

## Quantitative II Final Project

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Educational Policy Studies: Social Foundations

**Problem Title:** Effect of enrollment timing on student achievement

**Area of Problem:** Secondary Education – Student achievement

**Type of statistical analysis:** Two-way ANOVA

**Source of data:** I am using data I collected for the purposes of the final assignment. Although the data is real, it is a hand-selected subset and not a random sampling.

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### Problem:

This project was undertaken to determine if there is a significant difference in student achievement based on a student's matriculation into the independent school where I am employed. Specifically, I am interested in the effects of the overall academic program on student achievement as measured by the ACT Exam based on when students first enter the school. The primary research question is whether students who start in a particular division of the school (Lower School, Middle School or Upper School) perform significantly different from students who start at another division. Additionally, I would also like to see if there is any difference in student achievement on the ACT Exam based on whether the students at the school participate in a formal test prep course or self-prepare. Finally, I am interested in discovering whether there is a significant interaction effect between preparation method and division first enrolled.

### Data:

	Lower School	Middle School	Upper School
Test Prep	35, 33, 36, 32, 35, 34, 30, 28, 29, 33	30, 35, 31, 34, 28, 27, 35, 31, 33, 29	26, 27, 28, 34, 33, 27, 29, 30, 26, 24
Self Prep	31, 29, 27, 29, 33, 27, 29, 30, 32, 30	29, 30, 31, 25, 30, 30, 27, 29, 26, 29	24, 28, 22, 22, 26, 24, 25, 27, 26, 30

## Introduction

This project was undertaken to determine if there is a significant difference in student achievement based on a student's matriculation into the independent school where I am employed. There are three natural entry points into the School and a number of new students matriculate at each level. I am interested in learning if there is a difference in student achievement based on when students enter. The School is known to produce high achieving students, but there is still a range of student ability based on the ACT Exam. The School also offers a summer course for ACT preparation that is optional to students. I am interested to see if students who participate in the ACT course perform significantly different from students who do not take the course. To explore my research question, I selected 60 students to include in my study.

## Methods

Recent school graduates were identified who first enrolled at the school during various grade levels. The graduates were categorized based on School Division first enrolled in, Lower School (Kindergarten – 4<sup>th</sup>), Middle School (5<sup>th</sup> – 8<sup>th</sup>), and Upper School (9<sup>th</sup> – 12<sup>th</sup>). Graduates were further divided by participation in a formal ACT test prep course or by self-preparation for the ACT. A sample of ten student ACT scores from each of the 6 categories was analyzed using a Factorial ANOVA.

## Results

An alpha level of .05 was used for all statistical tests and  $\eta_p^2$  was calculated as the effect size. Scores on the ACT Exam of the graduates whom started in each School Division served as the dependent measure for the Prep type (2) x Division (3) analysis of variance are presented in Table 1. Leven's test for Equality of Variances found the variance of the populations samples are equal ( $p = .513$ ).

**Table 1**  
Cell Sizes, Means and Standard Deviations of ACT Scores

Prep	Treatment	Mean	Std. Deviation	N
Test Prep	Lower School	32.50	2.72	10
	Middle School	31.30	2.87	10
	Upper School	28.40	3.17	10
	Total	30.73	3.32	30
Self-Prep	Lower School	29.70	1.95	10
	Middle School	28.60	1.96	10
	Upper School	25.40	2.55	10
	Total	27.90	2.80	30
Total	Lower School	31.10	2.71	20
	Middle School	29.95	2.76	20
	Upper School	26.90	3.19	20
	Total	29.32	3.36	60

