



RICE UNIVERSITY

# Kinder Institute for Urban Research

*Houston Education Research Consortium*

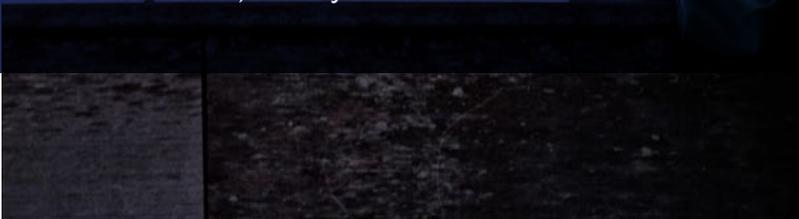
*Building Better Cities  
Building Better Lives*



Photo by Andre Hunter on Unsplash

## STEM Endorsement Completion and the Pathway to College

Brian Holzman\*, Bethany Lewis and Hao Ma



**Research Brief**

February 2024

\* Corresponding author: [bholzman@tamu.edu](mailto:bholzman@tamu.edu)

**Suggested citation.** Holzman, B., Lewis, B. & Ma, H. (2024). “STEM Endorsement Completion and the Pathway to College.” Houston, TX: Houston Education Research Consortium, Kinder Institute for Urban Research, Rice University.

**Note on the authors.** Brian Holzman, Ph.D., is an assistant professor at Texas A&M University. Bethany Lewis, M.A., is an analyst at Ithaka S+R.

**Funding acknowledgment.** This material is based upon work supported by the National Science Foundation under Grant No. 1842378.

**About HERC.** Focusing on the most pressing challenges facing the region, the Houston Education Research Consortium (HERC) is a research-practice partnership between the Kinder Institute for Urban Research and 11 Houston-area school districts. HERC research is developed directly alongside district leaders with findings shared with decision-makers — culminating in long-term, equity-minded solutions, opportunities and growth for Houston and beyond.

DOI: <https://doi.org/10.25611/JK8Q-XN28>

## Research Brief

# STEM Endorsement Completion and the Pathway to College

**This brief examines which students in the Houston Independent School District (HISD) are more likely to earn the STEM endorsement and whether STEM endorsement completion predicts college enrollment.** Analyses show that gender, STEM magnet program enrollment, and cumulative high school grade point average (GPA) predict STEM endorsement completion. While STEM endorsement completion is associated with college choice, the relationship appears to be explained by academic performance measures, particularly SAT scores and GPA. In fact, if STEM and non-STEM students had the same test scores and grades, college enrollment gaps at 2-year-or-less; 4-year, less-selective; and 4-year, more-selective institutions would reduce. Overall, the findings suggest that the STEM endorsement functions, by design or coincidence, as a funneling mechanism for high-performing students into more-selective colleges and universities.

## Key Findings

- **Students who completed the STEM endorsement were more likely to be male and academically high-performing** than students who did not complete the STEM endorsement.
- While the **STEM endorsement was positively associated with college choice**, the association was **largely explained by academic performance measures**, including SAT scores and cumulative high school GPA.



Photo by Good Free Photos on Unsplash

# Background

Passed by the Texas Legislature in 2013, House Bill 5 revamped PK-12 education by introducing the Foundation High School Program (FHSP). This new graduation framework aimed to facilitate college and career readiness by having students develop a content-area specialization aligned with their long-term goals, regardless of whether that involved attending college or a trade school or getting a job right after high school (Holzman & Lewis, 2020). High school freshmen in the 2014-2015 school year were the first cohort of students affected by this policy change.

