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Who Lives in a STEM Desert?

Brian Holzman, Bethany Lewis and Hao Ma

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Research Brief

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

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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.

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Research Brief

Who Lives in a STEM Desert?

This brief examines where STEM deserts were located within Houston Independent School District (HISD) boundaries and the students most likely to live in a STEM desert. STEM deserts are areas in which students have more limited access to STEM endorsement paths or STEM course offerings (see Table 1 below). The analyses showed STEM deserts were more common in the southern and eastern parts of HISD and less common in the northern and western parts of the district. Students in lower socioeconomic neighborhoods were more likely to live in a STEM desert than students in higher socioeconomic neighborhoods. Black students were also more likely than White students to live in a STEM desert. The findings suggest areas in which the district may target resources or interventions to increase STEM offerings.

TABLE 1 STEM Desert Terms

STEM Paths	Term based on how many unique STEM endorsement paths a student had access to within 2 miles of their residence. Students who had access to two unique endorsement paths or fewer were determined to live in a STEM path desert.
STEM Courses	Term based on how many unique STEM courses a student had access to within 2 miles of their residence. Students who had access to 59 unique STEM courses or fewer were determined to live in a STEM course desert.

Key Findings

- **STEM deserts were more common in the southern and eastern areas of HISD.**
- **Students living in lower socioeconomic neighborhoods were more likely to live in a STEM path or course desert.**
- **Black students were more likely than White students to live in a STEM path or course desert.**

Background

In 2013, the Texas Legislature passed House Bill 5, which introduced the Foundation High School Program, a new high school graduation framework that aimed to increase students' college and career readiness. The policy provided students opportunities to specialize in an area aligned with their professional goals, regardless of whether they planned to attend college or a trade school or enter the workforce immediately after high school. The program went into effect starting with ninth-grade students in the 2014-2015 school year.

The Foundation High School Program introduced *academic endorsements*, which operate in a similar manner to a college major. There are five possible endorsement options: arts and humanities, business and industry, public services, STEM (science, technology, engineering, and mathematics), and multidisciplinary studies. Each endorsement has multiple course sequences, or *paths*, that students can follow to earn their endorsements. See Table 2 for a summary of endorsements and

paths during the period of study (high school freshmen in fall 2014 and fall 2015). We focus on the STEM endorsement in this study of HISD students.¹

The availability of STEM paths and courses across the district may function like *education deserts*. Education deserts describe geographic areas in which there are few or no college options (Hillman, 2016; Klasik, Blagg, & Pekor, 2018). These areas tend to have lower levels of educational attainment and higher shares of Hispanic residents (Hillman, 2016). By constraining opportunity, education deserts reinforce social stratification since students must travel far from home to secure desired educational opportunities. Drawing upon the concept of education deserts, this study examines whether there are *STEM deserts* in HISD — areas in which STEM educational opportunities are more limited.

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

TABLE 2 Endorsements and Related Curricular Paths Outlined in House Bill 5

Endorsement	Paths
Arts and Humanities	Social Studies, Single Foreign Language, Double Foreign Language, American Sign Language, Fine Arts, English Language Arts
Business and Industry	Career and Technical Education, English Language Arts Electives, Other TEA-Designated Business and Industry Sequence, Interdisciplinary
Public Services	Career and Technical Education, Junior Reserve Officers' Training Corps, Other TEA-Designated Public Services Sequence
STEM	Career and Technical Education, Mathematics, Science, Other TEA-Designated STEM Sequence, Interdisciplinary
Multidisciplinary	Advanced Coursework, 4 Credits in the 4 Core Subject Areas, AP/IB/Dual Credit

Sources: House Bill 5, 2013; Houston Independent School District, 2014.

Key Findings

Research Questions

Using HISD administrative data, this study asks the following two questions:

1. Where were STEM deserts located within HISD boundaries?
2. Which students were more likely to live in a STEM desert?

The analyses focused on HISD sixth-grade students in 2011–2012 and 2012–2013. These students were in the ninth grade in 2014–2015 and 2015–2016 and comprised the first two cohorts required to choose endorsements (N = 18,954). Complete results from statistical models, as well as details on the data, sample, and analytic strategy, are available from the authors upon request.

