

Self-Efficacy and Vocational Interests in the Prediction of Academic Performance of Students in Engineering Technology

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ABSTRACT

Research on career self-efficacy has previously focused on investigations of the relationship of general elements of self-efficacy to students' consideration of a range of career options. However, researchers have moved from that traditional approach of general self-efficacy towards examining self-efficacy in relation to educational progress and achievement in specific fields. This paper will discuss the result of the study conducted to explore the extent to which variables such as career self-efficacy beliefs, math-SAT scores, high school GPA and vocational interest could predict the academic performance of the students enrolled in Computer Science and Engineering Technology programs.

The participants (N=125) included in the statistical analyses consisted of 85 males and 40 females. These participants completed measures of self-efficacy and expressed vocational interests in technical fields using a three-part instrument, referred to as the Science and Engineering Career questionnaire (SEC).

The results of the study provides the information needed in the process of translating self-efficacy theory into a practical model/tool useful for counselors and educators to select and prepare students who enter Computer Science and Engineering Technology programs. Finally, recommendation for future research to identify the factors influencing the academic performance of students in Computer Science and Engineering Technology programs will be discussed.

Introduction:

Computer Science and Engineering Technology graduates are more and more in demand, however, the supply of academically prepared graduates is not sufficient to meet the demands of

the industry. Hence there was a need for a counseling model/tool that will assist in the selection and preparation of students who enter Computer Science and Engineering Technology programs. However, review of the literature has failed to identify an effective, comprehensive counseling model/tool that will enable more students to graduate and become productive technologists in business and industry.

The research was conducted in order to accomplish the solution to the aforementioned problem by investigating the relationship of scores on the science and engineering questionnaire measuring the self-efficacy, vocational interests, and academic milestones to predict the academic performance of the students enrolled in computer science and engineering technology programs. The study also included their math SAT scores and high school GPA as independent variables. A total of 150 males and females from the computer science and engineering technology program volunteered to participate in the study. However, only 125 participants were included in the statistical analysis, 25 students were dropped out because 10 were foreign students and were not required to take the SAT, the other 15 students were transfer students from two-year colleges and were also not required to take the SAT. On the average, most students have been attending the University for at least four semesters.

Self-Efficacy Theory

Two decades have passed since Bandura first identified self-efficacy theory as a belief of one's ability to successfully perform a given task. By the end of his first decade of study, Bandura had determined that human functioning might be dependent on cognitive capacities [2,3].

Fundamental Cognitive Capacities

According to Bandura, human cognitive capacities that can predict individual's performance include ability to use symbols, learning through observation, planning, self-regulation, and self-reflection [1]. A brief description of each of these human cognitive capacities follows.

Ability to Use Symbols. By the use of symbols, humans transform immediate visual experiences into internal cognitive models that in turn serve as guides for their actions. Through symbolizing, people also ascribe meaning, form, and duration to their past experiences.

Learning Through Observations. Learning can also occur indirectly by observing other people's behavior and its outcomes. Individuals' capacity to learn by observation enables them to obtain and accumulate rules for initiating and controlling different behavioral patterns without having to acquire these behaviors by trial and error.

Planning. People not only react immediately to their environments through a symbolic process, but also self-regulate their future behaviors by planning. In particular, people plan courses of action for the near future, anticipate the likely consequences of their future actions, and set goals for themselves.

Self-Regulation. Through self-regulatory functions, human behavior is motivated and regulated by internal standards and self-evident reactions. The ability of self-regulation enables people to analyze their experience and to think about their own thought processes [2].

Self-Reflection. The self-reflective capability also called self-reflective consciousness, enables people to think and analyze their experiences and thought processes. By reflecting on their different personal experiences, individuals can generate a specific knowledge about their environment and about themselves [4].

Purpose of the Study

The purpose of the study was to assess the extent to which career related self-efficacy beliefs, vocational interests, academic milestones, math SAT scores and high school GPA could predict the academic performance of the students enrolled in Computer Science and Engineering Technology programs. The results of the study contributes the information needed in the process of translating self-efficacy theory into a practical model/tool useful for counselors and educators to select and prepare students who enter Computer Science and Engineering Technology programs.

Analysis of Data

Data collected to research question one was analyzed using the descriptive statistics and multiple linear regression. The regression analysis was performed at the .05 level of significance using all variables and forcing none. F statistics was used to determine whether the results occurred by chance. t-statistics was used to identify the variables that were useful in predicting the academic performance of the students in relations math SAT scores and high school GPA.

Data collected related to the research question two was analyzed using the descriptive statistics (means and standard deviations). Correlation analyses was used to assess the relationship between the scores on academic performance and self-efficacy as well as between scores on academic performance and vocational interests. Regression analyses was used to arrive at the model that would predict the academic performance of the students enrolled in the Computer Science and Engineering Technology programs.

Data collected for the third research question was analyzed using multiple linear regression. All variables, math SAT scores, high school GPA, vocational interests, and self-efficacy scores were used to predict the academic performance of the students.