The content-area specializations the FHSP introduced are called *academic endorsements* and are somewhat similar to college majors. Students can choose from five endorsement options: arts and humanities, business and industry, public services, STEM (science, technology, engineering, and mathematics), and multidisciplinary studies. Students can also select specific course sequences, or *paths*, to earn their endorsements.<sup>1</sup>

This study of HISD students focuses on the STEM endorsement. The STEM endorsement is unique given its strong focus on math and science. There are well-known gender, racial and ethnic, and socioeconomic inequalities in STEM education (Xie, Fang, & Shauman, 2015). If some students are more or less likely to earn the STEM endorsement, that may play a downstream role in college-going. A prior analysis shows that the STEM endorsement is the endorsement most closely aligned to the admissions requirements and recommendations of the state's most selective colleges and universities (Holzman & Lewis, 2020). More broadly, research has shown that when students take higher-level math and science courses, they are more likely to enroll in college and complete a degree (Douglas & Attewell,

2017; Rose & Betts, 2001; Trusty & Niles, 2003; Tyson et al., 2007). Given these findings, it is important to understand whether the STEM endorsement affects college outcomes for HISD students.

## Research Questions

Using HISD administrative data, as well as data from the National Student Clearinghouse, this study asked the following questions:

1. What student and school characteristics predict whether a student completes the STEM endorsement?
2. What is the relationship between completing the STEM endorsement and college choice (none; 2-year-or-less; 4-year, less-selective; 4-year, more-selective)?

To address these questions, this study focused on the first two cohorts of HISD students to be required to complete the FHSP: ninth graders in the 2014-2015 and 2015-2016 school years. The sample was further limited to students who attend an HISD middle school, resulting in an analytic dataset of 11,707 students. Full results and additional details on the data, sample, and analytic strategy are available from the authors upon request.

<sup>1</sup> For more information about the Foundation High School Program in HISD, see Holzman & Lewis (2020).

# Key Findings

**1** Students who completed the STEM endorsement were more likely to be male, be enrolled in STEM magnet programs, and have high cumulative high school GPAs than students who did not complete the STEM endorsement.

**F**emale students were less likely to complete the STEM endorsement than male students. Figure 1 shows that 27.6% of female students and 31.9% of male students completed the STEM endorsement.

Students enrolled in a STEM magnet high school program, including school-within-a-school programs (SWS) and whole-school programs, were more likely to complete the STEM endorsement than students not enrolled in a STEM magnet program. Figure 2 shows that only 20.7% of students who did not enroll in a STEM magnet program completed the STEM endorsement. In contrast, 36.4% of students enrolled in a SWS STEM magnet program and 57.9% of students enrolled in a whole-school STEM magnet program completed the STEM endorsement.

