What's Happening

Trends in Algebra II completion and failure rates for students entering Texas public high schools

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Key findings

This study examines Algebra II completion and failure rates for students entering Texas public high schools from 2007/08 through 2014/15. This period spans the time when Texas students, beginning with the 2007/08 grade 9 cohort, were required to take four courses each in English, math (including Algebra II), science, and social studies (called the 4x4) and the time when, beginning with the 2014/15 cohort, the state moved to the new Foundation High School Program, which eliminated Algebra II as a math requirement. Overall, Algebra II completion and failure rates followed the same trend for the 2014/15 cohort as for the seven cohorts that graduated under the previous graduation requirements.

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Summary

In recent years education policymakers have been debating and changing high school graduation requirements and examining the effects of those changes. For example, Florida eliminated Algebra II as a graduation requirement in 2010/11. Arizona increased its graduation requirements in 2013/14 and included Algebra II. Virginia changed its graduation requirements for 2017/18, increasing the emphasis on career readiness by adding credit-bearing internships and work experience. In 2013 Texas also adjusted its graduation requirements, under House Bill 5 (HB 5), which among other changes, eliminated Algebra II as a math course requirement (while maintaining the requirement of four math courses). Some observers have applauded the flexibility in the new Texas requirements, arguing that the changes may prevent some non-college-bound students from dropping out. Others view reducing the rigor of graduation requirements by dropping the Algebra II requirement as problematic, with the largest potential negative impact on Black and Hispanic students and economically disadvantaged students, groups that have traditionally lagged behind other students in the state in college readiness and enrollment.

Beginning with the 2007/08 grade 9 cohort, Texas high school students were required to take four courses in English, science, social studies, and math (called the 4x4). In line with admission requirements at most state universities and colleges, the math requirement included Algebra I, Geometry, Algebra II, and at least one advanced math course above Algebra II, in that sequence. Under HB 5, beginning with the 2014/15 grade 9 cohort, students were no longer required to take Algebra II, although they still must complete four math courses (Algebra I, Geometry, and two advanced math courses above Geometry). The State Board of Education developed two new courses that districts could offer in place of Algebra II: Algebraic Reasoning and Statistics.

Following passage of HB 5, the Texas Education Agency sought information about changes in Algebra II completion and failure rates, as well as about other courses that students take as their third math course, including the two newly developed courses. This study examined Algebra II completion and failure rates for Texas high school students in the grade 9 cohorts from 2007/08 through 2014/15. The study also examined the third math course that students completed by the end of grade 11, before and after HB 5 went into effect. Providing information on how districts responded to changes in the high school graduation requirements was another goal of this study.

The study used longitudinal student- and district-level administrative data from the Texas Education Agency and district-level responses to a statewide online survey administered during spring 2015 to explore Algebra II completion and failure rates, to see how districts were communicating with parents about the new graduation requirements, and to determine whether districts would offer the new Algebra II alternative courses during the first year that HB 5 was in effect.

Key findings include:
- In the 2014/15 school year, the first after enactment of HB 5, 37 percent of districts reported requiring students to complete Algebra II to graduate from high school.
- Fewer than half of districts reported that they planned to offer the alternative math courses in the first year of the new graduation requirements.

- Both before and after enactment of HB 5, 78 percent of students completed Algebra II as their third math course.
- Trends in Algebra II completion and failure for most student subgroups remained stable after enactment of HB 5:
  - When Texas began implementing the 4x4 curriculum in 2007/08, the Algebra II completion rate by grade 11 increased 11 percentage points among White students and 18 percentage points among Black and Hispanic students, a rate that remained stable with the 2014/15 grade 9 cohort.
  - The Algebra II completion rate was 11–12 percentage points lower among economically disadvantaged students than among students who were not, and the Algebra II failure rate was 6–7 percentage points higher.
  - The Algebra II completion rate was much higher among students with high grade 8 math achievement than among students with low grade 8 math achievement, and the Algebra II failure rate was substantially lower.[1]
- Almost all students who did not complete Algebra II after taking Geometry either were taking a pre–Algebra II course or had completed math courses only through Geometry in the first three years of high school.

HB 5 was intended to provide greater flexibility for districts and students, while emphasizing career preparation for students whose future plans might not include college. The findings from this study suggest that students' choice of the third high school math course was not immediately influenced by the HB 5 policy enacted in 2013. And although the state introduced flexibility into the high school math curriculum, many districts continued to place students in Algebra II.

