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Increasing Applied STEM Curricular Opportunities in High School and Impacts on Early Post-Secondary Outcomes: The Effect of Project Lead the Way

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Preparing students for STEM careers is essential to sustaining the nation's economic growth and competitiveness. STEM fields already make up nearly a quarter of the U.S. workforce, about 37 million workers, and that share is projected to grow twice as fast as non-STEM jobs over the next decade. Yet industries like engineering and health sciences are facing serious worker shortages. Strengthening the STEM pipeline has become a shared challenge for schools, policymakers, and employers alike: *how can we spark students' interest and prepare more students for STEM careers?*

A new study takes on that question by examining the impact of one of the country's most widely adopted applied-STEM programs: Project Lead the Way (PLTW). This pre-K–12 program brings hands-on, project-based learning to life through courses in engineering, computer science, and biomedical science, reaching millions of students across all 50 states.

As states and districts pour resources into STEM education, this research offers some of the clearest national evidence yet on what happens when high schools expand access to applied STEM coursework. The findings reveal how increasing opportunities for real-world, career-connected STEM learning can shape students' postsecondary choices—and who benefits most when schools invest in programs like PLTW.

ABOUT PROJECT LEAD THE WAY (PLTW)

PLTW is a nonprofit organization that partners with schools to offer hands-on, project-based curricula in STEM and career-connected learning.

- PLTW provides three main pathways for high school students: Engineering, Biomedical Science, and Computer Science

- The program emphasizes real-world problem solving, encouraging students to design, build, test, and reflect through multi-step projects that mirror industry and research processes.
- Participating schools must have certified PLTW teachers who complete intensive professional development and ongoing training through the organization's network.
- Courses align with state and national standards and can be integrated into existing science, math, or career and technical education (CTE) frameworks.

STUDY AND METHODS

Using data from public high schools in Missouri, this study employs a school-level difference-in-differences design to estimate the impact of expanding PLTW course options on program participation, college enrollment, and STEM majoring. The authors combined administrative data from high schools offering PLTW with longitudinal postsecondary records from the National Student Clearinghouse, tracking outcomes for students in more than 500 schools.

- Treatment schools: 225 schools in which PLTW course availability increased.
- Control schools: 276 schools that did not offer PLTW at all during the study period.

The authors compared changes in outcomes (like college enrollment and STEM majoring) within the same schools before and after they expanded PLTW course offerings to changes over the same period in similar schools that did not expand PLTW. This design controls for unobserved time-invariant differences between schools and for statewide trends over time, and isolates the effect of PLTW expansion itself. This shows how outcomes changed specifically because a school increased access to PLTW, rather than because of broader changes in education or student populations.

In addition to the difference-in-differences analysis, the authors use an instrumental variables (IV) model to estimate the causal impact of actually participating in PLTW on students' postsecondary outcomes. Because students who choose to take PLTW courses may already differ from those who do not (for example, in motivation or prior achievement), simply comparing participants and nonparticipants could produce biased estimates. To address this, the researchers use school-level PLTW expansion as an instrument for individual participation. This instrument predicts whether a student has access to and is likely to enroll in PLTW, but it is assumed not to directly affect postsecondary outcomes *except through that participation*.

KEY FINDINGS

What is the impact of increasing PLTW course availability?

*The following results measure the average impact of offering or expanding PLTW at the school level, so they include all students in treatment schools, whether or not they actually took a PLTW course.

1 **When schools make more sections of PLTW courses available, more students choose to take them.**

- When a school added one additional PLTW course section for every 100 students enrolled, the share of students who took a PLTW course increased by about 3 percentage points.
- Male students were more likely than female students to enroll in the Engineering track, while female students were more likely to enroll in Biomedical Science courses. This suggests that student interests, prior experiences, and perceptions of belonging in different STEM fields all shape who opts in.

2 Participation increases were mostly driven by students with stronger STEM preparation.

- For students who already had strong STEM preparation (those who performed well in math and science before high school), participation increased by about 5 percentage points. For students in the lowest quartile of prior achievement, participation increased by only 1–2 percentage points. This suggests that the students who were already confident or successful in STEM subjects were the ones most likely to take advantage of the new opportunities, and simply adding more courses may not be enough to draw in students who are less confident in STEM.

What is the impact of PLTW participation on college outcomes?

*The following results measure the effect on students who actually participated in PLTW.

3 When schools add more sections of PLTW courses, more students go on to enroll in college and choose STEM majors.

- Each additional PLTW section per 100 students led to increases in both college enrollment and STEM major declaration within five years by 0.3 percentage points.
- Male students showed a slightly larger immediate increase in college enrollment. In contrast, female students showed larger gains than males in declaring STEM majors by their fifth year of entering college.

4 PLTW participation increased college enrollment on average, and the impact was larger for males.

- On average, PLTW participants were about 12 percentage points more likely to enroll in college and 22 percentage points more likely to declare a STEM major within five years than non-participants.
- The impact of PLTW participation on college enrollment was larger for males (15.8 percentage points) than for females (9.4 percentage points and also not statistically significant.)

5 PLTW participation increased the likelihood of declaring a STEM major within five years on average, and the impact was larger for females.

- PLTW participation had a larger long-term effect for females. Five-year STEM declaration increased by 25 percentage points for females, compared to 20 percentage points for males. This suggests that while PLTW helps both groups engage with STEM, its most lasting influence may be in helping female students persist in STEM fields once they enter college, even if their initial enrollment effects are smaller.

6 **Students with strong STEM prior achievement benefit most from PLTW expansion, while lower-readiness students see smaller or no gains in postsecondary outcomes.**
   - For five-year STEM major declaration, among students in the top quartile, PLTW participation is associated with an increase of approximately 28 percentage points. For students in the lower quartiles, the study found either smaller magnitudes or non-statistically significant impacts.

IMPLICATIONS FOR POLICY AND PRACTICE

1 **Focus on course expansion, not just program adoption.** Encouraging new schools to adopt PLTW is only part of the solution (a previous study tested the effect of offering PLTW courses). Meaningful gains come when existing schools expand the number of available sections so more students can participate.

2 **Strengthen preparation and supports so more students can benefit.** Because PLTW's strongest effects appear among students with higher STEM readiness, earlier investments in math and science preparation are key. Bridging or introductory courses can help less-prepared students engage meaningfully with PLTW coursework and close equity gaps. Additional supports can help lower-readiness students fully benefit from PLTW courses.

3 **Pair expansion with targeted recruitment and advising to ensure equitable access across student groups.** Student interests, prior experiences, and perceptions of belonging in different STEM fields all shape who opts in. Without these intentional supports, program growth may widen rather than narrow existing participation gaps.

4 **Support smaller and rural schools through partnerships or shared resources.** Because PLTW expansion is concentrated in larger, well-resourced schools, regional collaborations, such as shared instructors, virtual delivery, or career center partnerships, can help extend access to students in rural or underfunded settings.

FULL WORKING PAPER

This report is based on the EdWorkingPaper "*Increasing Applied STEM Curricular Opportunities in High School and Impacts on Early Post-Secondary Outcomes: The Effect of Project Lead the Way,*" published in October 2025. The full research paper can be found here: https://edworkingpapers.com/ai25-1300

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