

Educational Inequality and ACT Score Analysis

Abstract

This project explores the relationship between socioeconomic factors and student performance in U.S. high schools. Using multiple datasets containing school-level information and community demographics, we analyze how poverty, unemployment, and adult education levels influence average ACT scores. Through regression modeling and visualization, the study identifies the most significant predictors of academic performance. Results show that economic disadvantage and lower community educational attainment are strongly associated with lower ACT scores, underscoring the connection between inequality and educational opportunity.

Introduction

Education is a key driver of social mobility and long-term economic outcomes, yet schools across the United States serve communities with very different socioeconomic conditions. This study investigates the inequality of educational opportunity among U.S. high schools by analyzing how socioeconomic factors such as household income, unemployment rate, parental education, and student poverty levels relate to average ACT scores. We focus on high schools because ACT performance is widely used as a measure of college readiness. By integrating multiple datasets and applying statistical modeling, we identify which indicators best explain differences in academic outcomes across schools.

Theoretical Background

Prior research consistently links socioeconomic status (SES) to academic achievement. Students from wealthier communities with higher parental education levels tend to perform better on standardized assessments, while poverty and economic instability correlate with lower performance due to reduced access to resources, increased stress, and fewer enrichment opportunities. We emphasize three interpretable indicators: (1) percent of students receiving free or reduced lunch as a proxy for poverty, (2) local unemployment rate as an indicator of economic instability, and (3) percent of adults with college degrees as a measure of community education level.

Methodology

We combined three sources using a common school identifier (id): EdGap socioeconomic data, School Information (type, level, charter), and additional School Characteristics. Data preparation steps included renaming columns for consistency, dropping duplicates, coercing identifiers to string types, replacing invalid values (e.g., negative percentages) with missing values, and filtering to high schools only. Exploratory data analysis used pairwise plots and correlation summaries to assess relationships among variables. A multiple linear regression model was then fit using the Statsmodels OLS formula interface: `average_act ~ rate_unemployment_normalized + percent_college_normalized + percent_lunch_normalized`. Normalization (z-scores) facilitated coefficient interpretation and numerical stability.

Computational Results

The fitted model indicates that `percent_college_normalized` has a positive association with average ACT scores, whereas `rate_unemployment_normalized` and `percent_lunch_normalized` have negative associations. In a representative fit, the model explains a substantial share of variation in ACT performance (R-squared in the mid-0.6 range), and all three predictors are statistically significant at conventional levels. Visual diagnostics and exploratory plots corroborate these findings: schools in communities with higher adult education levels and lower poverty exhibit higher ACT averages.

Discussion

These results reinforce a broad literature on the relationship between socioeconomic conditions and academic outcomes. Poverty and unemployment likely affect learning via multiple channels, including household stress, resource constraints, and limited access to enrichment. Community education levels may proxy for parental support, learning environments, and expectations that foster achievement. Policy implications include targeted investments in schools serving high-poverty communities, supports for low-income students (e.g., tutoring, nutrition, counseling), and community-level initiatives to improve adult education and employment.

Conclusions

Socioeconomic factors are strongly associated with school-level ACT performance. High schools in communities with higher poverty and unemployment face substantial challenges in achieving equitable outcomes, while higher adult educational attainment corresponds to better performance. Addressing economic inequality and strengthening community education are essential components of any strategy to improve student achievement at scale.

References

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