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Gritty students: The effect of perseverance on retention for traditional and nontraditional students

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Abstract:

It is important to examine characteristics that contribute to successful retention in an engineering program, particularly among nontraditional and transfer students. One characteristic trait that has been experimentally linked to success is grit, which is defined as "perseverance and passion for long-term goals" [1]. Although grit is widely seen as a personality trait, it has also been shown to be something that people can be taught; that is, interventions can be enacted to increase a person's grit. The simplicity of measuring someone's grit score, and the straight-forward intervention path for those with lower scores, makes this trait an attractive candidate for examination among students. Preliminary studies establish net grit scores of students at beginning stages of the engineering program, at a two-year and four-year institute. Intermediate and advanced students within a mechanical engineering program are also studied. The longitudinal aspect of this study will follow individuals as they progress through or abandon the program.

The mechanical engineering program at the University of Wisconsin - Platteville (UW - Platteville) has a collaborative program relationship with thirteen two-year Colleges that allows any student who has achieved an associate's degree to stay at their two-year Colleges campus while obtaining a mechanical engineering BS degree from UW - Platteville. This program increases educational access to nontraditional, place-bound students across the state.

Preliminary results of a longitudinal study involving grit in nontraditional and traditional students are presented. While the longitudinal study involves following students throughout their academic career, this study compares grit scores between groups of students at different academic stages. Traditional students are surveyed at a freshman introductory Success Skills course, and nontraditional and traditional students at the Colleges are surveyed in a transfer-equivalent course. Traditional and nontraditional students are surveyed together in an intermediate course, which is one of the first that students take after having been accepted into the mechanical engineering program, early in their junior year. Students are surveyed again in their senior design course. Comparisons are made between the different academic levels as well as between traditional and nontraditional students, with attention paid to confounding factors such as gender and racial identity.

Introduction:

The need for engineering students is wildly publicized and discussed. The question is, are there characteristics of students that can help predict their success in an engineering program, and if so, can it be taught to other students so that they, too, can be successful?

One intriguing characteristic is that of grit, or the ability and willingness to stick to a long-term goal. Grit is a characteristic that is distinct from the big-five personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism) [3, 1] and is correlated to success and achievement due to persistence. One reason that makes grit an attractive characteristic to study is that it is not an indelible facet of a personality, and that anyone can improve their "grittiness" with some relatively minor interventions.

This paper discusses the start of a longitudinal study that measures grit in students enrolled in a two-year college that is a feeder program for a four-year institution providing degrees in engineering. The University of Wisconsin Colleges - Rock County (UW - Rock) is a feeder school specifically because there is a collaborative agreement in place that not only allows the associates degree from UW - Rock to qualify as all liberal arts requirements at the University of Wisconsin - Platteville (UW - Platteville), but there are also UW - Platteville faculty placed full-time at UW - Rock location to teach place-bound students who cannot pick up and move to UW - Platteville. It will be years before any meaningful conclusions can be drawn, but data presented here can give a snapshot of what students' grit scores are at freshmen, junior, and senior levels.

Background:

A collaborative program exists between UW - Rock and UW - Platteville. Students who complete an associate's degree at UW - Rock are accepted into UW - Platteville with their liberal art's requirements satisfied. Students are then eligible to complete their four-year mechanical engineering degree by taking classes from a combination of options, including face-to-face courses offered at UW - Rock by faculty employed at UW - Platteville and remote streaming classes originated from UW - Platteville. Since this program allows students to remain at UW - Rock while completing their four-year degree, there is a reasonable concentration of students at UW - Rock who then transfer into UW - Platteville, either staying at UW - Rock for the duration, or transferring to the main campus of UW - Platteville.

Methods:

In order to evaluate retention of students across the program, students were surveyed at the beginning, middle and end of their mechanical engineering studies. Three courses were chosen to administer surveys based on this desire: an Introduction to Engineering class, with no prerequisites and therefore generally taken at the beginning of the curriculum, an intermediate Introduction to Computational Methods class, and Senior Design.

