second and third book superseding the one previous. Others have even tried to put motivation for students into a mathematical formula [11]. There can be little doubt that motivating human beings against their natural inclinations can be a difficult or impossible task.

Perhaps the most simple, practical explanation of motivation comes from inspirational speaker Anthony Robbins, who teaches that everything people do is for the purpose of receiving pleasure or avoiding pain.

FACTORS ADVERSELY AFFECTING MOTIVATION IN STUDENTS OF TODAY

Going by numbers alone, the United States ranks near the top in the world in affluence and quality of life [2]. While this is generally very desirable, it may have the unwanted influence of diminishing the drive and motivation of American children. There are two reasons for this.

First, the offspring of affluent parents see the wealth in the family and know they will never go hungry. A middle-aged couple living in a fine home with multiple bedrooms and baths, owning two or more nice vehicles, and with a substantial financial portfolio can feed and house their offspring in perpetuity if they wish, and their children sense this even if they are not told so outright. This was not true just a few decades ago, when young people or their parents had much less financial strength, and lived in much smaller homes even lacking indoor plumbing. Young people then knew they had to make their own way in the world because their parents simply did not have the resources to care for them indefinitely. Without the true sense of a need to succeed at college in order to survive and prosper, some students today may have difficulty feeling a sense of urgency to make it in a challenging field such as engineering.

Second, even if students can motivate themselves to pursue engineering, because of their parents' affluence, the students may have difficulty looking at their potential success as anything other than holding onto the *status quo*. They may tend to think that, at best, they might only match their parents' high standard of living, and this could reduce their enthusiasm and motivation. By contrast, students of a generation or two ago could see an engineering degree as being an obvious transition into a significantly higher social and economic level. In our present time, one in four adults has a college degree, compared to one in 20 in the early 1960s [16]. With college degrees becoming so much more prevalent, some young people may have more difficulty getting as excited about earning one; to them going to college is simply an extension of high school, where most of them were not seriously challenged and the reward was limited to the satisfaction and acceptance that come with conformity.

The weakness of our American high school system is another factor that can adversely affect motivation in students entering college to study engineering. Though it once was the envy of the world, our high school system is now in decline. American high school students of the Class of 2011 now rank 32nd in the world in math and 30th in science [17]. There are exceptions of course, but when most students are asked if high school adequately prepared them for college, the most common answer is an emphatic *no* [4]. As a result, it comes as a shock to many students who never made less than a B in high school to suddenly find themselves failing a college-level course in engineering. The students themselves have done their part and worked as they were told; rather, it is the structure and ineffectiveness of their high school that causes the problem. The result is a harsh blow to the students' confidence and motivation; as the *Self-Efficacy Theory* states, belief in a successful outcome is one of the key ingredients for human beings to feel motivated.

Once students are at the university, a detriment to the motivation of many is the presence of cheating [12]. When students see others around them receiving favorable grades while in their honest effort they find themselves struggling, it diminishes their morale and motivation. It is well-documented that cheating has for decades been on the rise in institutions of higher education, and there is no indication the trend is about to reverse [10]. There is little to discourage students from cheating, and at least one study states that students who cheat have a higher grade point average than those who do not [15]. The problem is made worse by the fact that tenure or promotion for faculty is not based upon efforts to curtail cheating; therefore many professors naturally feel it not worth the effort. Some faculty members have the philosophy that students cheating on homework or unsupervised assignments will eventually be caught on a supervised and controlled final exam. That may or may not be so, but even if it is, honest

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students can still become discouraged and lose motivation as they watch their dishonest peers cheating and apparently receiving favorably grades along the way.

The grading system most universities employ can also work against motivation. With the standard grades of A, B, C, D, and F, a student may exert a strong effort and yet fall short of a colleague who may have had better luck guessing. For example, two students can work an equal amount in the same two courses, and yet one can be awarded two high B's while the other receives one low A and one middle or low B. The difference is in how the students' efforts are allocated, and to some extent is a result of how difficult the professors make the final exam in each of the courses. In such a case, this can weaken motivation for the less successful of the two students and discourage him or her from trying as much in the future. This might be remedied in part by assigning only a numerical average for the final course grade, abolishing the A through F structure.

