Did the Apple Fall Far from the Tree?
A Comparison of Parental Education Levels, Income, and Student Standardized Testing Success
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Geography and Geoinformation Science

RESEARCH QUESTION & CONTEXT

Are SAT test scores from students attending Fairfax County Public Schools correlated with surrounding adult educational attainment and/or median household income?

There is a massive disparity in the quality of education in Northern Virginia. In understanding these gaps, we plan to investigate and consider factors that may be affecting student performance such as parental involvement, family financial background of students, and school funding/budgeting. There have been a plethora of student performance studies around the globe, but Fairfax County Public Schools has not yet been subject to one.

This project aims to analyze the connections leading to successful student performance as of the 2018-2019 school year (the last full school year before the pandemic), though it is assumed that educational quality conditions have grown worse for high school students in recent years due to the COVID-19 pandemic based upon instruction changes. It is known that failing to provide young students with the proper resources to facilitate a successful learning environment impacts not only their future, but the future of their societies as well. Through analysis, what factors are most significant in determining high school student testing outcomes in Fairfax County public schools?
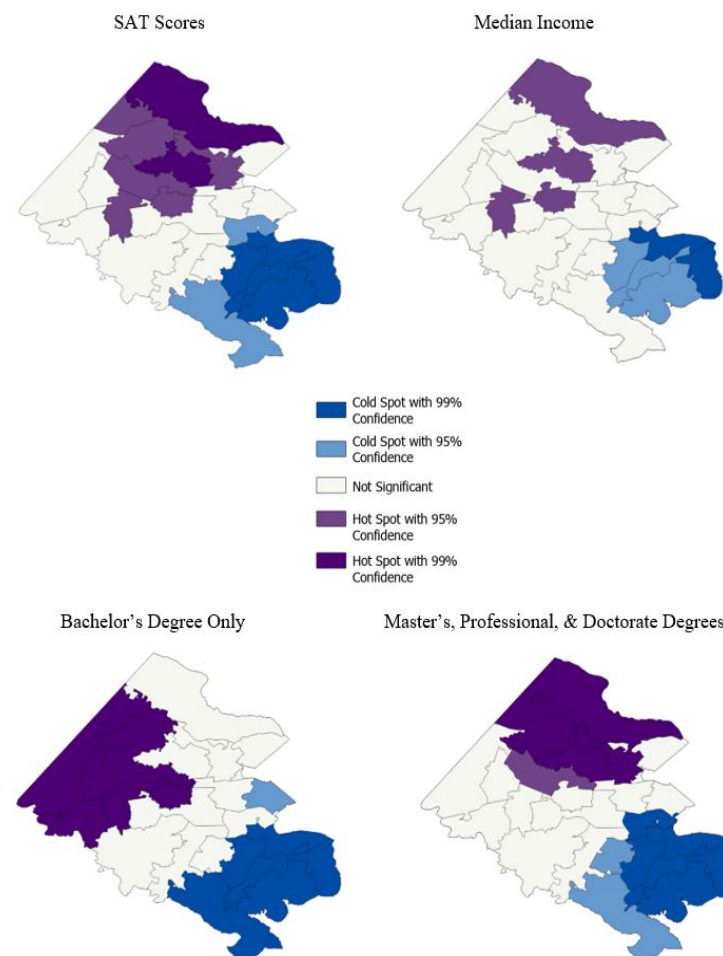
DATA & METHODS

Data for SAT scores was obtained from the Fairfax County Public Schools website, data for parental educational attainment was obtained from NCES, and data for median household income was obtained from the Census Bureau with all data representing the timeframe of 2018-2019.

The first step in our analysis was to standardize our data. For analysis purposes, the parental education attainment data was split into two categories: bachelor's degree only (meaning only a bachelor's degree was obtained and not higher) and master's degree and above. Then matching the data to each high school attendance area was performed. The SAT score data was already divided up by high school. Parental educational attainment and median household income, however, were listed by zip code. In order to match up this data with the high schools, we made a list of every high school and the zip codes that were within or partially within said high school's attendance area. The values for each high school were then averaged, giving us one final value for both parental educational achievement and median household income as a handful of zip codes were spread across more than one high school attendance area.

