ABSTRACT
APPLIED DATA SCIENCE INSIGHTS INTO GRADE EIGHT MATH, PHYSICS, AND AP® PHYSICS EXAM-TAKING INFLUENCING ACT STEM OUTCOMES

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This study examines the longitudinal relationships among eighth-grade mathematics proficiency, high school physics availability, AP® Physics exam participation, and ACT STEM scores across Wisconsin public-school districts. A retrospective, multi-cohort design was used, and two cohorts were tracked from middle school through junior year. Publicly available datasets were analyzed using an applied data science approach in R, incorporating exploratory visualization, univariate and bivariate analyses, and multivariate regression modeling.

Results indicate a positive association between eighth-grade mathematics proficiency and ACT STEM outcomes. AP® Physics exam participation emerged as a statistically significant independent predictor of ACT STEM scores after controlling for eighth grade mathematics proficiency, while general high school physics availability showed weaker and less consistent effects. These patterns were stable across both cohorts, suggesting longitudinal robustness.

This study contributes to physics and mathematics education research by presenting a statewide, multi-cohort analysis that integrates the variables into a single analytic framework. Findings highlight the importance of strengthening middle school mathematics foundations and expanding equitable access to AP® Physics pathways to improve ACT STEM performance thereby improving STEM readiness for college.