Summary of the Findings

The present study was designed to investigate the applicability of Bandura's self-efficacy theory in the prediction of academic performance. Eighty-five male and 40 female from a small southern university participated in the study by properly completing the Science and Engineering Questionnaire [5] . The following paragraphs will summarize the results of the study:

To address research question one, which investigated the relationship of academic performance to the combined effect of math SAT scores and high school GPA, regression analysis was

conducted to assess the contribution of the independent variables. The results of the analysis of variance indicates that 23.2% of the total variability in the dependent variable CGPA is explained by the independent variables. The F statistics shows that at alpha level of .05, the regression model is useful in predicting the academic performance of the students in computer science and engineering technology program. The beta value of .113 for high school GPA indicates the HSGPA is not a good predictor of the academic performance. For the prediction equation of academic performance MAT-SAT score was a positive predictor with a beta value of .413. Due to the insignificant effect of high school GPA, the model was run again using the stepwise regression analysis and the high school GPA was excluded in the analysis and the beta value changed from .413 to .47, which indicates a high correlation of MAT-SAT score in the prediction of academic performance.

Research question two investigated the relationship of the academic performance (college GPA) and students self-efficacy (scores) and vocational interests (scores) as measured by the Science and Engineering Questionnaire. Descriptive statistics for this research question showed that the self-efficacy score was 60% and the score on vocational interest was 56%. Both self-efficacy and vocational interest were highly correlated with the academic performance but the self-efficacy measure was $r = .73$ as compared to the vocational measure $r = .681$, so the self-efficacy was a stronger predictor of the academic performance. The results of the multiple regression analysis showed that the squared regression coefficient ($R^2 = .587$) represented 58.7% of the total variability in the dependent variable CGPA or the academic performance as explained by the independent variables. The analysis of variance was found to be statistically significant at the .05 alpha level, so the result of the F statistics concluded that all the variables in the regression model were strongly correlated in predicting the academic performance of the students. Parameter estimates of the ERS and VI along with the t statistics showed that both the variables were statistically significant in the analysis. The beta value for the self-efficacy measure was almost 50% whereas the beta value of vocational was 32%, hence the self-efficacy measure was a stronger predictor of the academic performance.

Research question three aimed at finding a relationship between the academic performance and students' math SAT scores, high school GPA, self-efficacy (scores), and vocational interests (scores) based on gender.

To evaluate the results of this research question, first the multiple regression analysis was applied to all the participants and then the regression analysis was applied to the female and male groups. On the math SAT scores, no significant differences were found between the male students ($M = 466$) and female students ($M = 451$). The average math SAT score for the all participant in the regression model ($M = 462$) was not significantly different as compared to the male and the female group.

The squared multiple regression coefficient for the model for all the participants was .668, which indicated that 66.8% of the total variability in the dependent variable is explained by the independent variables. In comparison the R^2 value of .619 for the male students was lower than the R^2 value of .837 for the female students. The F statistics for both the male and female students indicated that all the variables in the regression model were strongly correlated to the

academic performance. The t statistics showed that the HSGPA was not significant for the male students. The results of the t statistics for the female students indicated that the HSGPA, math SAT and vocational interest were not the contributing variables in predicting the academic performance of the students. The beta value of .293 for self-efficacy and the .294 for the vocational interest were the highest predictor of the academic performance, whereas to for the female students, the beta value of .64 for academic milestone and the .36 for the self-efficacy were the highest contributor in predicting the academic performance. The results clearly indicated that the female students possess much more higher level of self-efficacy than their male counterparts. Stepwise regression analysis was implemented to exclude the variables that were not contributing in the prediction of academic performance. The results of the stepwise regression changed the value of the coefficient for both male and female students, resulting in a regression equation which provided more accurate prediction of the academic performance of the students enrolled in the computer science and engineering technology programs.

Recommendations

This section will discuss the use of results obtained from the study and the recommendation for the future research.

Use of Results

The results of the study can be used to assess the strength of career related self-efficacy beliefs of students enrolled in Computer Science, Engineering Technology and its allied programs. Furthermore, the results of the study can also be used to assess the extent to which career-related self-efficacy beliefs, math SAT scores, high school GPA, academic milestones and vocational interests can predict the academic performance (college GPA) of students enrolled in Computer Science and Engineering Technology programs. In the final analysis the results of this study can also be used as counseling tool which can allow improvement of advisor effectiveness and career counseling of the students.

Recommendation for Future Research

This investigative findings leads to several direction for the future research. The following recommendations are suggested for future research:

1. This study was used to predict the academic performance of the students in engineering and computer science technology. However, no course was conducted to introduce to the students different areas in engineering, it is recommended that in future a pre-test and post-test study should be conducted to analyses the effects of the experimental study.
2. Further research can involve comparison investigations of academic progress and career behavior of African American students in different socioeconomic levels.
3. Future research can also focus on different kinds of institutions, small universities versus large, predominantly white, versus predominantly African Americans.
4. Comparative study with other programs such business, education and humanities can also be conducted to devise a better tool for effective counseling in the global sense which can result in a productive workforce.

5. Future research should also include questionnaires, investigating the counselor awareness of different areas in engineering, business and education programs.

Summary

This study explored the relation of the self-efficacy beliefs to the academic performance and furthermore assessed the extent to which efficacy beliefs, in concert with other relevant variables such as vocational interest, academic milestones, math SAT scores and high school GPA, predict the academic performance of the students enrolled in computer science and engineering technology programs.

Participants were 125 students enrolled in computer science and engineering technology programs at a southern university. Multiple regression analysis indicated that self-efficacy contributed significant unique variance in prediction of the academic performance.

The study provided a regression model that can assist the counselors to guide students in achieving good academic grades. The guidance can lead to increasing the self-efficacy of the students through training.

Bibliography

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