Factors Contributing to Student Success in a University Introductory Networks and Telecommunications Course

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Abstract

The introductory networks and telecommunications course is a part of an Organizational and End-user Information Systems (OEIS) curriculum in a large southeastern university. This course has typically been recognized as a difficult core course for students. This study uses multiple regression to examine the factors that contribute to the success of undergraduate technology support and training management students in the introductory networks and telecommunications course. The findings are based on data gathered from the college transcripts and academic files of students. The findings have implications for faculty who desire to improve the effectiveness of instruction for their networks and telecommunications students.

Introduction

When investigating information systems (IS), networks and telecommunications are vital components of the IS curriculum in which college and university students need to be prepared. Students must have the basic knowledge of the area of networks and telecommunications as a prerequisite for other courses or to successfully move forward into other technology-based areas. However, due to attrition rates in beginning networks and telecommunications courses there is a concern about student success.

The initial networks and telecommunications course is difficult for many students studying in an Organizational and End-user Information Systems (OEIS) curriculum. This study examines factors that contribute to the success of undergraduate OEIS students in an introductory networks and telecommunications course. Students in all sections between Fall 2004 and Spring 2005 in an introductory networks and telecommunications course at a large public university in the southeast were asked to participate in this study. Those students who agreed to participate in the study signed a consent form to allow researchers to gather data from their college transcripts and academic files. Sixty students agreed to participate.

Multiple regression analysis was used to identify those factors that contribute significantly to student success. Factors examined include students' college grade point average, success in previous OEIS courses, success in other technical courses, success in math courses, and standardized test scores. The findings have implications for faculty who desire to improve the effectiveness of instruction for networks and telecommunications students.

With an estimated failure rate of approximately thirty percent in the introductory networks and telecommunications course at this particular university, the concern for student success became more prevalent in the technology support and training management program when a curriculum update included the regulation that no student could take a core course such as this one more than two times. A requirement for the technology support major is that students must receive a grade of C or better in all core courses. Therefore, with this new regulation, if students did not receive a grade of C or better the first time taking the course, they would be allowed to take the course again. However, on the second try if a grade of C or better was not earned, the student would no longer be allowed to continue in the technology support and training management program.

The introductory networks and telecommunications course involved in this study is taught in a lecture environment. The course does not involve a hands-on component; however, it provides the basic components for success in two additional networking courses in the OEIS program. One explanation that may be given for the lack of success in an introductory telecommunications course is the lack of ability to analyze and solve problems. However, courses taken prior to this course should emphasize logic, mathematical skills, and problem solving.

In order for technology support educators to further adapt the course to meet the needs of technology support and training management students, a better understanding of the factors that affect students' success or failure is needed. The purpose of this study was to look at available data on typical undergraduate technology support and training management students and develop a predictive statistical model that gives insight into student achievement in an introductory networks and telecommunications course.

Literature Review

Networks and telecommunications are integral parts in any technology support curriculum. The transmission of voice and data are key components to data transfer and network performance. Significant changes in telecommunications have occurred over the years including the development of actually majors or departments in telecommunications. For several years some information systems (IS) departments have actually included telecommunications as a distinct discipline of study (Barnard, Bryant, Jones, & Reilly, 1996).

Wilson and Schrock (2001) completed a study of twelve factors contributing to the success of students in an introductory computer science course. The authors investigated this area of study because students at their university had an attrition rate of approximately 50%-60%

in the first computer science course. A few of these factors included computer self-efficacy, previous programming experience or lack of experience, and gender. Wilson and Schrock (2001) found that comfort level and math were also investigated and determined to be two of the predictive factors in order of importance. These factors had a positive effect on success.

Other studies have been completed in which previous computer experience was noted as a possible predictor of student success in a computer course (Bunderson & Christensen, 1995; Kersteen, Linn, Clancey, and Hardyck, 1988; Taylor & Mounfield, 1994); however, other factors must be investigated as well. More recently Allert (2004) investigated learning styles and success factors for engineering majors in an introductory course in computer science. Although computer and software familiarity were not strong positive success factors, it was obvious that verbal learners performed at a higher rated than visual learners. Forte and Guzdial (2005) noted that at their particular university the introductory computer science course that all students must complete (major and nonmajors) was not engaging for nonmajors. Therefore, many universities are struggling with the same issue of lack of involvement of students in introductory technology-based courses and high attrition rates.

Brookshire and Palocsay (2005) examined the factors predicting success in the introductory management science course in a business school. Their analysis identified instructor, overall grade point average, mathematics SAT score, and grade in the calculus course as significant predictors. Fincher (2000) reported on correlates of student success in the first year of college using data collected over thirteen years from the university system of Georgia. High school grade point average and SAT scores were the best predictors among those examined.

There have been many studies of the impact of SAT and other achievement tests on college performance. These studies have examined the effects of factors such as gender, race/ethnicity, socio-economic background, and other variables (Baron and Norman, 1992; Young and Barrett, 1992; Graham and Husted, 1993; Keller, Crouse, and Trusheim, 1994; Smyth, 1995; Young and Fisler, 2000; Rothstein, 2004). The results of these studies vary.

Several studies have investigated the performance of students in college science and mathematics courses. Spencer (1996) examined the relationship between SAT math scores and grades in general chemistry. He found a strong correlation between SAT math score and general chemistry grades, with no significant differences in any of the subsets for gender, ethnicity, and academic experience. Mason and Mittag (2001) investigated Hispanic-surnamed students in first-semester chemistry, finding that math experience was the best predictor of success.