The reason that these three classes were chosen is that due to the nature of the curriculum prerequisites at UW - Platteville, students are not allowed to enroll in Introduction to Computational Methods until they are accepted into the Mechanical Engineering Program at UW - Platteville, which means that they have obtained a 2.6 GPA in their core classes. Core classes include Calculus 1 and 2, Physics 1, Chemistry, and Introduction to Engineering. Therefore, this intermediate Introduction to Computational Methods class has to be taken after Introduction to

Engineering, and because it is a prerequisite for classes such as Heat Transfer and Dynamical Systems, it is approximately the midpoint for a student in the Mechanical Engineering Program. Senior Design has a prerequisite of most other senior-level classes, and a hold is placed on that class that can only be lifted once the Intent to Graduate form has been signed, and the Department has certified that a student is in their final semester of classes. For simplicity's sake, then, students enrolled in Introduction to Engineering are referred to as freshmen, those enrolled in Introduction to Computational Methods are referred to as juniors, and those in Senior Design are called seniors.

The nineteen-question survey administered contains the 8-question Grit-S survey [4], the participant's gender, age, name, whether they are a first generation college student, racial identity, marital status, the number of dependent children in their household, and asks to list any other extracurricular activities or obligations. The object of this writing is to discuss preliminary results from the first semester's data collection.

Results and Discussion:

One of the issues encountered with this study is that there are only small numbers of students that start at UW - Rock and then transfer to UW - Platteville for a mechanical engineering degree. For example, from the various groups, data was collected from 39 senior students, 70 juniors, and 20 freshmen. The freshmen were all enrolled at UW - Rock. Six of these students indicate plans to continue on to UW - Platteville and pursue an engineering degree. Of the 70 juniors surveyed, all but twelve were at UW - Platteville's main-campus location. Eight students were located at UW - Rock and the remaining four were scattered around Wisconsin, taking advantage of the streaming video technology and pursuing a degree remotely. However, due to the small number of students in each of these locations, their results are grouped in with the main-campus students for the purpose of this publication. It is important to note that these are preliminary results; data from subsequent semesters of surveying will be aggregated with these results to better study these influencing factors.

A histogram of the frequency of each grit score for students in each class is presented in Figure 1. These results correspond to means and standard deviations as shown in Table 1. Both the tabular data from Table 1 and the graphical data from Figure 1 indicate a shift in grit scores between the freshmen and junior/senior students, and that average grit levels for the freshmen are lower than that of junior/seniors. However, it would be presumptuous to draw conclusions from these numbers; t-tests do not support any statistical significance.

One interesting observation regarding grit, though, is that it appears that engineering students (or, at least this small group of engineering students) are, on average, "grittier" than the general populace. Adults aged 25 and older were found to have average grit scores of 3.65 and 3.41, according to two studies by Duckworth et al [1].

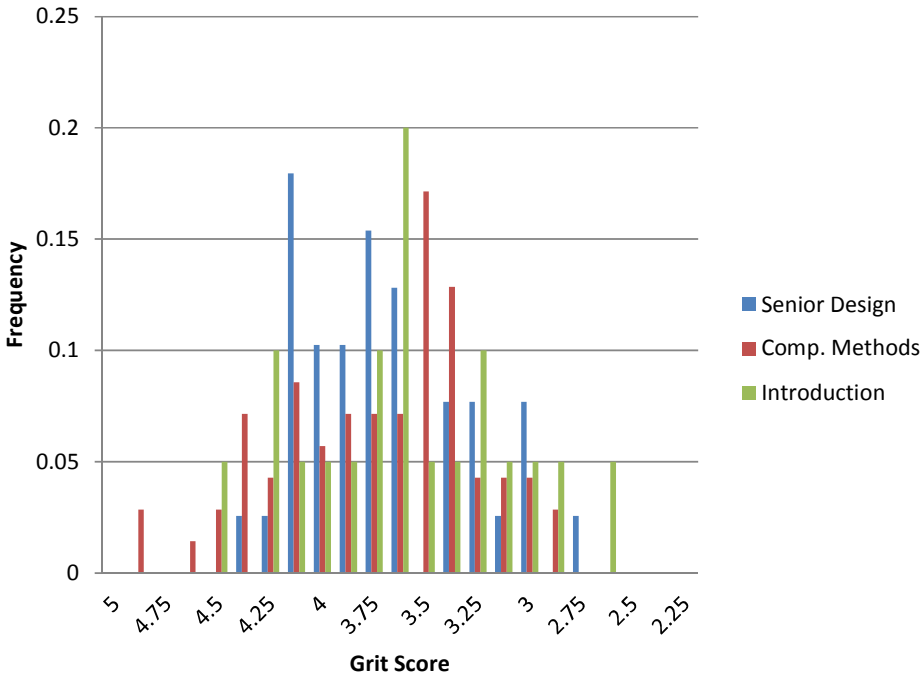

Figure 1: The frequency of grit scores for three students in three different courses across the mechanical engineering curriculum.

