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POLICY BRIEF

STEM Endorsement Uptake and Completion in Texas High Schools, Graduating Classes of 2018-2023

Jordan Conwell, Jane Furey, Katy Doncer, Michael Dinh, Carly May, and Cameron Rua-Smith, The University of Texas at Austin
January 2026

What We Studied

In 2013, the Texas House passed House Bill 5 (HB5), introducing student "endorsements" for high schools across the state. Endorsements are intended to provide students with depth in a specific knowledge area or subject and to signal students' completion of a bundle of such coursework to colleges and employers. One endorsement offered is in STEM – Science, Technology, Engineering and Mathematics. Increased STEM skills can potentially result in Texas students having clear indicators of in-demand skills, more efficient education-to-career linkages, and higher incomes.[1][2]

In our study, we investigated access to the STEM endorsement across Texas. We find that students who complete Algebra I by 8th grade are more likely to complete the STEM endorsement, as are students who not free or reduced price eligible. Students who are Asian or White are more likely to complete the STEM endorsement than students who are Black, Hispanic, or multiracial. These differences matter because, as we also find, students who complete the STEM endorsement take more rigorous STEM curricula in high school across both math and science. We also map STEM endorsement completion across the state and discuss districts where completion is notably high or low. Our study's investigation of STEM experiences among Texas students identifies intervention points for educators and policymakers interested in reducing inequality in STEM education and strengthening Texas's labor force for today's knowledge economy.

House Bill 5 (HB5) changed high school graduation requirements in several ways. Notably, it gave Texas high school students the option to graduate with "endorsements" – course sequences that provide depth in a particular subject – in five different areas: Arts and Humanities, Business and Industry, Multi-Disciplinary Studies, Public Service, and Science, Technology, Engineering and Mathematics (STEM). In today's knowledge economy, STEM skills and credentials, including a high school STEM endorsement, can potentially result in Texas students having clear indicators of in-demand skills, more efficient education-to-career linkages, and higher incomes. Therefore, we investigate patterns of STEM endorsement pursuit and completion to better understand who has access to the STEM endorsement, the types of opportunities the STEM endorsement offers, and who may take advantage of them.

Specifically, we answer the following research questions:

- How many Texas students have attempted and completed the STEM endorsement?
- Are there differences in STEM endorsement uptake and completion by students' social and demographic characteristics, geographic distribution, and/or 8th grade achievement?
- How much does STEM course-taking vary among students who complete and do not complete the STEM endorsement?

[1] Black, Sandra E., Chandra Muller, Alexandra Spitz-Oener, Ziwei He, Koit Hung, and John Robert Warren. 2021. "The Importance of STEM: High School Knowledge, Skills and Occupations in an Era of Growing Inequality."
[2] Goodman, Joshua. 2019. "The Labor of Division: Returns to Compulsory High School Math Coursework." Journal of Labor Economics 37(4):1141–82.

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How We Analyzed the Data

We used data from the Texas Education Authority (TEA) to analyze STEM endorsement pursuit and completion, and differences among students who completed and did not complete the STEM endorsement. Our sample includes first-time 9th graders in the 2014-2015 through 2022-2023 school years (i.e., the graduating classes of 2018 through 2023). Our sample includes 2,418,137 students. We focus on three groups of students: (1) Completers, who completed the STEM endorsement by the end of high school, (2) Attempters, who at one point elected the STEM endorsement, but did not complete the requirements, and (3) Never-takers, who neither elected nor completed the STEM endorsement.

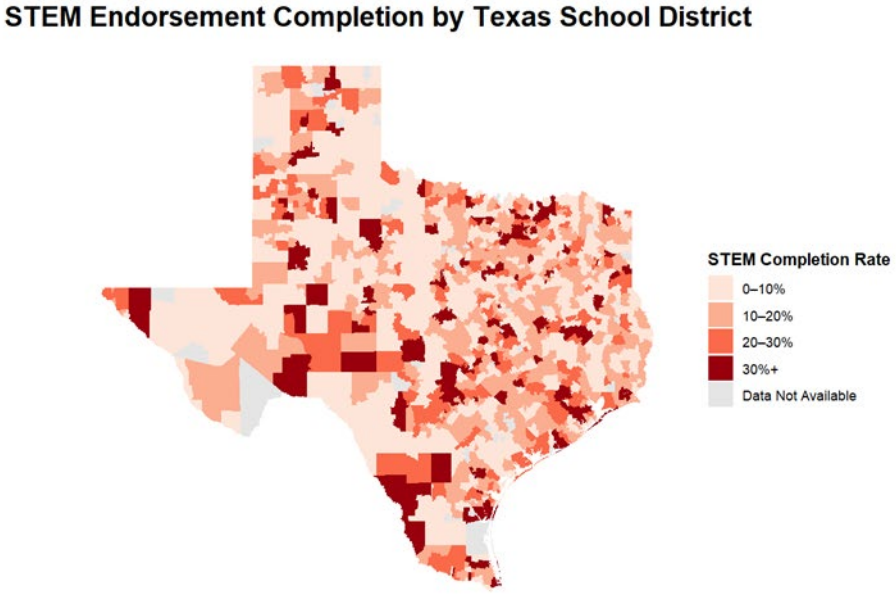
We analyze STEM endorsement election and completion across sociodemographic characteristics. We focus on students' gender, race and ethnicity, free or reduced-price lunch status, English language learner status, and gifted status in 9th grade. We also measure students' 8th grade achievement using percentiles of STAAR reading and math scores, as well as measuring whether a student passed Algebra I in 8th grade. Finally, we examine students' high school STEM experiences. We identify the highest math course students passed (Algebra II or lower, precalculus, or any AP math course); whether a student passed physics; and whether a student passed any AP science course.