Robinson and Kubala (1999) examined community college students enrolled in three mathematics courses. They examined factors such as mathematics experience, prior use of technology, SAT scores, gender, ethnicity, status as a new or returning student, enrollment in a study skills course, and the time since high school graduation. With these variables, they were able to account for 22 to 41 percent of the variability in student performance.

Previous research, consequently, shows that SAT scores, previous courses, grade point average, and a variety of demographic factors can be predictors of success in college coursework generally, and technical and scientific courses in particular. With these results in mind, data on students in a telecommunications course were collected.

Data Collection and Analysis

All students in the telecommunications course in an Organizational and End-user Information Systems (OEIS) department at a large southeastern university were asked to consent

to participate in a research study by allowing the researchers to examine their academic records. Fifty-nine students agreed, 39 in the fall semester of 2004, and 20 in the spring semester 2005.

Academic performance variables collected included overall grade point average, network and telecommunications course grade, the number of times the networks and telecommunications course was attempted, grades in entry-level OEIS courses, grades in mathematics, statistics, and logic courses, and SAT scores. Demographic variables included gender, ethnicity, and date of birth.

Forty-one of the students (69.5%) were male, while 18 (30.5%) were female. Twenty-six (44.1%) were African-American, 18 (30.5%) were Caucasian, and one (1.7%) was Asian. The ethnicity of 14 students (23.7%) was not available. Among the students participating, 45 (76.3%) were attempting to complete the networks and telecommunications course for the first time, 10 (16.9%) were attempting to complete it for the second time, and four (6.8%) were attempting to complete it for the third time. Those taking the course for the third time were students previous to the ruling that students may only attempt to complete the course twice to receive a grade of a C or better to continue in the program. The students ranged in age from 19 to 50, with an average age of 24.4 years. The grade point averages of the students ranged from 1.66 to 4.0 on a four-point scale, with an average of 2.66.

The average grade in the networks and telecommunications course was 2.47 on a four-point scale. Mathematics SAT scores ranged from 330 to 640, with an average of 498.5. Verbal SAT scores ranged from 310 to 620, averaging 501.3. SAT scores were available for 46 of the students.

End-user information systems course performance was measured using the grade for the introductory OEIS course. This grade was available for 51 of the participating students. For this

course, and for the overall grade point average, plus grades (D+, C+, and B+) were averaged at 1.5, 2.5, and 3.5. Minus grades are not assigned at this university.

Mathematics course performance was measured using the grade in the statistics course. If the student had not taken statistics by the end of the 2004-2005 academic year, the calculus grade was substituted; if the calculus grade was not available, the grade in logic or another mathematics course was used. Two students had no grades for any kind of mathematics or logic course at the time the data were collected.

Pearson correlations were calculated to examine the associations among the variables. Three variables were significantly correlated with performance in the networks and telecommunications course: overall grade point average ($r = .383$, $p = .003$), grade in the introductory OEIS course ($r = .556$, $p < .001$), and mathematics grade ($r = .405$, $p = .002$). None of the other variables had a significant bivariate correlation with the grade in the networks and telecommunications course.

The three variables that were significantly correlated with networks and telecommunications course grade were entered into a multiple regression analysis to determine the extent to which these factors could predict student performance. These three variables accounted for approximately 30% of the variability in the networks and telecommunications course performance ($R^2 = .320$, adjusted $R^2 = .276$, $F_{3,46} = 7.215$, $p<.001$). Table 1 summarizes the multiple regression analysis results.

Table 1
Regression Analysis Results

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t value	Significance
Constant	-.074	.677		-.109	.914
GPA	.147	.256	.082	.574	.569
OEIS Course Grade	.673	.180	.500	3.742	.001
Math Course Grade	.062	.135	.067	.460	.648

As the results in Table 1 indicate, only the grade in the introductory OEIS course was a significant predictor of the networks and telecommunications course performance. In contrast to findings in the literature (Brookshire & Palocsay, 2005) mathematics course performance and grade point average were not significant predictors.

Discussion

Why was the grade in the introductory OEIS networks and telecommunications course the only significant predictor of telecommunications course performance? Part of the reason may lie in the nature of the networks and telecommunications course itself. The course does not have a significant mathematical component, and few of its deliverables demand verbal facility. Therefore, mathematics and verbal ability, as measured by the SAT score, would not give students in this course a particular advantage. Likewise, performance in mathematics courses is not relevant, in contrast to the management science course studied by Brookshire and Palocsay (2005).

The overall grade point average might be expected to predict networks and telecommunications success. After all, students who do well in college courses generally should be likely to do well in this course. The content in the networks and telecommunications course, however, is different from anything these students have experienced before. Doing well in English, history, or biology does not prepare a student for networks and telecommunications.

The fact that gender and ethnicity are not related to networks and telecommunications course success is a sign that students are evaluated fairly and impartially. If any gender or ethnicity differences in technology interest or performance exist, they do not seem to carry over to the telecommunications class. The discipline of end user information systems and the subject area of networks and telecommunications are not widely taught in high schools or in lower-level college classes. Students thus have little background or preparation in these topics. The introductory OEIS course, therefore, is the only coursework that seems to prepare students for the networks and telecommunications course, despite the fact that the OEIS course has little telecommunications content. Experience with the subject matter covered in the OEIS course seems to prepare students for the new, different, and challenging material covered in the networks and telecommunications class.

The implications for faculty teaching networks and telecommunications are that students should have an introductory technology class as a prerequisite. It is not critical that students get networks and telecommunications content in this class, but it is important that they are exposed to information technology terminology and concepts. The content of the previous course helps students build a foundation they can carry forward in later coursework, a foundation that is not provided by other courses in the college curriculum.

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