



POLICY BRIEF:

Advanced Course Offerings and Completion in Science, Technology, Engineering, and Math in Texas Public High Schools

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SUMMARY

This study shows that, on average, Hispanic students in Texas have equal (if not greater) access to advanced STEM courses as White students and that a majority of Hispanic students attend schools offering about 25 advanced STEM courses. In fact, a larger proportion of the state's Black and Hispanic students (73 percent of each group) than White students (63 percent) attend schools offering the highest number of advanced STEM courses. Yet despite this observed equality of opportunity to take advanced STEM courses, smaller proportions of Black and Hispanic students than of White students completed three or more advanced courses in math or science. This disparity was found even within the subgroup of Black, Hispanic and White students demonstrating high math ability in grade 8. Although these results do not explain why in that subgroup fewer Black and Hispanic students complete three or more advanced courses in math or science, they point to a need to increase enrollment and perhaps encourage persistence among Black and Hispanic students in those advanced courses.

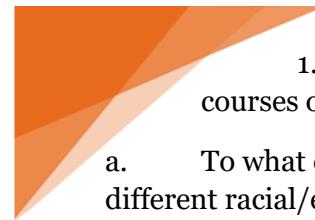
Background

Although the percentage of high school students in advanced STEM courses has risen steadily in the past two decades throughout the United States, disparities persist across student subgroups, such as racial/ethnic groups (Aud et al., 2013; Laird, Alt, & Wu, 2009; Texas Education Agency, 2011). Racial/ethnic minority student enrollment in advanced STEM courses in high school continues to lag behind nonminority enrollment, both nationally and in Texas. These gaps are wider for courses such as calculus and physics (Aud et al., 2013; Laird et al., 2009; Texas Education Agency, 2011).

In Texas, Hispanic students compose the majority of the student population (52 percent, as reported in 2014). In many regions, particularly the Rio Grande Valley in South Texas, Hispanic students make up more than 95 percent of the student body in each district in the region. Thus, research examining STEM-related topics specifically for Hispanic students is of paramount importance for the state.

This study examined advanced STEM course offerings in all regular-instruction public high schools in Texas, including charter schools that served students at any time from 2007/08 to 2013/14. The study also examined advanced STEM course completion among all students continuously enrolled in public high schools for four years (or five years in public schools when a math performance measure from grade 8 is included) for four cohorts of students in grades 9- 12 between the 2007/08 and 2013/14 school years.

This study answered three research questions. The first two consider variations in advanced STEM course offerings at the school level (research question 1) and through the lens of variations in student opportunity to access advanced STEM course offerings (research question 2):



1. To what extent did Texas high schools vary in the number of advanced STEM courses offered to students?
 - a. To what extent did the number of advanced STEM course offerings vary by schools serving different racial/ethnic subpopulations?
 - b. To what extent was this variation explained by other school characteristics, such as school locale or concentration of economically disadvantaged students?
 2. To what extent did Texas high school students vary by the number of advanced STEM courses available in their schools?
- The third research question considers advanced STEM course completion among other important student subpopulations:
3. To what extent did advanced STEM course completion in high school vary for Texas students by student race/ethnicity, grade 8 math performance, and student economic disadvantage?

Results are reported on average across the state in the public report and are summarized here.

Key findings

Science, technology, engineering, and math course offerings increased statewide from 2007/08 to 2013/14.

The number of advanced STEM courses offered at Texas high schools rose from an average of 9 in 2007/08 to 14 in 2013/14. A greater number of advanced courses were offered in science than in math: course offerings in science increased from an average of 4.0 to 5.5, while course offerings in math increased from 3.5 to 4.8. The largest increase in course offerings was for other advanced STEM courses (advanced career and technology courses in areas such as health science and information technology), which rose from an average of 1.4 in 2007/08 to 3.6 in 2013/14.

Schools enrolling the largest proportion of racial/ethnic minority students offered substantially greater numbers of advanced science, technology, engineering, and math courses than schools enrolling the largest proportion of White students.

Schools with more than 90 percent Hispanic students and those with more than 30 percent Black students offered a greater number of advanced STEM courses than schools with more than 85 percent White students. Schools with more than 90 percent Hispanic students offered approximately 10 advanced STEM courses on average in 2007/08 and 15 in 2013/14; schools with more than 30 percent Black students offered approximately 10 in 2007/08 and 17 in 2013/14; and schools with more than 85 percent White students offered approximately 7 in 2007/08 and 9 in 2013/14. The pattern was similar when math, science, and other advanced STEM course offerings were examined separately.

A greater number of advanced science, technology, engineering, and math courses were offered in schools with a low percentage of economically disadvantaged students.

When schools were organized into quintiles by the proportion of students classified as economically disadvantaged, schools in the bottom quintile (smallest proportion of economically disadvantaged students) offered more advanced STEM courses, and schools in higher quintiles offered fewer advanced STEM courses. Advanced STEM course offerings increased across all concentrations of students classified as economically disadvantaged between 2007/08 and 2013/14, though the increases were larger for schools in the top and bottom quintiles (approximately 6 advanced STEM courses in each quintile, on average). This pattern persisted across all types of advanced STEM course categories.



A greater number of advanced science, technology, engineering, and math courses were offered in urban and suburban schools than in rural or town schools.

Urban and suburban schools offered a substantially greater number of advanced STEM courses than schools in towns and rural locales. Urban schools offered approximately 18 courses on average, suburban schools offered 19, schools in towns offered 10, and rural schools offered 13 in 2013/14. Growth in the average number of advanced STEM courses was largest for schools in urban and suburban locales between 2007/08 and 2013/14.