This initial information can be used to answer questions about changes in course-taking patterns and course failure rates that may be expressed by parents, education practitioners and administrators, policymakers, and researchers. The Texas Education Agency might want to track additional cohorts of students over their high school career to determine whether their course taking changes in response to any additional changes districts make to address HB 5 or whether the increased flexibility in course selection is related to other student outcomes such as dropout rates.

Contents

Why this study?

In recent years education policymakers have been debating and changing high school graduation requirements and examining the effects of those changes. For example, Florida eliminated Algebra II as a graduation requirement in 2010/11. Arizona increased its graduation requirements in 2013/14 and included Algebra II. Virginia changed its graduation requirements for 2017/18, increasing the emphasis on career readiness by adding credit-bearing internships and work experience. In 2013 Texas also adjusted its graduation requirements. The most controversial change was the elimination of Algebra II as a math course requirement (while maintaining the requirement of four math courses), under House Bill (HB) 5.

Some observers have applauded the flexibility in the new Texas requirements, arguing that the changes may prevent some non-college-bound students from dropping out of high school by allowing them to take more career-oriented and technical education courses in areas of interest and to take applied math courses that may be better aligned with their career goals. Others view reducing the rigor of the graduation requirements by dropping the Algebra II requirement as problematic. Critics contend that all students should be prepared to meet the challenges of a competitive workforce, even if their future does not include college. Many critics expect the changes in the graduation requirements to have the largest effects on Black and Hispanic students and economically disadvantaged students, groups that have traditionally lagged behind other students in the state in college readiness and enrollment. Research has found that graduation requirements have had a disproportionate influence on marginal students (those who completed only the minimum graduation requirements; Chaney, Burgdorf, & Atash, 1997) as well as on racial/ethnic minority and economically disadvantaged students (Domina & Saldana, 2011; Saw & Broda, 2012; Schiller & Muller, 2003). (See appendix A for a review of the literature.)

This study provides information on changes in Algebra II completion and failure rates overall and by student and district characteristics following changes in math course requirements for high school graduation

Algebra II had been a requirement for high school graduation in Texas for seven years before HB 5. Beginning with the 2007/08 grade 9 cohort, students were required to take four courses each in English, science, social studies, and math (called the 4x4). In line with admission requirements at most state universities and colleges, the math requirement included Algebra I, Geometry, Algebra II, and at least one advanced math course above Algebra II, in that sequence. Under HB 5, beginning with the 2014/15 grade 9 cohort, students were no longer required to take Algebra II, although they still must complete four math courses (Algebra I, Geometry, and two advanced math courses above Geometry).[2] To expand the options for the third math course under the new graduation requirements, the Texas State Board of Education developed two new courses: Algebraic Reasoning and Statistics.

To learn more about changes in Algebra II completion and failure rates overall and by student and district characteristics as HB 5 is implemented, the chair of the Texas State Board of Education, along with the Texas Education Agency, approached the Regional Educational Laboratory Southwest for more information. This study informs the agency about what courses students are taking as their third math course, as well as whether fewer students—particularly racial/ethnic minority and economically disadvantaged students—are completing Algebra II and whether differences in completion and failure rates are more pronounced in high–racial/ethnic minority, high-poverty, or rural districts (see box 1 for definitions of key terms). This study also informs the Texas Education Agency about how

Box 1. Key terms

Foundation High School Program. The minimum 22-credit curriculum plan for Texas high school graduation. It includes four credits in English; three credits each in math, science, and social studies; two credits in a language other than English; one credit each in fine arts and physical education; and five electives.

Foundation High School Program Plus Endorsement. The default 26-credit curriculum plan for Texas high school graduation. It includes four credits each in English, math, and science; three credits in social studies; two credits in a foreign language; one credit each in fine arts and physical education; and seven electives focused on a selected career endorsement.

Distinguished Level of Achievement. An option of the Foundation High School Program that can be earned by completing Algebra II as well as the requirements of the Foundation High School Program Plus Endorsement.

Endorsement. A series of courses grouped by interest or skill set that provide students with in-depth knowledge of a subject area.

High-poverty district. A district in the top third of the distribution, among all Texas districts, of the percentage of enrolled students classified as economically disadvantaged (based on eligibility for the federal school lunch program) in 2007/08–2014/15.

High–racial/ethnic minority district. A district in the top third of the distribution, among all Texas districts, of the percentage of enrolled students whose race/ethnicity was Black, Hispanic, or other in 2007/08–2014/15.

Low–racial/ethnic minority district. A district in the bottom third of the distribution, among all Texas districts, of the percentage of enrolled students whose race/ethnicity was Black, Hispanic, or other in 2007/08–2014/15.