There is also evidence that the very act of students being evaluated by grades can weaken their motivation [5]. Research shows students perform better when they are simply encouraged along the way as they pursue their academics and are not worried by the threat of receiving an unfavorably assessment in the form of a grade. This is admittedly a difficult problem to overcome, however, for clearly an objective evaluation students' performance is necessary to confirm that ABET standards and other goals are met.

Another element impacting motivation in engineering students today is other favorable options outside that field. In times past a young person would look at the option of hard manual labor with low pay as a livelihood and be grateful for the opportunity to earn an engineering degree. Today, however, a young person can observe a plumber, for example, earning \$22 per hour [3] with minimal training after high school, and the result is that for many the disincentive to continue to take out loans and exert the effort to pursue an engineering degree is not worth it. There are some in our news media and society today who openly state that a college degree is not worth the cost in money and lost time [8]. Such attitudes can greatly lessen a student's drive and motivation to pursue engineering.

METHODS OF SURVEYING STUDENTS' MOTIVATION AND ITS INFLUENCE

To see what motivating considerations were most important to freshmen engineering students at Tennessee Tech University, during the first week of fall semester 2012, 274 first-semester freshmen students in two graphics courses and one programming course were given a survey. It consisted of a list of ten possible motivating considerations that might be the cause for the students wanting to pursue a degree in engineering. Five of the considerations were positive, indicating something the student might want to *gain* by pursuing engineering, and five were negative in that they were something the students might want to *avoid* by pursuing engineering. The students were asked to rank all 10 considerations, with a 1 being assigned to the one most motivating to them, and a 10 being assigned the one least motivating. Table 1 below shows the results.

Questions:	Rank:									
	1	2	3	4	5	6	7	8	9	10
# 1 Avoid looking inferior to friends	3	0	1	3	11	16	18	32	50	140
# 2 Gain the respect and admiration of others	3	22	34	21	54	40	22	29	41	9
# 3 Gain the joy of working in a career in the fields of science and mathematics	117	51	14	23	16	13	15	14	8	6
# 4 Avoid financial weakness	19	31	38	48	26	27	33	29	19	7
# 5 Avoid embarrassment of failure	6	5	11	12	18	30	31	66	57	40
# 6 Gain making parents and family proud and happy	15	35	43	43	38	37	33	21	10	6
# 7 Avoid disappointing parents and family	6	4	22	30	32	44	52	37	31	19
# 8 Avoid loss of money spent on pursuing the degree	3	5	22	30	35	31	45	37	40	30
# 9 Gain financial strength	36	61	63	37	29	23	13	7	8	6
# 10 Gain the personal satisfaction of meeting a difficult goal	72	66	31	33	19	18	13	8	10	11

Table 1

Following is a list of the considerations as they appeared on the survey for the students. Each is numbered here for the purpose of discussion, but they were not numbered in the survey. The comments below each consideration are for the discussion here and were not in the survey:

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1. Avoid Looking Inferior to friends

This consideration is likely greatest if many of a student's friends are also studying engineering, when peer acceptance is highly valued, and when the prestige of succeeding in a high profession such as engineering is given much weight in assessing the student's prestige among his or her friends. Students coming from a community where engineering is prized, such as Oak Ridge in Tennessee, might perhaps weigh this consideration strongly. However, only 1% of the students surveyed rated this as their highest motivating consideration.

2. Gain the respect and admiration of others

This relates to the pleasure from the general prestige a student expects upon earning the engineering degree. Engineering as a profession is still prestigious, but the amount of prestige has dropped from the 5th highest ranking in 1977 to 10th place in 2007[7]. In the survey only 1% of the students rated this as their highest motivating consideration.

3. Gain the joy of working in a career in the fields of science and mathematics

This consideration relates to the student's affection for the work in the profession because of the nature of the subject matter. This was the most common reason the students gave for pursuing engineering; nearly 42% rated this as their highest motivating consideration.

4. Avoid financial weakness

It might be expected that avoiding financial weakness or hardship in the future is a greater consideration when the economy is weaker and when engineering pays higher salaries than most non-engineering fields. In the survey, 6.8% of the students rated this as their highest motivating consideration.

5. Avoid embarrassment of failure

This consideration relates to what might motivate a student to stay with engineering once pursuit of the degree is initiated. Just 2% of the students rated this as their highest motivating consideration.

6. Gain making parents and family proud and happy

The hope of pleasing one's parents is a consideration for some students when the parents exert an influence in a positive, nurturing way. This would perhaps relate more to families where engineering is not prevalent, and where earning a degree in engineering is considered a special achievement. Of the students surveyed, 5.4 % rated this as their highest motivating consideration.

