Key Drivers for Successful Graduation Rates & ACT Scores

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I. Introduction

In this study, we performed a quantitative correlational research analysis to determine the key drivers for graduation and ACT Scores at a school district. Historical datatables were provided to the researchers for analysis.

Key Findings

Over the course of the research analysis, we discovered the following key findings:

ACT Scores	Graduation
• Students who graduated, on average, scored higher ACT Scores. • Students enrolled in AP Courses, on average, scored higher ACT scores than in their non-AP counterparts, with students in AP History and AP Science showing the greatest difference in scores of +2.13 and +2.64, respectively. • Students in AP Science (25.74) and AP History (25.29), on average, scored the highest ACT scores among the AP courses, respectively. • Students taking the ACT Test in December scored closer to the Average Overall Score than students taking the test in June, with a difference in the range of scores being 5, with the range narrowing from 19 in June to 14 in December, as the test date grew closer to December. • African American Students, on average, scored the highest ACT Scores (23.52), 0.04 higher than the next ethnicity.	• The graduation rate of students is more likely to increase as household income increases. • Students in AP Courses were more likely to graduate than those in non-AP courses, with students who had enrolled in AP Science having the highest graduation rate of 89.8% and students in AP English having the second highest of 89.6%, which is above the overall graduation rate of 85.3%. • Students enrolled in AP courses attained, on average, a higher GPA than those in non-AP courses • Student graduates in AP Courses attained, on average, a higher GPA and scored, on average, a higher ACT Score than those in non-AP Courses. Furthermore, students in AP Science saw the highest difference in average scores, with graduate students, on average, scoring +2.47 higher than those graduates in non-AP courses.

From the historical data we were provided, we determined that students who had enrolled in AP Courses had higher graduation rates, higher GPAs, and higher ACT Scores than those who had enrolled in non-AP courses, with students in AP Science showing the highest graduation rate of 89.8% and highest average ACT Scores of 25.74.

II. Data and Methodology

Research Method

The research analysis conducted was a quantitative correlational research study. This is a non-experimental research method that studies the relationship between an independent variable and a dependent variable. As we were using historical data that had already been collected, this gave us the opportunity to strictly focus on the relationship between different variables.

The purpose of this study was to identify and understand the key drivers of two separate variables, Graduation and ACT Scores. Data tables provided to the researcher were uploaded to Google Cloud Platform, where the data could be cleaned, transformed, and analyzed using Google BigQuery. The researcher used Structured Query Language (SQL), a database language used to manage and manipulate data, to transform the data for statistical analysis. This data was then copied to a Google Sheets spreadsheet for analysis and visualization.

We used the data from the spreadsheets for statistical analysis, to discover underlying patterns and trends between variables. We created tables consisting of descriptive statistics, including mean and range, and graphs for regression analysis.

Data Instruments and Methods

We were provided three historical data sheets from the entity to perform our research study. These data tables were labeled as Demographics, Courses, and ACT scores.

Demographics Data Table (Table 2.1)

Variable	Translation
Student_ID	Student Identification Number
Gender	Student Gender M = Male F = Female
Ethnicity	Student Ethnicity
Special_Ed	Student Special Education Status Y = Yes N = No
Age	Student Age
Household_Income	Student's Household Income
Grade_Level	Student's Grade Level
Performance_Index	School-calculated variable representative of student performance
Graduated	Whether or no the student graduated 1 = Yes 0 = No

The Demographics data table (Table 2.1) consisted of data containing student identifier, gender, ethnicity, special education status, age, household income, grade level, performance index, and whether or not the student graduated. The Performance Index column was incomplete and a description of how the column was calculated was not present, so this column was omitted from the analysis.

Course Data Table (Table 2.2)

Variable	Translation
Student_ID	Student Identification Number
Course	Course Classification

AP_Class	Whether or not the course was an Advanced Placement (AP) course Y = Yes N = No
Letter_Grade	Student Course grade as a letter (ex. A, B, C, D, F)

The Courses data table (Table 2.2) consisted of data containing student identifier, course, whether or not the course was an Advanced Placement course, and letter grade. Grade Point Average (GPA) was calculated using the following grade translations: A=4, B=3, C=2, D=1, and F=0.