FIGURE 1

## STEM Endorsement Completion by Gender

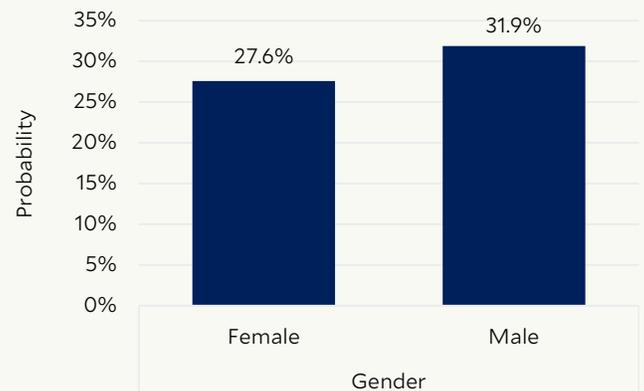
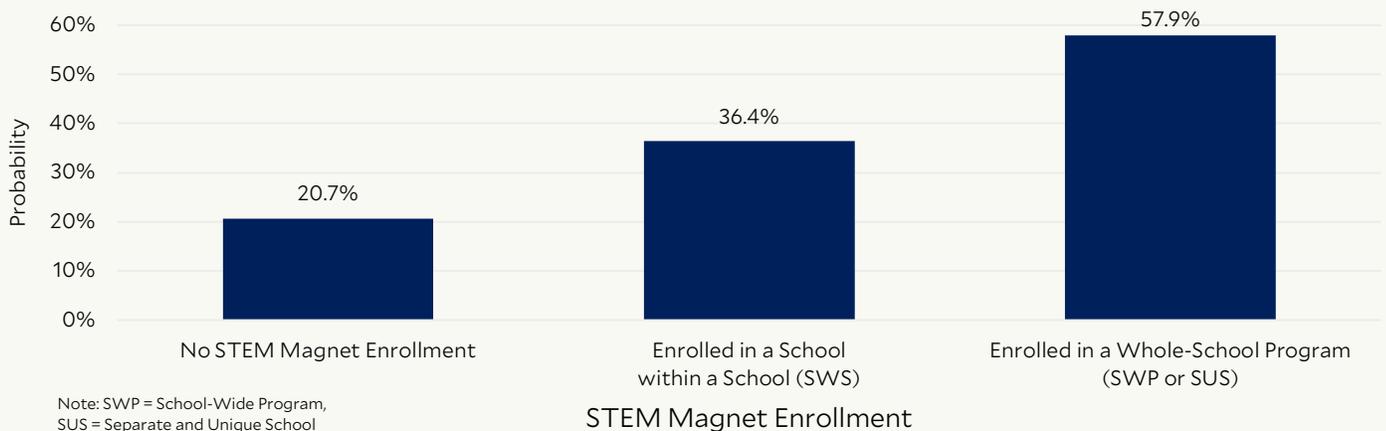
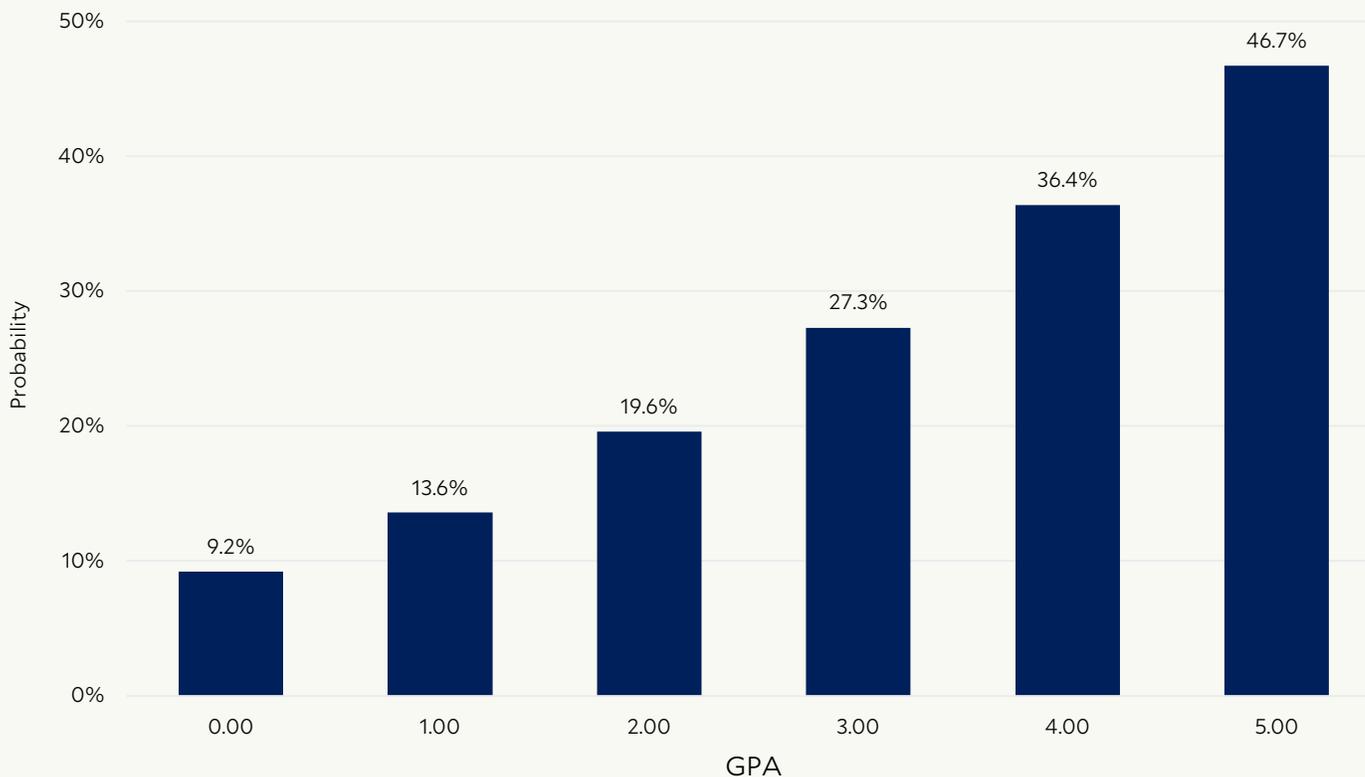