1 STEM deserts were more common in the southern and eastern areas of the district.

FIGURE 1 STEM Path Deserts in HISD

Percentage of Students Living in a STEM Path Desert by Census Tract

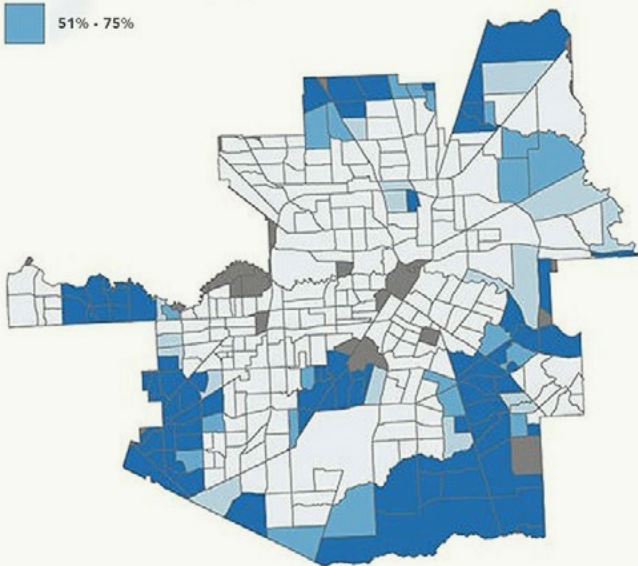
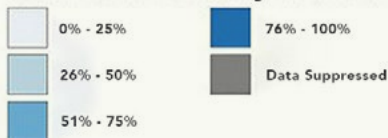


Figure 1 shows HISD divided into census tracts. The darker blue areas indicate census tracts with more students living in a STEM path desert (i.e., having access to two or fewer unique STEM endorsement paths). STEM path deserts were more common in the southern and eastern parts of the district's boundaries. The map of STEM course deserts (i.e., having access to 59 or fewer unique STEM courses) is similar and available from the authors upon request.

2 Black students, students who did not speak English at home, and students living in lower socioeconomic neighborhoods were more likely to live in a STEM desert.

STEM Path Deserts

- Black students were 13 percentage points more likely than White students to live in a STEM path desert.
- Asian and Pacific Islander students were 6 percentage points more likely than White students to live in a STEM path desert.
- Students who did not speak English at home were 6 percentage points more likely than students who did speak English at home to live in a STEM path desert.
- Students receiving special education services were 3 percentage points less likely than students not receiving special education services to live in a STEM path desert.
- Students from lower socioeconomic neighborhoods were more likely to live in a STEM path desert than students from higher socioeconomic neighborhoods. For example, while 31% of students living in low socioeconomic neighborhoods resided in a STEM path desert, only 25% of students living in very high socioeconomic neighborhoods resided in a STEM path desert.²
- Students who moved during middle school were 2 percentage points less likely than students who did not move during middle school to live in a STEM path desert.

STEM Course Deserts

- Black students were 11 percentage points more likely than White students to live in a STEM course desert.
- Immigrant students were 3 percentage points less likely than native-born students to live in a STEM course desert.
- Students who did not speak English at home were 2 percentage points more likely than students who did speak English at home to live in a STEM course desert.
- Students receiving special education services were 4 percentage points less likely than students not receiving special education services to live in a STEM course desert.
- Economically disadvantaged students were 3 percentage points less likely than non-economically disadvantaged students to live in a STEM course desert.
- Students from lower socioeconomic neighborhoods were more likely to live in a STEM course desert than students from higher socioeconomic neighborhoods.

² *Low* is defined as one standard deviation below the average neighborhood socioeconomic status, while *very high* is defined as two standard deviations above the average neighborhood socioeconomic status.

Across the two definitions of a STEM desert, this study found Black students were more likely than White students to live in one. It also found students who did not speak English at home were more likely to live in a STEM desert than students who did speak English at home. Finally, neighborhood socioeconomic status was related to living in a STEM desert, with students who resided in lower socioeconomic neighborhoods more likely to live in a STEM desert than students who resided in higher socioeconomic neighborhoods.³

Recommendations

- **Identify and target STEM deserts in HISD.** Given the relationship between neighborhood socioeconomic status and residing in a STEM desert, schools serving students from low socioeconomic neighborhoods should be given priority for receiving additional resources to support the expansion of STEM educational opportunities.
- **Ensure students living in STEM deserts have the information they need about the availability of STEM paths and courses in order to choose a school that meets their needs.** Since students are expected to select their endorsement in eighth grade, while also navigating the high school choice process, more information regarding which endorsements, paths, and courses are available at HISD schools may support students and families in the decision-making process. For students living in STEM deserts, this information may be especially helpful to determine whether they choose to attend their zoned high school, a magnet high school, or another high school in the district.

³ Other student characteristics predicted living in a STEM path desert or a STEM course desert but not both.

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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
kinder.rice.edu