ACT Score Data Table (Table 2.3)

Variable	Translation
Student_ID	Student Identification Number
Course	Course Classification
Gender	Student Gender M = Male F = Female
Ethnicity	Student Ethnicity
Age	Student Age
Test_Date	Student ACT Test Date
Test_Score	Student ACT Test Score

The ACT Scores data table (Table 2.3) consisted of data containing student identifier, gender, ethnicity, age, test date, and test score. Some students had taken the ACT test multiple times and had multiple scores. For the purposes of this study, we used average test scores instead

of the student's most recent score, as we found the average of the scores the most relevant in our comparisons of the scores to the number of graduates & non-graduates, GPA by course, and average score by testing date.

We used Google BigQuery to upload, clean, and manipulate our data for analysis. Google BigQuery is a data warehouse that uses Structured Query Language (SQL) to communicate with the stored data.

The data collected from our SQL queries was copied onto spreadsheets on Google Sheets. Google Sheets is a spreadsheet program that allows us to organize data and create data visualizations.

III. Results

Results Overview

The quantitative correlational research analysis was conducted to determine the key drivers for graduation and ACT Scores at a school district. Historical datatables were provided to the researchers for analysis. From this data, we were able to retrieve the following results:

ACT Scores	Graduation
• Students who graduated, on average, scored higher ACT Scores. • Students enrolled in AP Courses, on average, scored higher ACT scores than in their non-AP counterparts, with students in AP History and AP Science showing the greatest difference in scores of +2.13 and +2.64, respectively. • Students in AP Science (25.74) and AP History (25.29), on average, scored the highest ACT scores among the AP courses, respectively. • Students taking the ACT Test in December scored closer to the Average Overall Score than students taking the test in June, with a difference in the range of scores being 5, with the range narrowing from 19 in June to 14 in December, as the test date grew closer to December. • African American Students, on average, scored the highest ACT Scores (23.52), 0.04 higher than the next ethnicity.	• The graduation rate of students is more likely to increase as household income increases. • Students in AP Courses were more likely to graduate than those in non-AP courses, with students who had enrolled in AP Science having the highest graduation rate of 89.8% and students in AP English having the second highest of 89.6%, which is above the overall graduation rate of 85.3%. • Students enrolled in AP courses attained, on average, a higher GPA than those in non-AP courses • Student graduates in AP Courses attained, on average, a higher GPA and scored, on average, a higher ACT Score than those in non-AP Courses. Furthermore, students in AP Science saw the highest difference in average scores, with graduate students, on average, scoring +2.47 higher than those graduates in non-AP courses.

From the historical data we were provided, we determined that students who had enrolled in AP Courses had higher graduation rates, higher GPAs, and higher ACT Scores than those who

had enrolled in non-AP courses, with students in AP Science showing the highest graduation rate of 89.8% and average ACT Scores of 25.74.

Analysis of ACT Scores

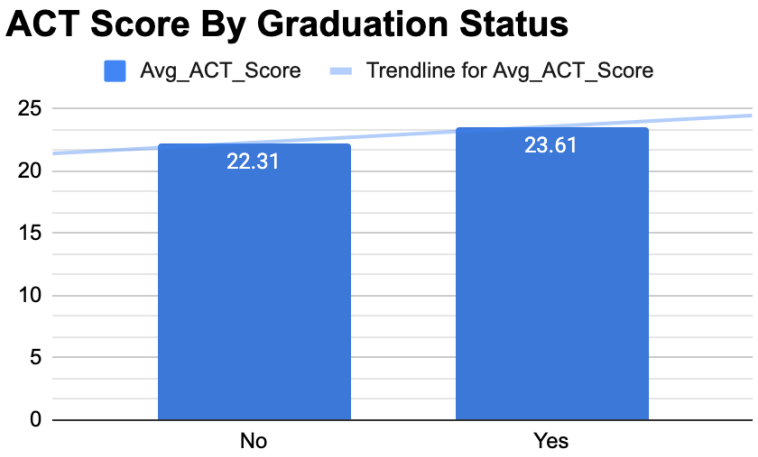
We began our analysis of ACT Scores by comparing the average scores of graduates and non-graduates to determine if graduation status affected average ACT scores. We wrote a query into our SQL database and retrieved the data in Table 3.1.