What We Discovered

We find that, since the introduction of HB5, approximately one-third of 9th graders attempted the STEM endorsement in each cohort. However, only one-fifth of 9th graders completed the STEM endorsement by 12th grade. This means that only 70% of students who attempted the STEM endorsement completed it.

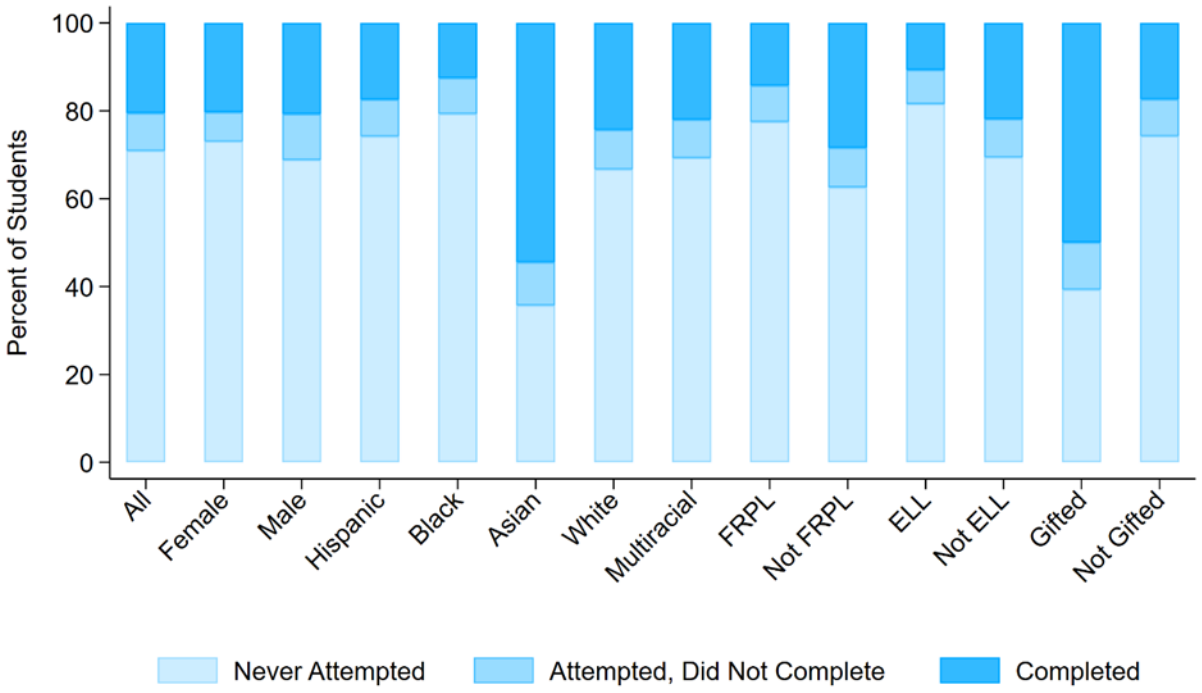
Who attempts and completes the STEM endorsement? First, we find that there is wide variation in STEM endorsement completion across the state of Texas. Unsurprisingly, districts around urban centers have relatively high rates of STEM endorsement completion. For example, 74% of students in the Carroll ISD near Dallas completed the STEM endorsement, as did 73% of students in the Friendswood district, outside of Houston. But there are districts in western and southern Texas with similarly high rates of STEM endorsement completion (Figure 1). For example, Laredo ISD and Sharyland ISD, both in south Texas, also have high STEM endorsement completion rates (~63%). There are districts with low STEM endorsement completion across the state as well. For example, less than 3% of students in Ector County ISD (Odessa) completed the STEM endorsement and only 9% of Northwest ISD students (Forth Worth) did so.

