Predicting ACT from Socioeconomic and School Level Factors

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Abstract

This report investigates whether average ACT scores can be predicted using school level factors such as student–teacher ratio, charter status, and lunch program participation. Using data from EdGap (2016), the NCES Common Core of Data (CCD), and an additional school dataset, records were merged by NCES ID, cleaned, and analyzed. Results suggest that smaller class sizes and reduced lunch program participation correlate with higher ACT performance.

Introduction

Understanding the role of school level factors is essential for improving educational outcomes. Factors such as student–teacher ratio, charter status, and the proportion of students receiving free or reduced lunch serve as indicators of school resources and student needs. This project explores how these characteristics relate to ACT performance across U.S. schools.

Theoretical Background

Education research emphasizes the influence of resource allocation and governance on academic performance. Smaller student–teacher ratios can enhance individual attention, while charter status may reflect alternative management and curriculum structures. Lunch program participation rates serve as a proxy for economic need. Together, these school level factors offer insight into structural and resource-based influences on student achievement.

Methodology

Data were obtained from three sources: EdGap (average ACT and SES data), NCES CCD (school profiles), and an uploaded school dataset containing student–teacher ratios and lunch program data. Columns were standardized to lowercase, snake_case format, numeric variables were converted using 'pd.to_numeric', duplicates and invalid entries removed, and datasets merged on the 'ncessch' school identifier. Outliers and missing values were addressed through filtering and imputation. Derived variables such as percent_low_income and student_teacher_ratio were created for modeling. Two regression models were fitted: a baseline model using socioeconomic indicators and an extended model including school level factors. Model fit was compared using adjusted R^2, AIC/BIC, and mean absolute error metrics.

Computational Results

Exploratory analysis revealed moderate correlations between ACT and school level factors. Scatterplots indicated a negative relationship between ACT and student–teacher ratio and between ACT and the

percentage of students on free/reduced lunch. Charter schools displayed slightly higher ACT medians in boxplots, though variance was wide. The regression analysis confirmed that smaller student–teacher ratios and lower lunch participation predict higher ACT scores, controlling for other variables.

Discussion

Findings indicate that resource-based school characteristics are meaningful predictors of academic performance. Schools with smaller classes generally achieve better ACT outcomes, suggesting benefits from increased teacher interaction. High lunch program participation reflects concentrated disadvantage that can hinder achievement. Charter status effects were mixed, implying that governance structure alone does not guarantee improved results. These outcomes highlight the importance of both resource equity and instructional quality.

Conclusions

School level factors—particularly class size and economic composition—exert significant influence on academic performance. Targeted investments in teaching staff and support for low-income students may help narrow achievement gaps. Future work should incorporate multi-year data and additional measures such as funding levels, teacher experience, and curriculum quality to deepen understanding of these relationships.

References

1. EdGap.org (2016). ACT and Socioeconomic Data. 2. NCES Common Core of Data (2016–17). 3. Hanushek, E. (2016). School resources and educational outcomes. 4. Coleman, J. (1966). Equality of Educational Opportunity Study.