Third math course completion. The math course that students take after Geometry, regardless of whether students pass or fail the course. Students must receive credit for Algebra I, Geometry, and one advanced math course above the level of Geometry in order to graduate under the Foundation High School Program. See box B1 in appendix B for courses that meet the third math course requirement.

many districts continue to require Algebra II, how many offer the alternative math courses, and how many students take those courses in place of Algebra II. This study also may be of interest to the Texas Higher Education Coordinating Board because it provides information on the level of Texas students' preparation for college related to course completion in math. A report by the coordinating board found that college-going rates decreased from 2015 to 2016 for all public high schools (Texas Higher Education Coordinating Board, 2017). HB 5 has the potential to reduce college-going rates even more, especially for racial/ethnic minority students and economically disadvantaged students, who may be less likely to follow a rigorous high school curriculum.

What the study examined

The following research questions guided the study:

1. How are districts implementing the curriculum requirements for graduation under HB 5?

2. What is the trend in Algebra II completion rates by the end of grade 11 for students who entered grade 9 during the 2007/08–2014/15 academic years?
   - Does the trend differ by student and district characteristics?

3. What is the trend in Algebra II failure rates by the end of grade 11 for students who entered grade 9 during the 2007/08–2014/15 academic years?
   - Does the trend differ by student and district characteristics?

4. What math courses did students take who entered grade 9 during the 2007/08–2014/15 academic years but who did not take Algebra II as their third math course?

Although this study looks at Algebra II completion and failure rates over time, including before and after HB 5 went into effect, the design of the study does not permit determining conclusively whether changes in Algebra II completion are due to changes in the high school graduation requirements. Box 2 describes the study data, sample, and methods.

Although this study looks at Algebra II completion and failure rates before and after HB 5 went into effect, the design of the study does not permit determining conclusively whether changes in Algebra II completion are due to changes in the high school graduation requirements

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Box 2. Data, sample, and methods

Data

For research question 1 on how districts are implementing the curriculum requirements of the new graduation program, the Texas Education Agency provided the study team with district-level responses to a statewide online survey administered during spring 2015. For the remaining research questions, the study used longitudinal student- and district-level datasets for 2007/08–2016/17 from the agency's Public Education Information Management System (PEIMS), statewide assessment files for 2011/12 (the first year of implementation of the statewide assessment) through 2014/15, and Texas Academic Performance Report (TAPR) files for 2007/08–2015/16. PEIMS contains data on student enrollment and demographic characteristics, special program participation, and course completion data. Statewide assessment files contain scores and performance standards from the State of Texas Assessments of Academic Readiness (STAAR™), and TAPR files contain organizational data for schools and districts. (See table B1 in appendix B for a summary of the data files and variables used in the study.)

Sample

The survey was administered in spring 2015 to 1,098 Texas K–12 districts with a high school; 890 districts completed the survey, for a response rate of 81 percent. School districts responding to the survey were generally representative of all school districts in the state on characteristics such as state accountability rating in the 2013/14 school year and student demographic group proportions in the district, including economically disadvantaged students, English learner students, students in special education programs, and student race/ethnicity (see table B3 in appendix B). However, charter school districts and districts with enrollments of fewer than 500 students were underrepresented among respondents to the survey.

(continued)

The study also followed eight cohorts of grade 9 students who entered a Texas public high school during the 2007/08–2014/15 academic years and who had the opportunity to complete Algebra II by the end of grade 11 (2009/10–2016/17). Only students who were enrolled continuously in any Texas public high school for three consecutive years were included in the analyses. (See table B4 in appendix B for details about the number and percentage of students in each cohort by demographic characteristics.)

Methods

For research question 1, descriptive statistics were calculated using district survey data to provide an in-depth look at how districts responded to the graduation requirements enacted under Texas House Bill 5. For research questions 2–4, completion and failure rates for Algebra II and completion rates for other third math courses by the end of three years of high school were calculated by cohort to compute trends for these outcomes. Differences in trends on these outcomes were calculated by gender and for racial/ethnic minority, economically disadvantaged, and low-achieving students and by district characteristics, including high percentages of racial/ethnic minority students and of economically disadvantaged students, district community type, and Texas region. (See table B2 in appendix B for descriptions of district community types and box B1 for math courses approved by the Texas State Board of Education to fulfill the third math course requirement.)

What the study found

This section presents the findings of the analysis for each of the research questions.

Districts most commonly informed parents and students about the new graduation requirements through meetings with parents or students, discussions with counselors, and the district student handbook

Districts used a variety of communication tools to inform parents and students about the changes in the graduation requirements. The top three means of communication with both parents and students were meetings, discussions with counselors, and the district student handbook. A majority of districts (62 percent) also reported that teachers provided information directly to students about the new graduation requirements (figure 1).