Table 3.1

Graduated	Num_of_Students	Avg_ACT_Score
No	147	22.31
Yes	853	23.61

From this data, we were able to determine that on average graduates scored +1.3 points higher than non-graduates. We created a column chart in our spreadsheet to visualize the data in Table 3.1, which is shown in Graph 3.1.

Graph 3.1



Using Graph 3.1, we are able to visually confirm that students who have graduated, on average, scored higher ACT scores than students who did not graduate. Using the visualization in Graph 3.1 and the data listed in Table 3.1, we are able to confirm that students who have graduated, on average, scored higher ACT scores than students who did not graduate.

We looked at the relationship between ACT Scores and courses. We wrote a SQL query to our database and retrieved the following data on Table 3.2.

Table 3.2

Course	AP_Class	Avg_GPA	Total_Students	Num_of_Graduates	Num_Not_Graduated	Graduation_Rate	Avg_ACT_Score
English	Non-AP	2.34	862	731	131	84.8%	23.18
English	AP Course	2.84	134	120	14	89.6%	25.02
History	Non-AP	2.39	864	732	132	84.7%	23.16
History	AP Course	2.9	124	111	13	89.5%	25.29
Math	Non-AP	2.39	867	738	129	85.1%	23.23
Math	AP Course	2.82	119	106	13	89.1%	24.92
Science	Non-AP	2.4	856	726	130	84.8%	23.1
Science	AP Course	2.74	128	115	13	89.8%	25.74

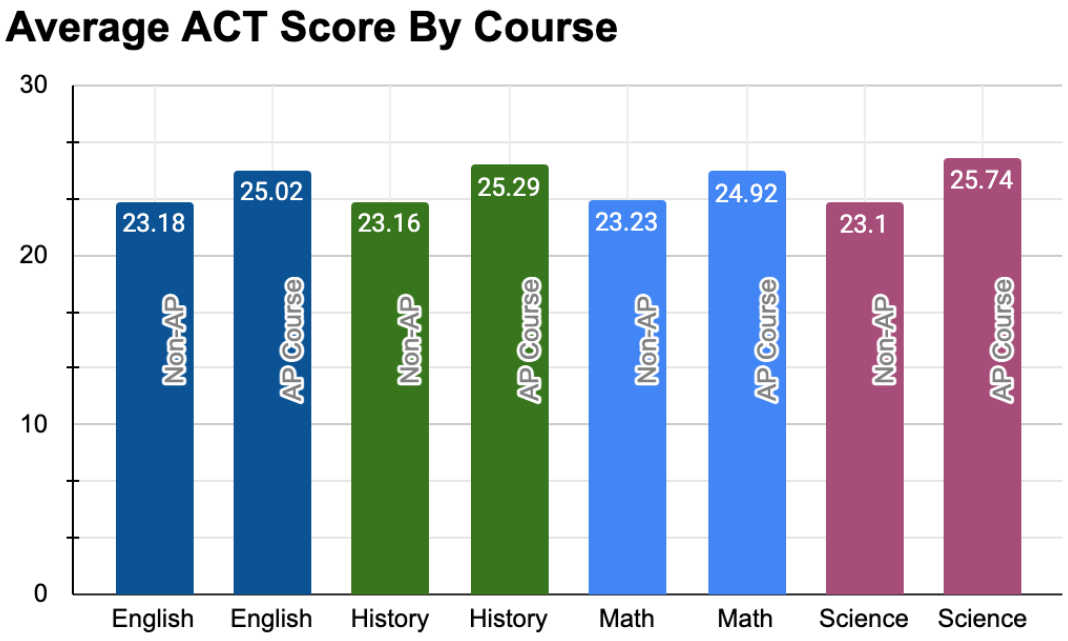
We calculated the difference between average ACT scores for students in AP courses and their non-AP counterparts and noted the differences in Table 3.2.1.