**Table 2**

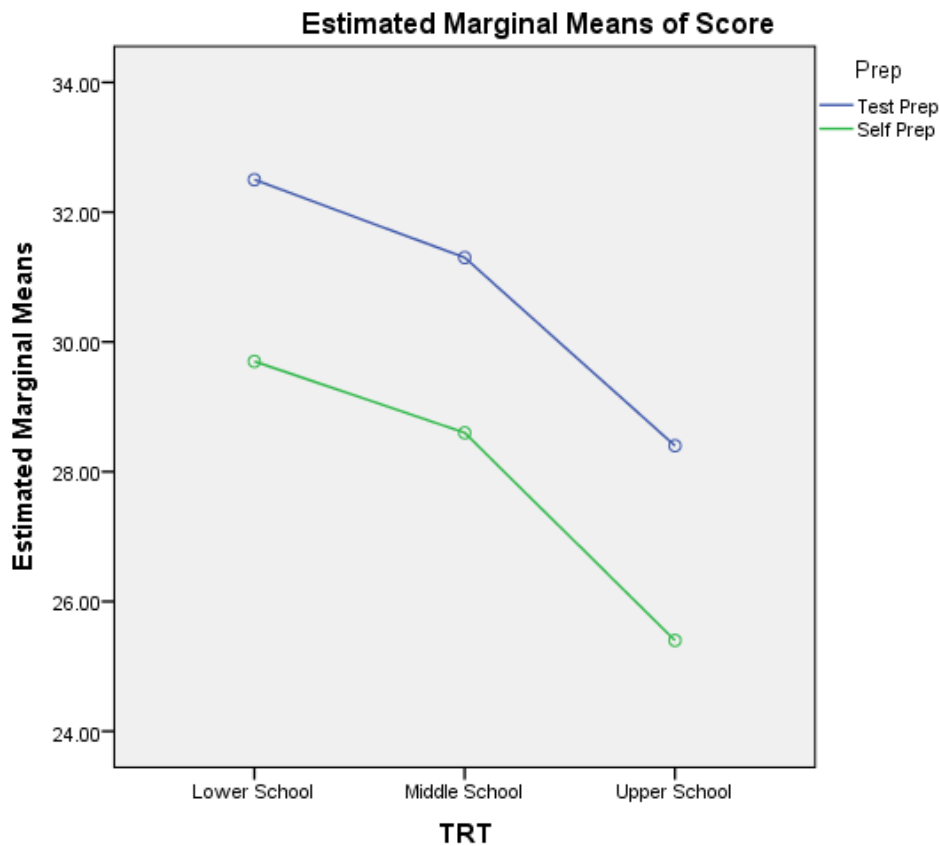
Factorial Analysis of Variance in ACT Scores

Source	df	SS	Mean Square	F
Prep	1	120.417	120.417	18.168*
Division	2	188.433	94.217	14.215*
Prep * Division	2	.233	.117	.018
Error	54	357.900	6.628	
Total	60	52235.000		

\* $p < .001$ .

As shown in Table 2, a significant main effect was found for the Prep Method  $F(1,54) = 18.168, p < .001, \eta_p^2 = .252$  and for Division  $F(2,54) = 14.215, p < .001, \eta_p^2 = .345$ . The Prep Method X Division interaction was not found statistically significant  $F(2,54) = 0.18, p = .983, \eta_p^2 = .001$ .

As Figure 1 shows, students who started in every Division that participated in a formal ACT test prep course performed significantly better than those students who self-prepared for the ACT Exam.



**Figure 1.** Estimated marginal means of ACT scores by Division Started and Prep Method.

As shown in Table 3, Posthoc analyses using Tukey's HSD ( $\alpha = .05$ ) indicate there is significant difference between Lower School and Upper School ( $p < .001$ ), and Middle School and Upper School ( $p = .001$ ), but did not differ significantly between Lower School and Middle School ( $p = .342$ ).

**Table 3**  
Tukey Post Hoc Comparison of ACT Score by Division

Division	Division	Mean Difference	Std. Error	Sig.
Lower School	Middle School	1.15	.81411	.342
	Upper School	4.20*	.81411	.000
Middle School	Lower School	-1.15	.81411	.342
	Upper School	3.05*	.81411	.001
Upper School	Lower School	-4.20*	.81411	.000
	Middle School	-3.05*	.81411	.001

### Discussion

This study revealed a main effect for Division started by the graduates and a main effect for Test Prep method. No interaction effect was observed. Graduates who enrolled at the School in Lower School or Middle School performed significantly better on the ACT than their counterparts who first enrolled in Upper School. Additionally, students who participated in a formal test prep course performed significantly better than their counterparts who self-prepared for the ACT Exam. Additional research around what types of schools (public, private, parochial) students are coming from before enrolling might be revealing. Additionally, further research into the curricular aspects that contribute to increased achievement are necessary.