

2006-946: HELP-SEEKING BEHAVIOR AMONG FRESHMEN ENGINEERING STUDENTS: A PREDICTOR OF CALCULUS PERFORMANCE

David Thompson, Oklahoma State University

Academic background: Ph.D., Agricultural Engineering, Michigan State University. M.S. Agricultural Engineering, Purdue University. B.S. Agricultural Engineering, Purdue University.

David R. Thompson has expertise in the education and continuing education of engineers and in the storage, handling and processing of food. In his present position, his scholarly work has focused on student success and retention in engineering, engineering technology and architecture. He has extensive experience in the thermal processing and freezing of foods with emphasis on the microbial and chemical changes occurring during processing and storage. His international experience includes assignments in institution building, research and education in North America, Europe, Africa, and Asia.

Mwarumba Mwavita, Oklahoma State University

Academic background: Ph.D., Educational Psychology, specializing in Research Evaluation Measurement and Statistics (REMS), Oklahoma State University. MEd, Educational Administration, University of Central Oklahoma. BEd (Science) Specializing in Physics and Mathematics, Kenyatta University. Mwarumba Mwavita is a visiting assistant professor in the School of Educational Studies at Oklahoma State University. His expertise is in the education psychology and research evaluation measurement and statistics. In his present position, his scholarly work has focused on motivational factors, specifically non-academic factors that influence academic achievement in quantitative subjects such as calculus and statistics. He has experience in program evaluation, and quantitative research methodologies in social sciences. Recently he completed a study that examined a motivational model that examined factors influencing calculus success among freshmen engineering students.

HELP-SEEKING BEHAVIOR AMONG FRESHMEN ENGINEERING STUDENTS: A PREDICTOR OF CALCULUS PERFORMANCE

Abstract

This study examined whether help-seeking behaviors among engineering students at a large Midwestern University predicted success in an entry level calculus course. Two hundred and ninety five freshmen engineering students enrolled in an entry level calculus course participated in the study. Bivariate correlation between help-seeking behavior and calculus course grade was statistically significant at $\alpha = .05$. Regression analysis indicated that help-seeking behavior was significant predictor of calculus performance. Implications of this study are also discussed in relationship to student advising.

Introduction

Core courses in engineering programs have been found to play a significant role in influencing retention among engineering students.^{1,2} These core courses in most cases are foundational and engineering students take them prior to admission to specific engineering program. Success on these foundational or entry level courses is therefore paramount to continued progress toward completion to an engineering degree. Studies have continued to investigate factors influencing success in the entry level courses.^{1,2,3,4,5}

One of the foundation and entry course required for all engineering majors is calculus. Engineering students take this course during their first year of college. In order to continue in the engineering program, students are expected to pass this course, otherwise they may have to retake or drop from the program.

Many studies have focused on academic factors influencing students' success in engineering core courses. These studies have divided the factors as academic and non-academic. For instance, prior educational background as measured by high school GPA, ACT, SAT, to name a few have been found to predict success in both core courses.⁶ Other studies identified the type of mathematics and science courses taken prior to college as predictors of students' success in engineering programs.⁷

Despite the usefulness of these academic factors, there have been many instances that these factors have not predicted success as well as retention in engineering programs. For example, academic factors have been found in other studies to inaccurately eliminate minority students in engineering programs.⁵ As a result a lot of engineering programs in the country have come up with Minority Enrichment Programs (MEPs), summer bridge programs to name just a few to address this issue. Success of these alternate programs to addressing the problem of retention of engineering students has prompted research factors other than academic that influence success as well as retention of engineering students.

College students' research has clearly indicated that most critical influences of students' success as well as persistence in college are the involvement with peer group centered on an academic task and out-of-class contact with faculty.⁸ Among the most widely recognized intervention programs in college mathematics is the calculus workshop model that was originally developed to serve under-represented students at the University of California, Berkeley by Uri Treisman in the late 1970s.⁹ The Berkeley model, known as the Emerging Scholars Program (ESP), has been adapted in mathematics courses at several major universities.¹⁰ The program has been credited for its outstanding improvement in lowering the drop rate of minority students at such universities as Rice, and at University of Texas at Austin.¹⁰

Due to their success, these programs are intentionally serving both diverse and inclusive student populations.¹¹ These programs provide mathematics workshops designed to identify and build on student strengths for the students arriving at college with gaps in their mathematical backgrounds. Besides addressing the mathematical background issue, these programs also address help-seeking strategies such as how one prepares for a test, seeking assistance from faculty, peers, and other available resources to study and completing assignments.¹¹

Purpose of the Study

Due to poor performance in calculus among freshman students in the last ten years, the undergraduate calculus course has attracted an unprecedented level of national interest.¹² Many of the freshman engineering students fail to meet the minimum grade criterion of A, B, or C in their calculus course.² Thus, researchers have conducted several studies to determine factors that cause low performance in calculus among college students. The purpose of this study was to investigate whether help seeking behaviors among engineering students influenced calculus achievement among freshmen engineering students at a large Midwestern university. The study was guided by the following research question:

Does help-seeking behaviors among freshmen engineering students correlated with calculus performance?