Table 3.2.1

Course	AP_Class	Avg_ACT_Score	Difference
English	Non-AP	23.18	
English	AP Course	25.02	1.84
History	Non-AP	23.16	
History	AP Course	25.29	2.13
Math	Non-AP	23.23	
Math	AP Course	24.92	1.69
Science	Non-AP	23.1	
Science	AP Course	25.74	2.64

We took the Course and Avg_ACT_Score columns, labeled the Courses with identifiers from the AP_Class column, and created a column chart, shown in Graph 3.2 to provide a visual representation of the variables Courses and Average ACT Scores.

Graph 3.2



From the data visualization in Graph 3.2 and the data in , we can see that students in AP Courses scored, on average, higher ACT scores than those in non-AP courses.

From the calculations in Table 3.2.1 and Graph 3.2, we were able to determine that students enrolled in AP Courses, on average, scored higher ACT scores than in their non-AP counterparts, with students in AP History and AP Science showing the greatest difference in scores. Furthermore, Students in AP Science and AP History, on average, scored the highest ACT scores among the AP courses, respectively.

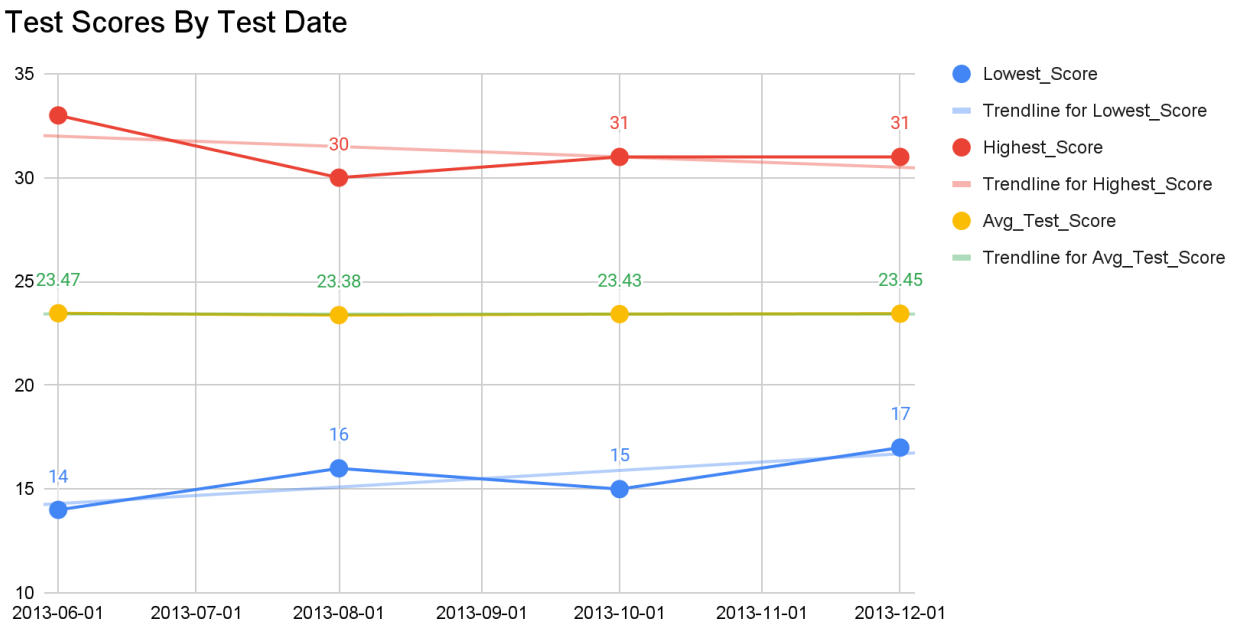
We looked at the average test scores by test date. We wrote a query to retrieve the number of students, the lowest test score, the highest test score, the range of test scores, and the average of the test scores from our SQL database, grouped the data by test date, ordered it chronologically, and copied the data into Table 3.3.

