

The Effect of High School ACT Scores on First-Year GPA of First-Generation Engineering Undergraduates

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Introduction

First-generation (FG) college students are generally defined as those undergraduates whose parents' highest level of education is a high school diploma or less, or whose parents have never enrolled in postsecondary education [1]. In the recent Executive Order on Diversity, Equity, Inclusion, and Accessibility in the Federal Workforce issued by the U.S. White House on June 25, 2021, FG college students are included as one of the "underserved communities" [2]. This extended abstract (2 pages maximum plus one page of references) focuses directly on FG college students and addresses two topics of the ASEE Northeast 2022 Conference: Diversity, Equity, and Inclusion pipeline for engineering as well as the success of diverse, underrepresented populations in engineering.

The recent 2017 statistical report from the U.S. Department of Education states that a significant percentage (24%) of college students are first-generation students, and many of them are from low-income families with racial and ethnic minority backgrounds as well [3]. Existing research has shown that compared to their college peers, FG students are generally less prepared for entering college and have lower retention and graduation rates [1, 3, 4]. However, not much research has been conducted to study how high school American College Testing (ACT) scores affect the college Grade Point Average (GPA) of first-generation engineering undergraduates. ACT is a standardized test employed for college admissions in the U.S. ACT scores usually include ACT English score, ACT math score, ACT reading score, and ACT science score. Conducting research on how high school ACT scores affect college GPA is important due to pressing demands to increase engineering retention and graduation [5-7].

Research question, data collection, and data analysis

The research question of the present study is: Among ACT English, math, reading, and science scores, what particular ACT score is a statistically significant predictor of college GPA of first-generation engineering undergraduates? To answer this research question, quantitative research involving descriptive and inferential statistical analysis was conducted in the present study.

The present study involved a total of 168 first-year FG engineering undergraduates at a public land-grant research university in the U.S., including 53 FG students in Academic Year I, 57 FG students in Academic Year II, and 58 FG students in Academic Year III. The following data were collected from each student participant: first-year college GPA, ACT English score, ACT math score, ACT reading score, and ACT science score.

Multiple linear regression was performed using first-year college GPA as the dependent variable and ACT scores as independent variables. In multiple linear regression, data collected from Academic Year I, Academic Year II, Academic Year III, and from all three academic years as a whole, were analyzed, respectively. Particular attention was paid to standardized coefficients (Beta) generated from multiple linear regression. Standardized coefficients (Beta) indicate the

strength of the effect of independent variables (ACT scores) to the dependent variable (college GPA).

Research findings

Table 1 shows the results of descriptive statistical analysis. Table 2 shows the results of multiple linear regression using 168 datasets collected from students in three academic years.

Table 1. Descriptive statistical analysis (n = 168)

Category	First-year college GPA	ACT English	ACT math	ACT reading	ACT science
Mean	2.797	21.90	23.83	23.39	24.18
Std. deviation	0.943	4.545	4.293	4.814	4.133

Table 2. The results of multiple linear regression (168 datasets)

Category	Standardized coefficients		Standardized coefficients Beta	Coefficients	
	B	Std. error		t	Sig.
Constant	1.258	0.442		2.846	0.005
ACT English	0.036	0.024	0.174	1.496	0.137
ACT math	0.068	0.025	0.310	2.750	0.007
ACT reading	0.016	0.021	0.081	0.742	0.459
ACT science	-0.051	0.030	-0.225	-1.688	0.093

From Table 2, it can be seen that based on the datasets collected from students in all three academic years as a whole, “in general,” ACT math score is a statistically significant predictor of college GPA (Beta = 0.310, $p = 0.007 < 0.05$); ACT English, reading, and science scores are not statistically significant predictors of college GPA ($P > 0.05$). *One standard deviation of increase in ACT math score would cause 0.31 standard deviations of increase in college GPA.*

It should be pointed out that the above-described “general” conclusions do not always hold in every academic year because students are different from one year to another. The research findings generated from this research emphasize the importance of math in the success of first-generation engineering students.

Take-home conclusions

The present study has involved 168 first-year first-generation (FG) engineering undergraduates at a public land-grant research university in the U.S. The results show that among high school ACT English, math, reading, and science scores, ACT math score is a statistically significant predictor of college GPA of FG engineering undergraduates. To improve the retention of FG engineering students in college, efforts should be made to improve their math skills while they are in the K-12 (kindergarten through 12th grade) stage.

References

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