FIGURE 2 STEM Endorsement Completion by STEM Magnet Program



**FIGURE 3** STEM Endorsement Completion by Cumulative High School GPA

Students with higher cumulative high school GPAs were more likely to complete the STEM endorsement than students with lower cumulative high school GPAs. Figure 3 shows that while only 19.6% of students with a GPA of 2.00 completed the STEM endorsement, 46.7% of students with a GPA of 5.00 completed the STEM endorsement.

Other academic characteristics predicted STEM endorsement completion. Students were more likely to complete the STEM endorsement if they took Algebra I in middle school, took more college prep courses, and took more STEM courses.<sup>2</sup>

<sup>2</sup> Full results are available from the authors upon request.

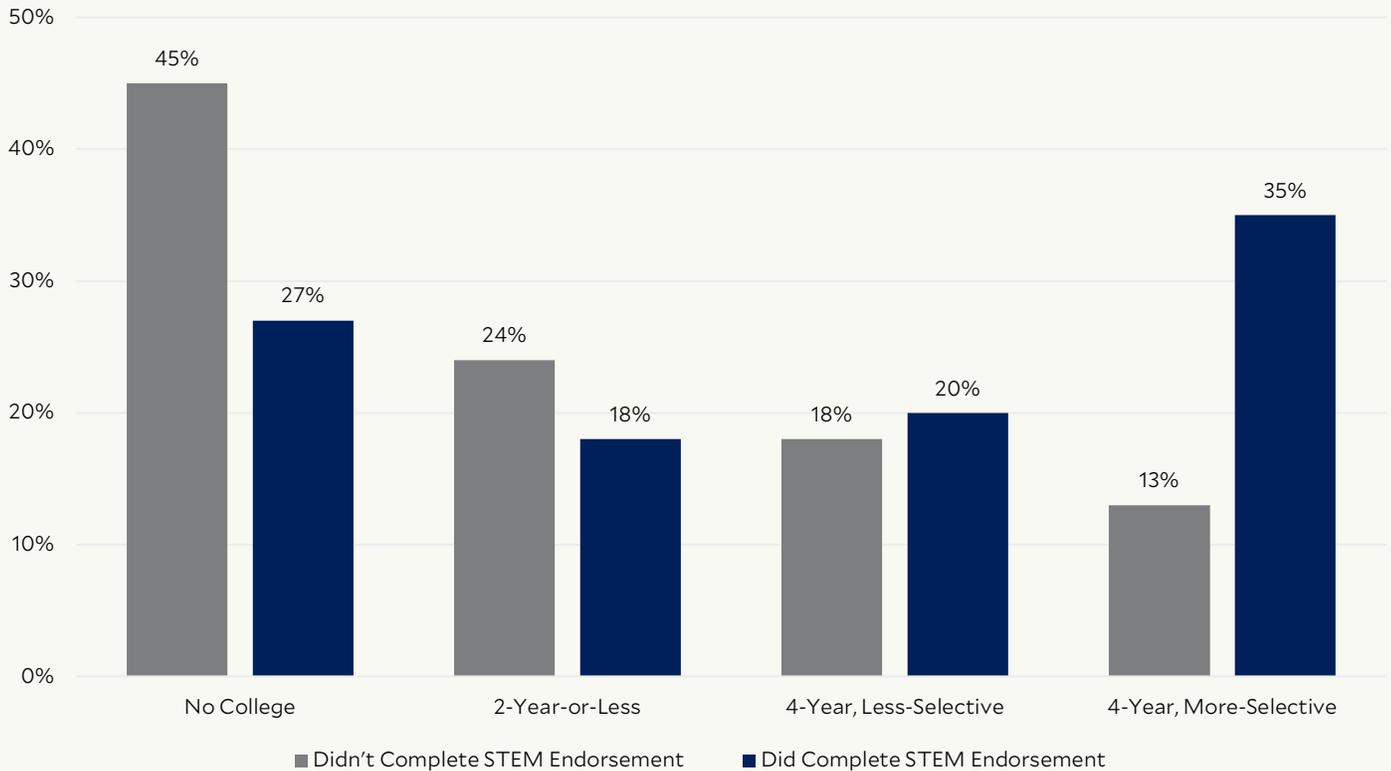
## 2 Students who completed the STEM endorsement were more likely to enroll in 4-year, more-selective colleges.