Table 3.3

Test_Date	Num_Students_Tested	Lowest_Score	Highest_Score	Range_of_Scores	Avg_Test_Score
2013-06-01	325	14	33	19	23.47
2013-08-01	335	16	30	14	23.38
2013-10-01	332	15	31	16	23.43
2013-12-01	314	17	31	14	23.45

We took the average test scores and test date, and placed the two variables on a line graph, shown on Graph 3.3.

Graph 3.3

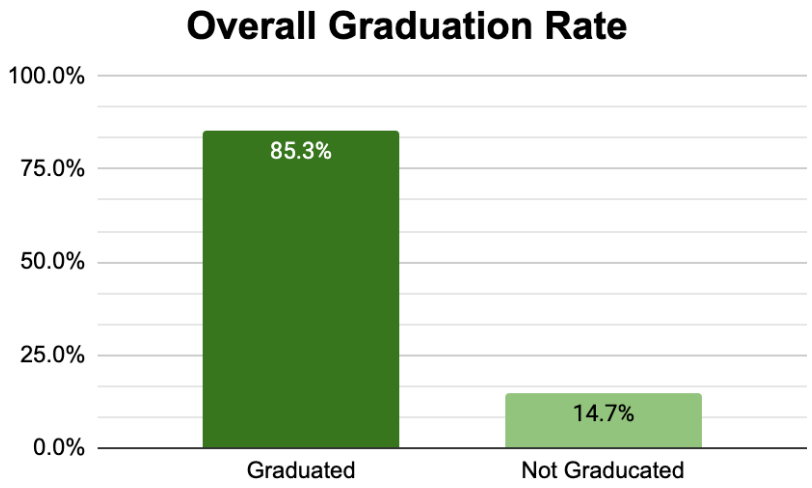


Using the data on Table 3.0 and Graph 3.0, we found that the average test score for all four testing dates remained between 23 and 24, but the range of the test scores narrowed down over the course of the four testing dates. On 2013-06-01, the scores ranged from 14 to 33, for a difference of 19, while on 2013-12-01, the scores ranged from 17 to 31, for a difference of 14.

We also determined that lowest scores trended upward from 2013-06-01 to 2013-12-01. From this information, we are able to determine that students taking the ACT Test in December scored closer to the Average Overall Score than students taking the test in June, with a difference in the range of scores being 5, with the range narrowing as the test date grew closer to December.

Analysis of Graduation Rate

Graph 3.4



We first looked into the number of graduates for the school district. Out of 1000, 853 students graduated, for a graduation rate of 85.3%. We visualized this data onto Graph 3.4 to give us a visualization of the difference.