Once we had the zip code data formatted to high school attendance areas, the data was joined to the high school attendance area shapefile where a Local Getis-Ord G test was performed. K nearest neighbors of eight was used as the grouping algorithm. After this, we performed an Ordinary Least Squares Multivariate Regression test. SAT Scores were used as the dependent variable, while median household income and the two parental educational achievement levels were used as the independent variables. In addition, a group clustering test was performed, but the results did not add anything substantial to our findings.

HOT SPOT ANALYSIS BY HIGH SCHOOL ATTENDANCE AREA: FAIRFAX COUNTY, VIRGINIA 2018-2019

SAT Scores | Median Income

Cold Spot with 99% Confidence
Cold Spot with 95% Confidence
Not Significant
Hot Spot with 95% Confidence
Hot Spot with 99% Confidence

Bachelor's Degree Only | Master's, Professional, & Doctorate Degrees

RESULTS

The SAT score analysis shows a cluster of hot spots in the northern attendance areas of the county while the cold spots are clustered in the southeast area. The Bachelor's Degree analysis clustered the most areas for both hot and cold – the north and west for hot spots, and the southeast for cold spots. Though the regions are similar to the SAT score hot spots, there is a distinctive shift towards the western areas of the county. This suggests a relationship, but not a strong one, with the dependent variable. The Master's Degree/Professional Degree/Doctorate Degree hot spot analysis indicates a stronger relationship with the dependent variable. The regions and attendance areas designated as hot and cold spots are nearly the same. The median income analysis hot spots and cold spots are all within the hot and cold spot clusters of the SAT scores. This suggests the strongest relationship of all of the independent variables with the dependent variable of SAT scores.

The relationship between each of the three variables of parental attainment of a bachelor's degree percentage, parental educational attainment of master's/ doctorate/ professional school degree percentage, and median household income compared with SAT scores within given high school attendance areas were determined using Pearson's correlation coefficient; all of which yielded positive correlations. In terms of multivariate linear regression analysis, 73% of the variance for SAT scores could be explained by the three independent variables. The significance of each independent variable was determined by p-values falling within at least a 95% confidence interval. The independent variable of parental attainment of a bachelor's degree percentage yielded a non-significant p-value in predicting SAT scores when accounting for the two other independent variables. The independent variable of parental educational attainment of master's/ doctorate/ professional school degree percentage yielded a significant p-value in predicting SAT scores. However, the largest predictor by far of SAT scores was accounted for by the independent variable of median household income.

MULTIVARIATE LINEAR REGRESSION

Dependent Variable	Regression Constant	Independent Variable	Beta Coefficient	Adjusted R Squared	F Statistic
SAT Scores	Constant		7.614e+02 (1.33e-08***)	0.73	21.73 (1.67e-06***)
		Parental Attainment of Bachelor's Degree Only	1.973 (0.51462)		
		Parental Attainment of Master's/ Doctorate/Professional Degree	4.833 (0.03039*)		
		Median Household Income	1.660e-03 (0.00821**)		

p-values are indicated by parentheses () and significance of p-values is denoted by *

DISCUSSION & CONCLUSION

The results of both analyses indicate that there is a strong correlation between SAT scores, parental educational attainment, median household income, and geographical location in Fairfax County. While we cannot confirm causation between the variables, our contextual research provides potential explanations for the correlation. Previous research has shown that there are links between income levels and children's well being (Altintas and Prickett, 2016). This includes a range of factors that can influence school performance, and even the quality of the public school itself (Walker and Smrekar, n.d.). We are able to see this at play with the clustering of low-income, low SAT scores in the southeastern part of Fairfax County, as well as the clustering of high-income, high SAT scores in the northwestern part of Fairfax County.

Mapping the link between socioeconomic and educational privileges and student achievement will help bring attention to both the causes behind low achievement and the areas that need particular help (Begić et. al, 2019). In the end, our goal is to highlight areas where students are in need of assistance, and potentially break children out of the cycle of poverty by creating a more equitable and equal ground for education.

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