

Computer Science course enrollment and student achievement across subject areas by demographic groups

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ABSTRACT

This study examines how high school Computer Science (CS) enrollment relates to academic performance using data from the U.S. Department of Education and the Virginia Department of Education. School-level CS enrollment rates were merged with Standards of Learning (SOL) pass rates to test whether CS participation corresponds with higher achievement in STEM and non-STEM subjects. Correlation and regression analyses by gender and race show that greater CS enrollment leads to better outcomes. Results emphasize the need for equitable access to CS education across all demographic groups.

INTRODUCTION / LITERATURE REVIEW

Computer Science (CS) participation remains uneven across gender and race. Prior research shows CS builds problem-solving and computational thinking skills that boost performance in other subjects. This study tests whether Virginia high schools with higher CS enrollment achieve better SOL results across STEM and non-STEM areas.

METHODOLOGY / PROCESS

Publicly available data from the Civil Rights Data Collection (CRDC) and the Virginia Department of Education (VDOE) were merged for Virginia high schools. Python was used to clean and align school names, calculate CS enrollment rates, and combine these with SOL pass rates for STEM and non-STEM subjects. Data were stored and profiled in AWS S3 and Glue DataBrew. Correlation and regression analyses assessed relationships by gender and race to identify demographic patterns in academic achievement.

RESEARCH QUESTIONS

- Does access and participation in high school CS classes improve student outcomes inside and outside of STEM?
- Do schools with higher CS enrollment rates also have higher overall SOL pass rates?
- Do schools with higher CS enrollment rates have higher non-STEM SOL pass rates?
- Does the relationship between CS enrollment and SOL outcomes differ by gender or race?

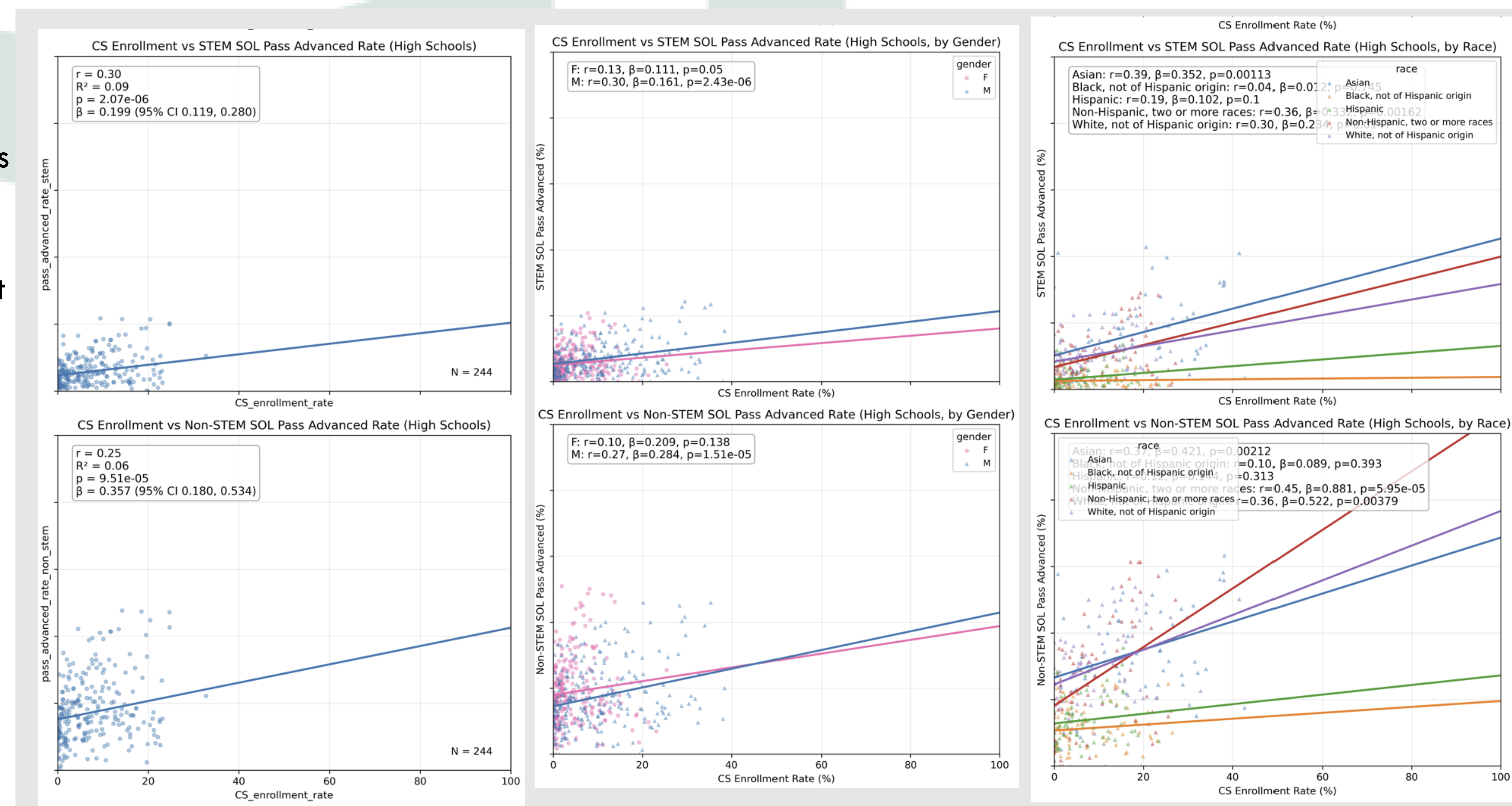


Figure 1 Computer Science enrollment rates vs. SOL Pass Advanced rates

RESULTS

Schools with higher Computer Science (CS) enrollment showed higher SOL pass and advanced-pass rates across both STEM and non-STEM subjects. Gender patterns were similar, though girls showed less variation in non-STEM subjects. Overall, greater CS participation was linked to improved academic outcomes and appeared to benefit most demographic groups.

DISCUSSION/CONCLUSIONS

Higher Computer Science (CS) enrollment is linked to stronger academic performance across subjects, suggesting that CS education supports learning both within and beyond STEM. Benefits were consistent across genders and races. These results indicate that broad access to CS courses can promote academic success for all learners and highlight the importance of equity and inclusion in expanding CS opportunities.

REFERENCES:

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Average Computer Science Enrollment Rates by Gender
Virginia Public High Schools, 2021–2022



Fig. 1. Average Computer Science (CS) enrollment rates by gender in Virginia public high schools (2021–2022). Male students enroll in CS courses at more than twice the rate of female students



Figure 3 Link to project repository on GitHub