Table 1: Average Grit Scores and Standard Deviations for Students in Three Different Courses

Course	N	μ	σ
Seniors	39	3.7	0.4
Juniors	70	3.73	0.47
Freshmen	20	3.6	0.49

While statistical significance cannot be found from this data, certain trends can. The first trend is that juniors and seniors have approximately the same average grit score, around 3.7. Freshmen tend to have a slightly lower grit score. Grit has been found to remain constant as people age and also with respect to education [1], so neither reason explains the difference. However, very few of the freshmen sampled will eventually be in the junior/senior class, whereas students at UW - Platteville have very high retention between junior and senior standing. Perhaps, then, the difference in grit scores can be explained by a population change, that perhaps the students with higher grit scores are retained and those with lower grit scores are not.

In this group of students, very few were nontraditional in age. Of the students surveyed, eight juniors and five freshmen identified as being older than 25. There were a total of six women enrolled in the study, and therefore gender discrepancies are not examined.

On the other hand, both UW - Rock and UW - Platteville recruit large numbers of first-generation college students. Ten of the 20 freshmen surveyed identified as first-generation college students. 27 of the 70 juniors were first-generation, as were 15 of the 39 seniors. That corresponds to 50%, 39% of juniors, and 38% of seniors. Figure 2 shows the average grit response and error bars represent one standard deviation from the mean for each of these groups. At this time, no meaningful conclusions can be drawn regarding these groups.

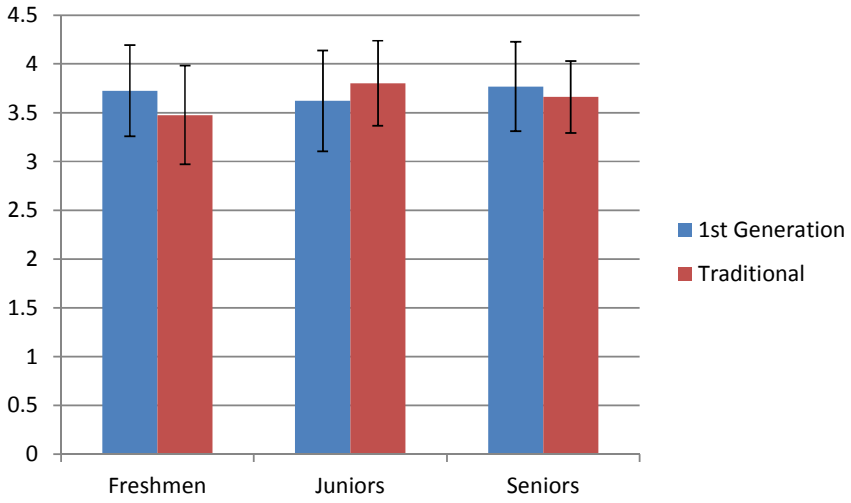

Figure 2: First-generation and non-first-generation students' average scores for freshmen, juniors, and seniors surveyed.

Conclusions:

The effect of grit, or perseverance in achieving a long-term goal, on successful retention of two-year students into a four-year program is unknown. A longitudinal study has been proposed between two institutions with a collaboration agreement in place allowing students who obtain their associate's degree from UW - Rock to remain at UW - Rock and obtain their four-year, mechanical engineering degree from UW - Platteville.

The data presented here gives a snap shot of students currently enrolled in a freshman, junior, and senior level course. The freshmen were all enrolled at UW - Rock, and the juniors and seniors were enrolled at UW - Platteville, although some were taking the junior course from the UW - Rock location and others were taking the junior course from other two-year institutions around Wisconsin.

There was no statistical significance across the preliminary data, although average grit levels of juniors and seniors were slightly higher than that of the freshmen. Not enough data was taken from women, minorities, and nontraditionally-aged students to draw comparisons, but there was a significant number of first generation students to examine results. There appears to be no difference in grit levels between first generation and non-first generation students enrolled in

classes. It is anticipated that with longitudinal data, more revealing information will be revealed as students are retained or withdraw from the program.

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