Background

Help seeking is a way of regulating the social environment to promote learning.¹³ Help seeking behavior incorporates strategies students use in seeking assistance when they encounter difficulties. Theory on academic help seeking among students treats help seeking behavior as an adaptive strategy for coping with difficulty and promoting mastery.¹⁴ In addition, research on help seeking posits help seeking as an important self-regulatory strategy that contributes to student learning.¹⁵

Asera's¹¹ review of Emerging Scholars Programs (ESPs) posits that these programs have become a major source of help to students in need of help. Students who realize that the task at hand is beyond their ability attend these programs to get assistance. In fact several

studies have pointed out that students who attend these programs to get assistance do perform higher than their counterparts. For example, Allen¹⁶ at the University of Missouri, Rolla showed that engineering students who attended the ESP program had higher calculus grades than the non ESP participants.

Method

The participants in this study were 295 freshmen engineering students who had enrolled in an entry level calculus course during fall 2002 and spring 2003 semesters. Table 1 provides the participants demographics.

Table1: Sample's Demographics

Ethnicity	N
Caucasians	237
African-Americans	7
Native-Americans	21
Hispanics	5
Asians	5
Internationals	20

Out of the 295 students, 20.3% were female (n = 60) and 79.7% were male (n = 235). Eighty percent (n = 237) were Euro-American , 7.1 % Native Americans (n= 21), 1.7% African Americans (n = 5), Hispanic (n = 5), and Asian American (n =5) each. International students (n = 20) accounted for the remaining 6.8 %.

Help-seeking behavior was assessed by five likert type items based on literature. These items sought to know from how often they asked for assistance while they were taking the calculus course. This assistance was in the form of teaching assistance, faculty member, review sessions, and group work. The aggregate of the five items represented a help-seeking behavior score, with a high value indicating high tendency to seek assistance when encountering difficulties in calculus. The range of help-seeking scale was 5 – 35. Calculus success was assessed by the end of course grade. The grades were recoded to numbers using the following scheme. Grade “A” was coded as “5”, grade “B” as “4”, grade “C” as “3”, grade “D” as “2”, and grade “F” as “1”.

Results

Statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS). First, means and standard deviations were calculated (Table 2).

Table 2: Mean and Standard deviation of calculus grade and help-seeking variables

Variable	N	Mean	Standard Deviation
Calculus grade	243	3.51	1.4
Help-seeking	294	13.7	6.1

The results indicated freshmen engineering students in this sample on average achieved a high “C” grade. On the other hand, the students exhibited low help-seeking behaviors. Further analysis was conducted to find out the correlations between the two variables (Table 3)

Table 3: Correlation matrix

Variable	Calculus grade	Help-seeking
Calculus grade	1	
Help-seeking	-.265**	1

A statistically significant correlation coefficient between the two research variables was found ($r = -.265$, $p = .00$).

Thus a simple regression analysis was conducted with calculus grade as a criterion and help-seeking as a predictor (Table 4). The results indicated help-seeking as a significant predictor explaining 7% of variance in calculus success. However, the variable was had a negative sign.

Table 4: Regression analysis summary

Variable	Beta Weight	T	p-value
Help-seeking	-.169	-2.9	.00

Discussion and Implications of the study

Help-seeking behavior was a statistical significant predictor of calculus course success. Help-seeking has been identified as an adaptive strategy for coping with difficulty and promoting mastery.^{14, 15} This study found that help-seeking behavior to be negatively related to calculus course success. Based on the results of the study, successful freshmen engineering students in an entry level calculus course, tend to exhibit less help-seeking behaviors.

There are several possible explanations to this finding. The first explanation may be due to the fact that freshmen engineering students have had a strong calculus background, thus, capable of doing well with minimum help or would not seek help at all. The second explanation emanates from help-seeking literature. Help-seeking behavior may be avoided because it is experienced as dependency.¹⁴ This state may conflicts with personal autonomy needs, which Deci and Ryan¹⁷ see as the major component of intrinsic motivation. Thus students most students would rather struggle on their own to perform task instead of seeking help. As a result, only students who are struggling very hard in the course are the ones who seek help, and in most cases when it is too late.

In conclusion, despite the study’s limitation, the results provide a “jumping off” point to examine help-seeking behaviors among freshmen engineering students. A positive attitude on help-seeking is paramount for help-seeking to positively influence

performance. By encouraging helping seeking behaviors by both faculty and student advisors, students may benefit by improving their academic performance. Otherwise, if the attitude toward help-seeking is not positive, majority of the students may struggle through the entry level courses in engineering leading to dropping out or switching majors.

Results from this study may assist faculty members from college of engineering and mathematics departments to pay close attention to help-seeking behaviors. From the time the students enter the engineering program; help-seeking should be emphasized as well as offered to the students. Learning resource centers should be readily available and even scheduled for students to attend and receive the necessary assistance. Such programs may be provided by the engineering department. In doing so, the negativity that this study showed on help-seeking behavior would be minimized and a positive attitude fostered. This may lead to more students performing well in the calculus course, thus reducing the drop out rate.

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