7. Avoid disappointing parents and family

It might be predicted that this consideration would be more prevalent in families where the engineering profession is common, and pursuing it is more likely to be expected of the children. Both this consideration and number 6 above are perhaps more common in cultures where parental approval exerts a strong influence. In the survey 2% of the students rated this as their highest motivating consideration.

8. Avoid loss of money spent on pursuing the degree

This is another consideration perhaps more related to sustaining the pursuit of the degree once started. This might be a greater consideration for international students who have invested heavily financially in their education, or with students who have taken out significant loans to finance their pursuit of an engineering degree. There were 1% of the students who rated this as their highest motivating consideration.

9. Gain financial strength

This consideration is based solely on expected earning power from having the engineering degree. It was the third most commonly selected choice as the main motivating consideration, as rated by nearly 13 % of the students.

10. Gain the personal satisfaction of meeting a difficult goal

This consideration is for students with personalities drawn to a challenge because of the satisfaction felt from overcoming it. With engineering arguably being the most challenging degree that can be pursued, some students are motivated toward it for that reason. With 25.5 % of the students rating this as their highest motivating consideration, this was the second most common selection.

RESULTS AND DISCUSSION

The names of the students were recorded on their survey and each student’s course average at midterm was noted to see if there were any correlations. For the entire group of students, the median grade average at midterm was 81.7, and the overall average was 76.6.

Figure 1 below shows what percentage of the students selected a specific consideration as their highest motivator.

**Considerations Students Ranked First for
What Motivates Them to Pursue Engineering**

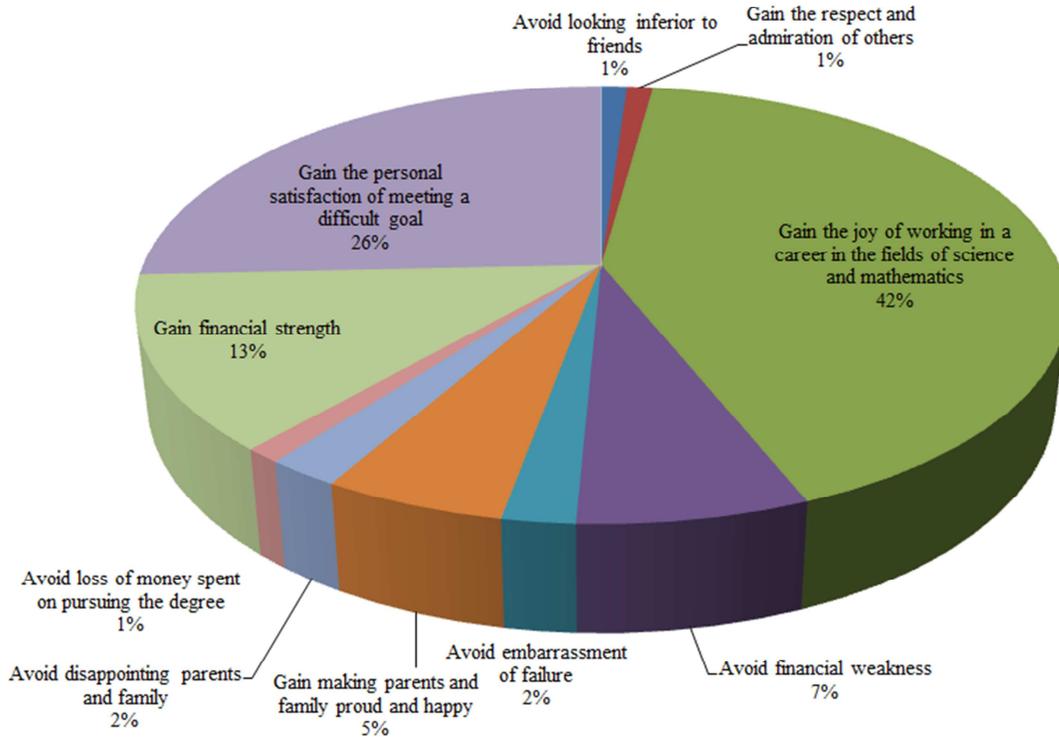


Figure 1

At 42% the most commonly selected choice was consideration number 3, which was *Gain the joy of working in a career in the fields of science and math*. This might be seen as being partially influenced by American affluence, where young people have the leisure of being able to select a profession based upon natural interest instead of financial opportunity—though engineering does also provide the latter. For the 117 students in this subgroup, the median midterm grade average was 83.1, and the overall average was 76.0. These scores are close to those of the entire student population surveyed.