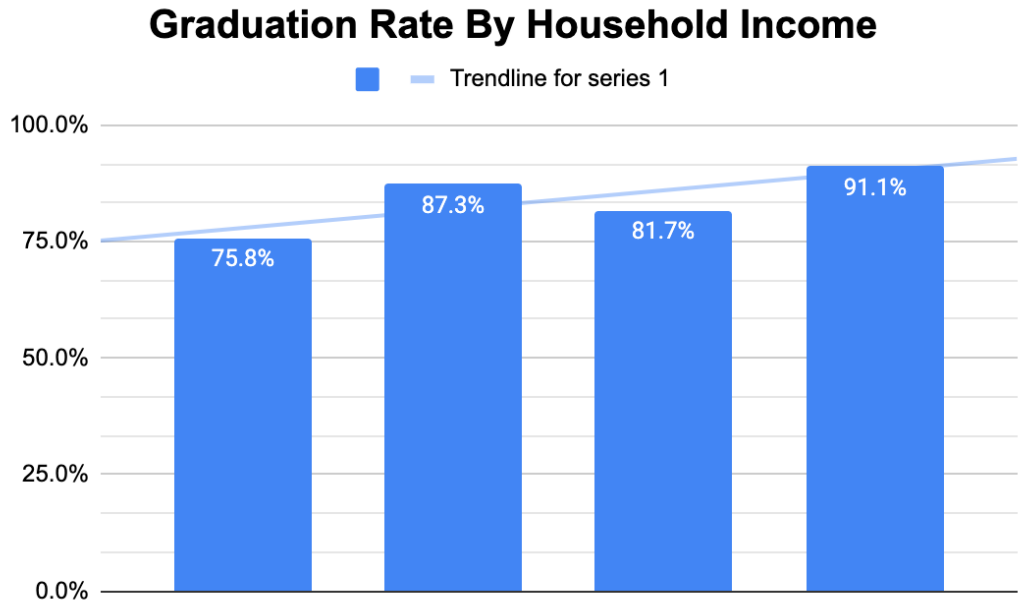
We first looked at the Graduation Rate by Household Income. We wrote a SQL query, separating household income by intervals of $30,000 and grouping by graduation status. We copied the data onto our spreadsheet, totaled the students in each income range, and calculated the percentage of graduates in each income range. This data is presented on Table 3.4.

Table 3.4

		Household Income			
Graduated	**Num_Students**	**$0 to $30000**	**$30001 to $60000**	**$60001 to $90000**	**Greater Than $90000**
Yes	853	47	550	215	41
No	147	15	80	48	4
Total	1000	62	630	263	45
% of Total	85.30%	4.70%	55.00%	21.50%	4.10%
% Graduated		75.8%	87.3%	81.7%	91.1%

We took the data in Table 3.4 and created a column chart, Graph 3.5, representing the percentage of graduates in each income range.

Graph 3.5



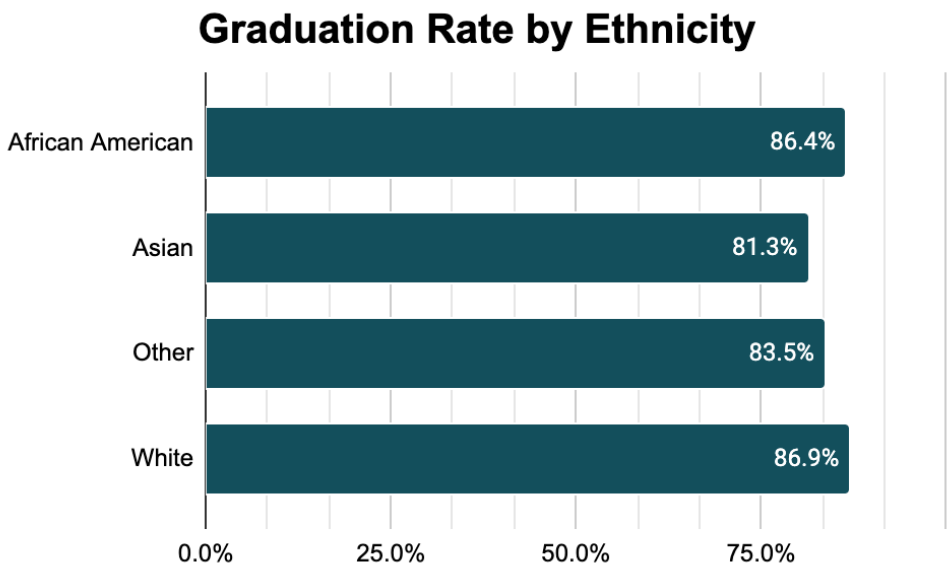
From the information on Graph 3.5 and Table 3.4, we are able to determine that the graduation rate of students is more likely to increase as household income increases.