This section explores the relationship between completing the STEM endorsement and college choice. The main variable of interest is college choice, a four-category measure that shows whether and where a student enrolls in college:

- No college enrollment
- Enrollment in a 2-year-or-less college
- Enrollment in a 4-year, less-selective college
- Enrollment in a 4-year, more-selective college

Figure 4 shows students who completed the STEM endorsement were more likely to enroll in 4-year, more-selective colleges than students who did not complete the STEM endorsement. STEM endorsees were less likely to enroll in a 2-year-or-less college than non-STEM endorsees, and they were less likely to forgo college than non-STEM endorsees.

Student demographic background and behavioral characteristics did not explain the relationship between completing the STEM endorsement and college-going.

**FIGURE 4 College Enrollment by STEM Endorsement Completion**

### 3 The relationship between STEM endorsement completion was largely explained by academic characteristics.

The analyses illustrated that accounting for academic characteristics (i.e., gifted student, SAT score, cumulative high school GPA, took Algebra I in middle school, the number of college prep and STEM courses taken) explained much of the STEM and non-STEM gap in college enrollment.<sup>3</sup>

Additional analyses showed that SAT scores and cumulative high school GPA played a key role in explaining the higher college enrollment rates of students completing the STEM endorsement. If STEM and non-STEM students had the same SAT scores and cumulative high school GPA as one another, then gaps in college choice might reduce by the following amounts:

- Enrollment in a 2-year-or-less college → 5.3-percentage-point reduction in the STEM/non-STEM gap
- Enrollment in a 4-year, less-selective college → 2.2-percentage-point reduction in the STEM/non-STEM gap
- Enrollment in a 4-year, more-selective college → 14.9-percentage-point reduction in the STEM/non-STEM gap

While students who completed the STEM endorsement were more likely to enroll in college, particularly more selective institutions, it was most likely because they tended to have higher levels of academic performance.

<sup>3</sup> Full results are available from the authors upon request.

# Conclusion

## Implications

Overall, the findings show that while the STEM endorsement is positively associated with college choice, the association is largely driven by academic performance. This means there is nothing intrinsically unique about the STEM endorsement. However, the strong ties between the STEM endorsement and college choice suggest that the endorsement system is functioning as a sorting mechanism. As previous analyses from HERC have shown, the STEM endorsement is most closely aligned to selective college admissions criteria (Holzman & Lewis, 2020). HISD has made changes to reduce this association, including the requirement that all students must complete Algebra II. Although this is an important first step, the findings presented here suggest that more measures should be taken by the district to further disrupt this relationship.

It is possible that high-performing students self-select into the STEM endorsement out of interest, or because they perceive that the endorsement is more challenging and can help them gain admission to college. It is also possible that school and district staff guide high-performers into the STEM endorsement, potentially because they perceive it as the curriculum track for college-bound students. Of course, our study cannot explain why STEM functions as the endorsement for high-performing students. Additional research, especially qualitative studies, may be able to understand this better by examining the guidance students and their families receive from schools regarding the endorsement system.