At 26%, the second most commonly chosen motivating factor was consideration number 10, *Gain the personal satisfaction of meeting a difficult goal*. For this subgroup the median grade average at midterm was 82.6 and the overall average was 78.6, which again is not much different than the overall scores for all the students.

In observing the motivating factor of earning power, or lack thereof, as related to having a degree in engineering, the considerations of *Gain financial strength*, *Avoid financial weakness*, and *Avoid loss of money spent pursuing the degree* only received a total of 21% of the students’ vote for the number 1 motivating factor when all three are combined. Again, in an affluent society where opportunity has abounded in recent times, that may have impacted the students’ view of the significance of financial considerations as motivators.

Figure 2 below shows that the most frequent choices for the 2nd most important motivating factor were *Gain the personal satisfaction of meeting a difficult goal* (24%) followed closely by *Gain financial strength* (22%).

Considerations Students Ranked Second for What Motivates Them to Pursue Engineering

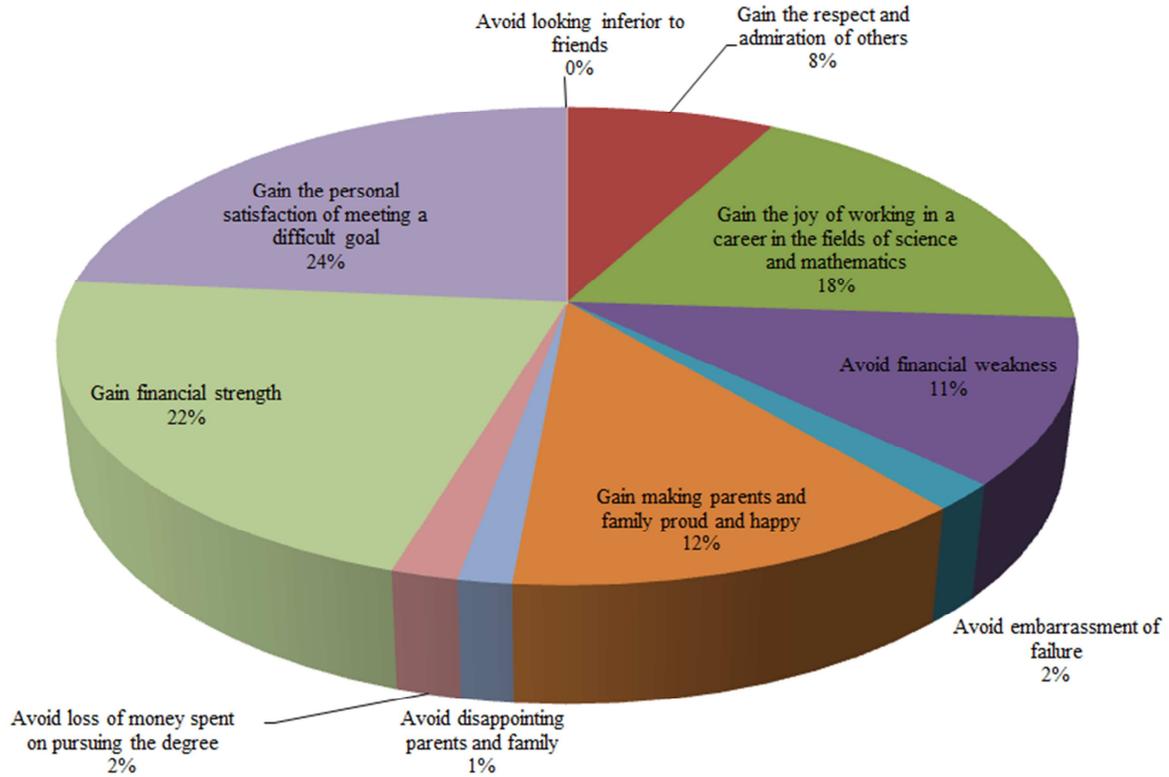


Figure 2

When *Avoid financial weakness* is combined with the latter, the total share is 33%, revealing financial considerations are directly or indirectly a significant secondary motivator.