We examined the relationship between graduation rate and ethnicity. A SQL query was written to retrieve data regarding graduation status, number of students, graduation rate, and average ACT Score, grouped by ethnicity. This data was compiled onto Table 3.5, with graduation rate and ethnicity visualized on Graph 3.6.

Table 3.5

Ethnicity	Graduated	Not_Graduated	Num_of_Students	% Graduated	Avg_ACT_Score
African American	247	39	286	86.4%	23.52
Asian	156	36	192	81.3%	23.32
Other	86	17	103	83.5%	23.19
White	364	55	419	86.9%	23.48

Graph 3.6

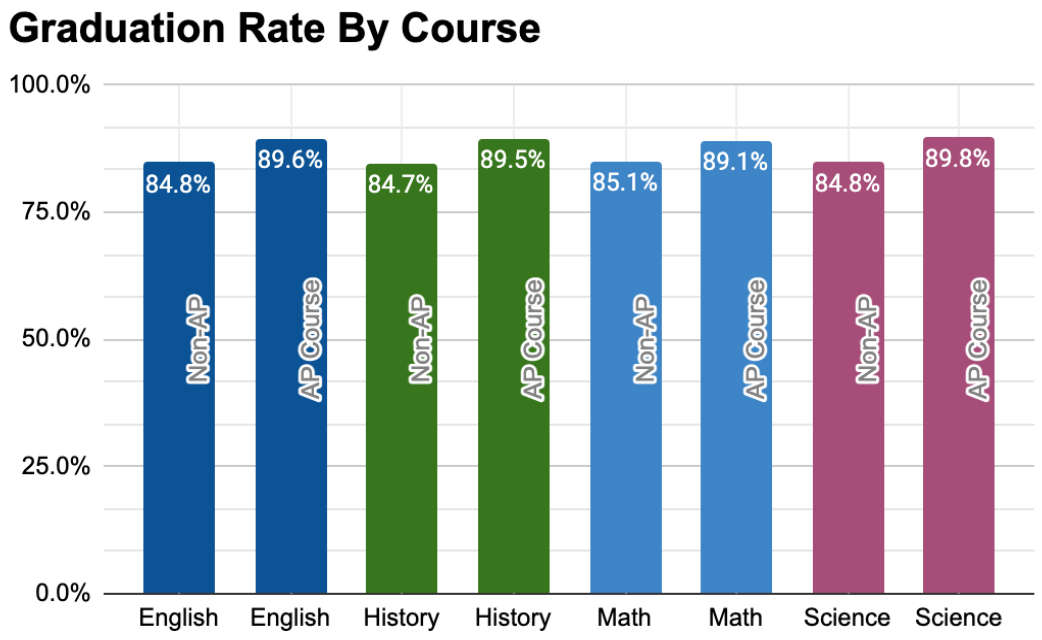


Based on the data from Table 3.5 and Graph 3.6, we were able to determine that students who identified as White had the highest graduation rate of 86.9%, followed by African American

(86.4%), Other (83.5%), and Asian (81.3%). We also noted that African American students scored, on average, the highest ACT Scores.

We then examined the relationship between graduation rate and courses taken. This data was included on Table 3.2 and visualized on Graph 3.7.