Figure 1. STEM endorsement completion rates by district, 2017-2018 school year. Data is not available for 160 districts. Data on these districts is either suppressed due to small district size or low STEM endorsement participation or cannot be mapped, such as when districts do not correspond to a specific geographic area.



We also find that students from more advantaged backgrounds are both more likely to attempt the STEM endorsement and more likely to complete it. For example, Figure 2 shows that 37% of students not eligible for free or reduced price lunch (FRPL) attempted the STEM endorsement, compared to 22% of FRPL eligible students. Of FRPL and non-FRPL students who attempted the STEM endorsement, 76% of non-FRPL eligible students completed the endorsement compared to only 63% of FRPL-eligible students.

Figure 2. Rates of STEM endorsement attempts and completions by student characteristics. Graduating classes of 2018-2023.



A larger share of Asian (64%) and White (33%) students than Black (21%) or Hispanic (25%) students attempted the STEM endorsement. Completion rates are also higher among Asian and White students than Black and Hispanic students: for example, 84% of Asian students who attempt the STEM endorsement complete it, compared to 61% of Black students. Fifty percent of students identified as gifted in 9th grade complete the STEM endorsement, compared to only 22% of students not identified as gifted. Half as many English Language Learners (ELL) complete a STEM endorsement (11%) compared to non-ELL students (22%).

Math course-taking prior to high school entry is strongly associated with students attempting and completing the STEM endorsement. As shown in Table 1, 57% of STEM endorsement completers completed Algebra I in 8th grade. Only 22% of STEM attempters and 13% of STEM never-takers did so. The gap in Algebra I course-taking in 8th grade between STEM and non-STEM students is larger than the gap in these students' standardized test scores. STEM endorsement completers, attempters, and never-takers had similar standardized reading scores in 8th grade. STEM completers' average STAAR math scores in 8th grade were approximately 10 percentiles higher than STEM attempters and never-takers.

Table 1. Academic achievement prior to high school and high school academic achievement and course-taking outcomes. Graduating classes of 2018-2023. TEA data.

	STEM Endorsement Completers	STEM Endorsement Attempters	STEM Endorsement Never-Takers
Academic Achievement Prior to High School			
STAAR Percentile, 8th Grade Reading	48.8	50.4	50.7
STAAR Percentile, 8th Grade Math	58.4	49.9	44.9
% Passed Algebra I by 8th Grade	57.7	32.2	13.8
STEM Course-taking in High School			
Highest Math Course Passed (%)			
Algebra II or Lower	22.6	57.7	73.3
Precalculus	35.3	33.5	23.2
AP Math Course or higher	42.0	8.8	3.5
% Passed Physics	90.2	65.7	63.2
% Passed any AP Science Course	41.6	14.6	6.6
N	**496,263**	**208,118**	**1,713,756**

Why do differential rates of STEM endorsement pursuit and completion matter? Descriptively, STEM completers tend to take more advanced STEM courses in high school. As shown in Table 1, 42% of STEM completers took an AP math course, compared to only 9% of attempters and 4% of never takers. In contrast, Algebra II is the highest math course for most attempters (58%) and never-takers (73%). Ninety percent of STEM completers pass Physics, compared to just over 60% of attempters and never-takers. STEM completers are also much more likely to have taken an AP science course. Our findings suggest that students who complete the STEM endorsement take more rigorous STEM curricula in high school across both math and science.

Policy Recommendations

Our analyses have several implications for education policy in Texas. First, students who complete the STEM endorsement complete more rigorous STEM courses in high school across both math and science. To the extent such coursework predicts better college and labor market outcomes [2], expanding participation in the STEM endorsement can improve students' postsecondary and labor market outcomes.

Although STEM endorsements are high school requirements, another recommendation involves middle schools. Improving students' access to Algebra I in 8th grade can reasonably be expected to increase STEM endorsement interest, pursuit, and completion. Differences in Algebra I completion by 8th grade between those who complete, attempt, and never attempt the STEM endorsement are large. Logistically, completing Algebra I by 8th grade also simply makes it easier for students to complete the STEM endorsement in high school. One way to complete the STEM endorsement is to complete two advanced math courses beyond Algebra II. Taking Algebra I in 8th grade can allow students to pass Algebra II by 10th grade, leaving two high school years to take additional advanced courses. Texas middle schools should ensure broad access to Algebra I, encourage students to take it, and emphasize to both students and parents that passing it before leaving middle school likely has positive implications for students' high school, college, and labor market pathways.

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