Preliminary results on students' study habits and their grades in STEM courses

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***Abstract*— This short manuscript presents our preliminary results on students' study habits and the impact of these habits on their grades. Preliminary data related to three engineering classes is presented.**

Keywords—study habits; grades; STEM; Engineering; students

I. Introduction

Most students enter college directly from high schools where teaching methods as well as learning habits and expectations differ vastly from those in college-level STEM courses. Many students have been successful in high school with study skills which are unrelated to academic success in college [1-2]. Veenstra et al. [3] summarize nine pre-college characteristics contributing significantly to first-year student success in terms of GPA. Among other factors, good study habits and skills are found to be important for independent learning, success, and retention in engineering courses [4-6]. Blumner et al. [7] report that study habits are linked to performance and that more meaningful study habits could improve overall academic performance.

Further, not only do students lack awareness of connections between study practices and learning, they also lack a full sense of the control they have over their performance. Bandura [8] and Dweck [9] indicate that viewing the ability to do something as a skill that must be developed and practiced helps students achieve academically. This has been shown in a recent study of students in first-year writing classes at NMSU indicating that students performing well are more aware of their own control over their performance and grades. Those with stronger beliefs in control over their grade attended class more frequently and submitted assignments more regularly.

The struggling students in many hardcore STEM courses often complain that they are committing an extraordinary amount of time outside the class for these courses, yet they do not see their return for investment reflected in their grades. The first author's previous advice to "study hard or work harder" did not resonate with the students. While teaching the EE310 – Engineering Analysis II course in Fall 2013, the first author noticed the second exam average was only 62% after a relatively easy first exam. Students who barely passed the first exam were particularly demoralized, some giving up hopes to pass this course. Around this time, he attended a workshop, ***"****Get Students to Focus on Learning Instead of Grades: Metacognition is the Key!"* by Dr. McGuire of Louisiana State University, conducted at the Teaching Academy, NMSU. Intrigued and encouraged by the results depicted in the workshop, he procured Dr. McGuire's permission to use some of her work in his class.

The goal was to provide students with tools for increasing the role they (students) can play in their own learning through careful attention to and monitoring of their study habits and strategies. The first objective was to determine "*To what extent do students' self-reported study practices correlate with their academic performance, defined in terms of exam grades?"* To this end, some of our preliminary results are briefly reported through this manuscript.

Data collection instruments and methods are briefly explained in Section II, followed by data analysis, results, and discussions in Section III. Conclusions and future work are reported in Section IV.

II. Data collection Instrument and methods

Following the workshop as mentioned above, the first author, with permission, modified and administered a variant of a self-evaluation survey, now called "Self-Evaluation Study Strategy Instrument" (SESSI), depicted in Table 1, to students in the EE310 class after the second exam. Since then, SESSI has been iteratively improved and administered in three classes: EE310 (7 semesters), Engineering Technology course, ET240 (3 semesters), and Freshmen Engineering course, ENGR 100. The SESSI allows classification of students into one of the two groups, namely Type 1, with self-study strategies and habits not conducive to better learning, compared to those in Type 2, with more conducive strategies.

The SESSI responses were captured against each prompt through a 5-point Likert-scale as given in Table 1.

Table 1: Self-Evaluation Study Strategy Instrument (SESSI)

Statements: 1=Strongly disagree with the statement; 2 = Disagree with the statement; 3 = Neither agree nor disagree with the statement; 4 = Agree with the statement; 5 = Strongly agree with the statement.
1. I did not spend enough time on the material
2. I did preview-review for every class
3. I started the homework too late
4. I did a little of the homework at a time
5. I didn't memorize the needed information
6. I made flashcards to prepare for the exam
7. I did not use the book
8. I used the book and did the suggested problems
9. I assumed I understood information that I had read and re-read but not applied.
10. I practiced explaining the information to others

III. Data Analysis, Results, and Discussion

Odd and even numbered prompts were separated under the titles "Type 1 (T1)" and "Type 2 (T2)," respectively. The respective responses in each type (T1 or T2) were summed, and each respective student was placed under the group with the greater sum. T1 students displayed positive study skills and T2 students did not.