Graph 3.7



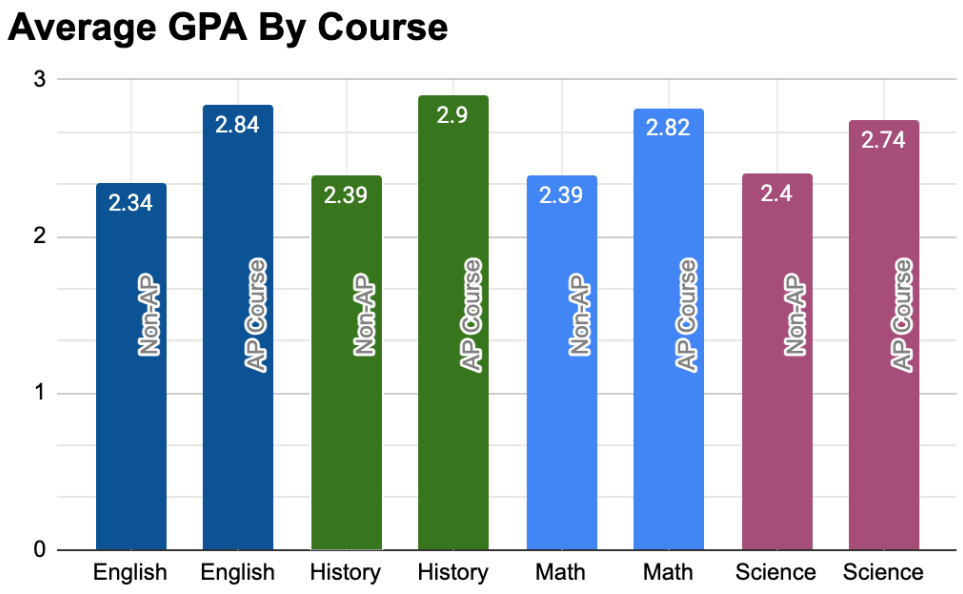
From the data gathered on Table 3.2 and visualized on Graph 3.7, we are able to determine that students in AP Courses were more likely to graduate than those in non-AP courses, with students who had enrolled in AP Science having the highest graduation rate of 89.8% and students in AP English having the second highest of 89.6%, which is above the overall graduation rate of 85.3%, shown on Graph 3.4.

We looked further into AP courses by examining the relationship between AP Courses and average grade point average (GPA) by course. We used the data included on Table 3.2 to create Table 3.6 and Graph 3.8.

Table 3.6

Course	AP_Class	Avg_GPA	GPA Difference
English	Non-AP	2.34	
English	AP Course	2.84	0.5
History	Non-AP	2.39	
History	AP Course	2.9	0.51
Math	Non-AP	2.39	
Math	AP Course	2.82	0.43
Science	Non-AP	2.4	
Science	AP Course	2.74	0.34

Graph 3.8



Upon examining Table 3.6 and Graph 3.8, we were able to determine that students enrolled in AP courses attained, on average, a higher GPA than those in non-AP courses.

We then compared the average GPA and average ACT Scores of graduates in AP courses and graduates in non-AP Courses, shown in Tables 3.7 and 3.8.

Table 3.7

Graduates in AP Courses					**Graduates in Non-AP Courses**			
Course	**AP_Class**	**Avg_GPA**	**Avg_ACT_Score**		**Course**	**AP_Class**	**Avg_GPA**	**Avg_ACT_Score**
English	TRUE	2.86	25.21		English	FALSE	2.3	23.34
History	TRUE	2.94	25.3		History	FALSE	2.48	23.33
Math	TRUE	2.75	25.05		Math	FALSE	2.43	23.39
Science	TRUE	2.71	25.74		Science	FALSE	2.44	23.27

Table 3.8

Difference between AP and Non-AP Graduates		
Course	**Avg_GPA Difference**	**Avg_ACT_Score**
English	0.56	1.87
History	0.46	1.97
Math	0.32	1.66
Science	0.27	2.47

Based on the data from Table 3.7 and Table 3.8, we are able to determine that student graduates in AP Courses attained, on average, a higher GPA and scored, on average, a higher ACT Score than those in non-AP Courses. Furthermore, students in AP Science saw the highest

difference in average scores, with graduate students, on average, scoring +2.47 higher than those graduates in non-AP courses.

Conclusion

Looking back at the quantitative correlational research analysis, we were able to determine the key drivers for graduation and ACT Scores at a school district. From the historical data we were provided, we determined that students who had enrolled in AP Courses had higher graduation rates, higher GPAs, and higher ACT Scores than those who had enrolled in non-AP courses, with students in AP Science showing the highest graduation rate of 89.8% and average ACT Scores of 25.74.