From Figure 3 below, it is of interest to observe which of the 10 potential motivators was chosen by the students as being the *least* influential.

Considerations Students Ranked Last for What Motivates Them to Pursue Engineering

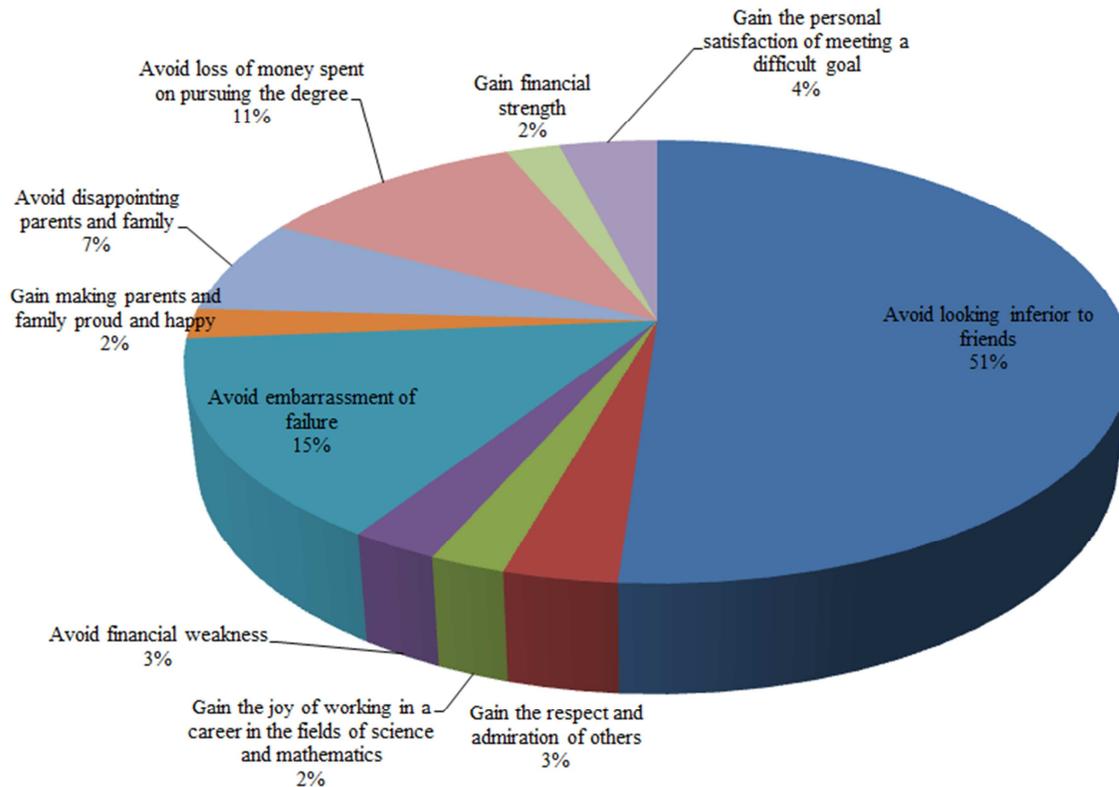


Figure 3

An actual majority (51%) of the students chose *Avoid looking inferior to friends* as being least significant. Again, the median of 81.9 and average of 75.3 for those students' midterm grades was in line with the overall scores for all the students. The next-closest consideration for the lowest ranking, number 5, received less than 15% of the responses.

Another question is whether the top students of the classes had different choices for what motivated them to succeed. The top ten students, all with course averages of 100, responded generally the same as the other students, with half of them also indicating consideration number 3 was the one most likely to motivate them.

The response of the 20 female students was also observed. The median of their midterm averages was 84.2, and their average overall was 81.8. They, too, were consistent with the rest of the students, with twelve of them choosing consideration number 3 as their most significant first motivator.

CONCLUSION

Of the students surveyed, no single motivating consideration emerged as a strong indicator of success during the first half of their first semester. It appears for this group that factors other than motivation *type* are more influential in predicting student success. Overall, this may be interpreted, at least in part, as a result of the affluence we enjoy in the United States; all the students were motivated by one or more considerations, but none of the students appear to be pursuing engineering out of urgent financial concerns. If the economy changes dramatically for the worse that may change, but for the time-being most students are motivated to pursue engineering because they feel they would enjoy it.

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