It is troubling that there are positive and significant relationships between academic performance and STEM endorsement completion or between STEM endorsement completion and college choice (before accounting for background characteristics). The endorsement system was designed to provide students with curricular options, not to function as a sorting mechanism. The fact that the STEM endorsement is so strongly tied to academic performance indicates that, either by design or coincidence, it has formalized and specialized tracking in Texas. This dynamic is pernicious given well-known associations between academic performance, gender, race/ethnicity, and social class. If students from marginalized backgrounds are less likely to choose the STEM endorsement, then their college prospects may be limited.

## Recommendations

Even though House Bill 5 is a state policy, there are several actions HISD may be able to take to broaden college opportunities for all:

- Several student groups, such as female students, were less likely to complete the STEM endorsement even after accounting for background characteristics like academic performance. District leaders may be able to build on already-existing initiatives that can support female students' access to and success in STEM, as well as develop new strategies to address these gaps.



Photo by ThisisEngineering RAEng on Unsplash

- It is unclear why academic performance measures, in particular SAT scores and cumulative high school GPA, strongly predict STEM endorsement completion and/or selective college enrollment. School and district leaders may want to explore these patterns by speaking to students, families, teachers, and guidance counselors. These conversations may lead to effective strategies that can broaden access to the STEM endorsement among all students, regardless of academic performance. Depending on what these leaders learn, they may:
  - Develop strategies to disseminate information on the STEM endorsement to students and their families: HISD already posts information on the endorsement system on its website. Other dissemination strategies may include text message reminders, communication through Naviance, or mailings to students and their families.
  - Work with guidance counselors on innovative advising efforts. For example, HISD requires counselors to check in with high school seniors on their endorsement progress. Depending on staff capacity, schools may have counselors reach out to students earlier in high school.

# References

- Douglas, D., & Attewell, P. (2017). School Mathematics as Gatekeeper. *The Sociological Quarterly*, 58(4), 648-669.
- Holzman, B., & Lewis, B. (2020). *House Bill 5 and High School Endorsements: How Do They Align to College Admissions?* Houston, TX: Houston Education Research Consortium, Kinder Institute for Urban Research, Rice University. Retrieved December 17, 2020, from <https://kinder.rice.edu/research/house-bill-5-and-high-school-endorsements-how-do-they-align-college-admissions>
- House Bill 5, 83rd Legislative Regular Session (Texas, 2013).
- Rose, H., & Betts, J. R. (2001). *Math Matters: The Links Between High School Curriculum, College Graduation, and Earnings*. San Francisco, CA: Public Policy Institute of California.
- Trusty, J., & Niles, S. G. (2003). High-School Math Courses and Completion of the Bachelor's Degree. *Professional School Counseling*, 7(2), 99-107.
- Tyson, W., Lee, R., Borman, K. M., & Hanson, M. A. (2007). Science, Technology, Engineering, and Mathematics (STEM) Pathways: High School Science and Math Coursework and Postsecondary Degree Attainment. *Journal of Education for Students Placed at Risk*, 12(3), 243-270.
- Xie, Y., Fang, M., & Shauman, K. (2015). STEM Education. *Annual Review of Sociology*, 41(1), 331-357.



### **Mission**

The Kinder Institute for Urban Research builds better cities and improves lives through data, research, engagement and action.

### **About**

The Houston Education Research Consortium (HERC) is a research-practice partnership between the Kinder Institute for Urban Research and 11 Houston-area school districts. HERC aims to improve the connection between education research and decision making for the purpose of equalizing outcomes by race, ethnicity, economic status, and other factors associated with inequitable educational opportunities.



RICE UNIVERSITY

Kinder Institute for Urban Research

6100 Main Street MS-208 • Houston, TX 77005  
713-348-4132 • [kinder@rice.edu](mailto:kinder@rice.edu)  
[kinder.rice.edu](http://kinder.rice.edu)