Averaged over seven semesters for EE310, as shown in Figure 1, the students whose responses placed them in study practices Type 2 (T2) had an average exam 1 score of 78% as compared to Type 1 (T1) students, with an average score of 66%. Preliminary results for ET240 and an ENGR100 indicate a similar overall grade difference between these two types as shown in Figure 1. In the entry-level ENGR 100, the percentage of students belonging to T1 and T2 roughly stand at 75% vs. 25%, compared to an improved 50/50 distribution during the second year (ET 240) and an even better one-third vs. two-third split during the third year. Although this trend is statistically not significant because of limited data, it is nevertheless an alarming indicator of poor study skills and habits of freshmen entering the college, when they are most likely to drop out of engineering, if not the university.

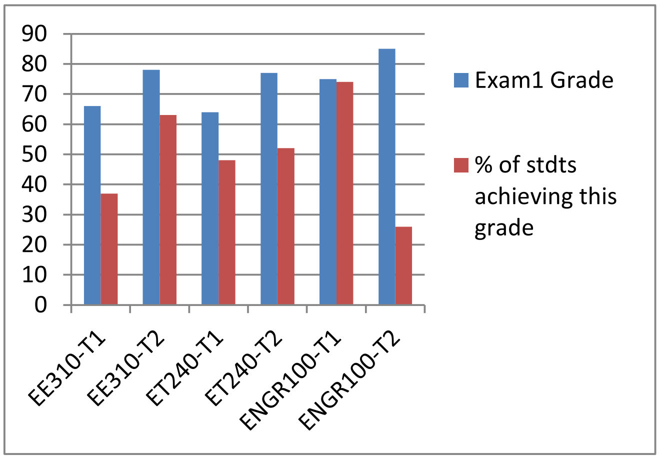

Figure 1: Exam 1 grades for some STEM courses by SESSI classification.

Further, the above data were analyzed using logistic regression analysis under two binary outcomes, passing the course with 70% or greater and failing the course below 70%. The use of logistic regression in educational research is not new, having been considered in the 60s and 70s [10]. Shown in Figure 2 are the odds of obtaining the pass percentage given students' T1 and/or T2 scores on SESSI. As is evident from Fig. 2, those who attain high scores under T1 study habits will face considerable odds to pass the course as opposed to those who obtain small scores under T1 and large under T2. These results are statistically significant ($P<.0000$) for T1 and relatively less significant ($P<.003$) for T2.

IV. Conclusions

From our preliminary analysis using a simple self-evaluation study strategy instrument, there appears to be a strong correlation between students' performance in exams and their study habits as self-reported on the SESSI instrument. Clearly it would be advantageous for students to switch from T1 study habits to T2. Our preliminary analysis indicates that when students are apprised of these results, they do make efforts to move from T1 to T2, a phenomenon we are currently examining in more depth. Those who shift from a T2 student to a T1 student, may have an increased probability of passing the course successfully.

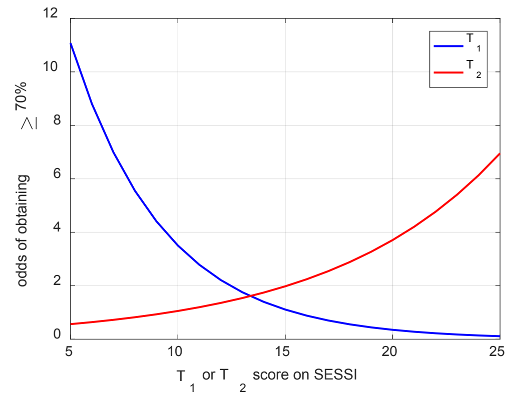

Figure 1: Odds of obtaining passing percentage of 70% or greater on exam based on SESSI classification.

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