Schools in towns and rural areas that enrolled large proportions of economically disadvantaged students offered the fewest advanced science, technology, engineering and math courses.

Rural schools enrolling large proportions of economically disadvantaged students offered the fewest advanced STEM courses: approximately 6 in 2007/08 and 9 in 2013/14. Urban schools with large proportions of economically disadvantaged students offered approximately 9 advanced STEM courses in 2007/08 and 16 in 2013/14, and suburban schools offered 11 in 2007/08 and 17 in 2013/14.

Seventy-five percent of the state's student population attended schools in the top two quintiles of advanced science, technology, engineering, and math course offerings.

Because students in Texas disproportionately attended schools in densely populated urban areas (the top 10 percent of the state's public high schools enrolled 45 percent of students in 2013/14), the majority of Texas students, including racial/ethnic minority students, attended schools offering high numbers of advanced STEM courses. Some 75 percent of the state's student population attended schools in the top two quintiles of advanced STEM course offerings. For example, the top quintile offered 27 courses on average in 2013/14, and the second quintile offered 19. Approximately 78 percent of Black and Hispanic students and 68 percent of White students attended schools in these two quintiles.

A greater proportion of White students than of Black or Hispanic students completed three or more advanced math or advanced science courses, even among students demonstrating high math ability.

Although a greater number of advanced STEM courses were offered in schools with the highest proportions of Black and Hispanic students, and a greater proportion of Black and Hispanic students attended schools with the highest number of advanced STEM course offerings, greater proportions of White students completed three or more advanced STEM math courses (compared with Black or Hispanic students). Across the four cohorts included in the study, 25 percent of White students completed three or more advanced math classes, compared with 13 percent of Hispanic students and 10 percent of Black students. And 39 percent of White students completed three or more advanced science classes compared with 32 percent of Hispanic students and 28 percent of black students.

This disparity is slightly smaller among the 36 percent of students demonstrating high math ability in grade 8. Among this group, approximately 52 percent of White students completed three or more advanced math courses during high school, more than 10 percentage points higher than the proportion of Hispanic students (41 percent) and Black students (39 percent). While the differences among students demonstrating high math ability are smaller in advanced science courses, the pattern persists: 58 percent of White students completed three or more advanced science courses, compared with 51 percent of Black students and 51 percent of Hispanic students. Considerably fewer students who did not demonstrate high math ability in grade 8 (half to two-thirds fewer) than students who did demonstrate high ability completed three advanced math or three advanced science courses, but greater proportions of White students than Black or Hispanic students did so.¹

¹ Even among students demonstrating high math ability in grade 8, Black students were less likely than White or Hispanic students to enroll in a calculus or pre-calculus course. Among students demonstrating high math ability in grade 8, 28 percent of Black students enrolled in a calculus course, compared with 36 percent of White and 32 percent of Hispanic students. Nearly 86 percent of White students enrolled in a pre-calculus course, compared with 83 percent of Black and 85 percent of Hispanic students.

Implications

This study shows that, on average, Hispanic students in Texas have equal (if not greater) access to advanced STEM courses as White students and that a majority of Hispanic students attend schools offering about 25 advanced STEM courses. In fact, a larger proportion of the state's Black and Hispanic students (73 percent of each group) than White students (63 percent) attend schools offering the highest number of advanced STEM courses. Yet despite this observed equality of opportunity to take advanced STEM courses, smaller proportions of Black and Hispanic students than of White students completed three or more advanced courses in math or science. This disparity was found even within the subgroup of Black, Hispanic and White students demonstrating high math ability in grade 8. Although these results do not explain why in that subgroup fewer Black and Hispanic students complete three or more advanced courses in math or science, they point to a need to increase enrollment and perhaps encourage persistence among Black and Hispanic students in those advanced courses.

These results may inform state and local efforts to influence advanced STEM course completion among Black and Hispanic students and to understand why the highest achieving Black and Hispanic students take fewer advanced STEM courses than their White student counterparts. Future research might focus on other mechanisms that may contribute to lower course completion rates among racial/ethnic minority students, such as less (or less effective) communication with parents, less involvement by parents, less effort in middle school to spark interest in STEM, insufficient or low quality career advising, or less access to highly qualified teachers. The results of this study may also guide the expansion of initiatives to boost enrollment in advanced STEM courses, particularly where offerings are already plentiful. For example, one area of state focus might be training counselors and advisors to guide students of all race/ethnicities towards advanced high school STEM coursework, particularly students demonstrating high levels of math and science competency who might not otherwise receive encouragement. Another possibility is an online learning environment to improve counselors' and advisors' skills in postsecondary career advising, which the University of Texas was tasked with creating under House Bill 18, passed by the 84th Texas Legislature in 2015.

References

- Aud, S., Wilkinson-Flicker, S., Kristapovich, P., Rathbun, A., Wang, X., & Zhang, J. (2013). *The condition of education 2013* (NCES No. 2013-037). National Center for Education Statistic Working Paper. Washington, DC: U.S. Department of Education.
- Laird, J., Alt, M., & Wu, J. (2009). *STEM coursetaking among high school graduates, 1990–2005*. MPR Research Brief. <http://files.eric.ed.gov/fulltext/ED508154.pdf>
- Texas Education Agency. (2011). *Advanced Placement and International Baccalaureate examination results in Texas, 2009–10* (Document No. GE11 601 07). Austin, TX: Author. Retrieved August 3, 2016, from <http://goo.gl/3mFE32>

To access the full, public report: <https://ies.ed.gov/ncee/edlabs/projects/project.asp?projectID=4494>

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