Almost all districts reported encouraging students to earn a Distinguished Level of Achievement

Almost all districts that responded to the survey (94 percent) reported that they were encouraging students to complete the Distinguished Level of Achievement (DLA; see box 1). When asked to report which actions the district was taking to encourage completion of the DLA, nearly 92 percent of districts reported that guidance counselors were promoting the DLA to students (table 1). Additionally, more than 60 percent of responding districts reported that the DLA was promoted at parent and student meetings and by teachers. Districts also reported encouraging students to complete Algebra II. Slightly less than half of responding districts (49 percent) reported that coursework toward completing the DLA was automatically included as a requirement for students in their district. Approximately 37 percent of districts reported requiring students to complete Algebra II to graduate from high school.

Nearly 92 percent of districts reported that guidance counselors were promoting the Distinguished Level of Achievement (DLA) to students, and more than 60 percent of responding districts reported that the DLA was promoted at parent and student meetings and by teachers

Figure 1. Texas districts most frequently reported communicating the change in high school graduation requirements through parent and student meetings and through guidance counselors, 2014/15
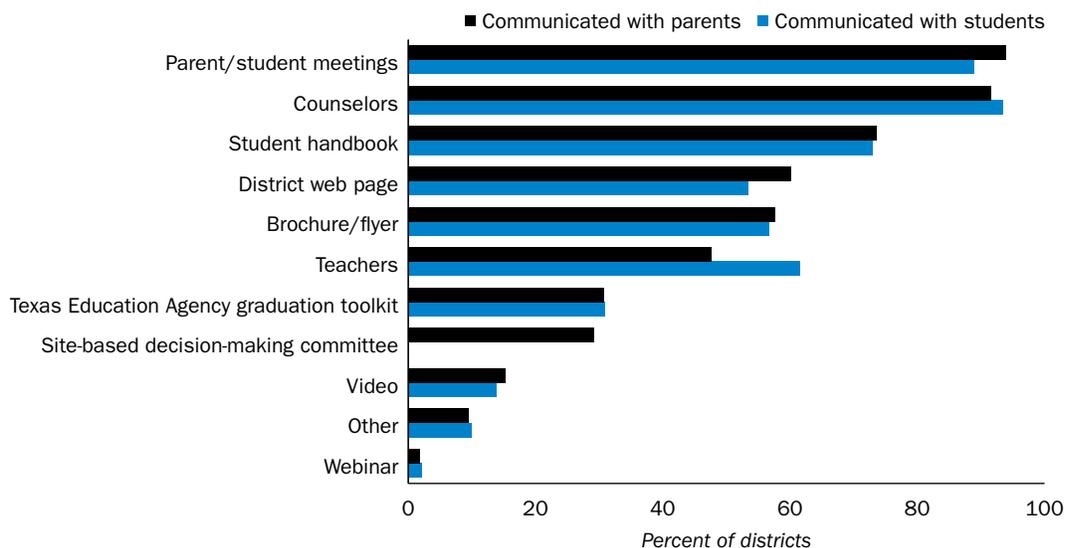
Note: *n* = 890.

Source: Authors' calculations using data from the Texas Education Agency spring 2015 District Survey.

Table 1. Actions that Texas districts reported taking to promote the Distinguished Level of Achievement and Algebra II to high school students, 2014/15

Action	Percent of districts
Guidance counselor promotes Distinguished Level of Achievement to students	91.8
District promotes Distinguished Level of Achievement at parent meetings	81.6
District promotes Distinguished Level of Achievement at student meetings	74.7
District encourages students to complete Algebra II	72.0
Teachers promote Distinguished Level of Achievement	60.4
District automatically includes coursework toward Distinguished Level of Achievement	49.2
District promotes Distinguished Level of Achievement in student handbook	48.5
District requires students to complete Algebra II	36.8
District promotes Distinguished Level of Achievement on website	23.5
District promotes Distinguished Level of Achievement in other ways	5.0

Note: *n* = 839.

Source: Authors' calculations using data from the Texas Education Agency spring 2015 District Survey.

Fewer than half of districts reported that they planned to offer the alternative math courses in the first year that House Bill 5 was in effect

Relatively few districts reported planning to offer the courses in 2014/15 that the Texas State Board of Education developed as alternatives to Algebra II. Only 30 percent of districts reported that they planned to offer Algebraic Reasoning, and 44 percent of districts reported that they planned to offer Statistics.

The third math course taken by students in the 2014/15 cohort did not appear related to changes in graduation requirements

The rate of Algebra II completion by the end of grade 11 increased by 15 percentage points between the 2007/08 and 2011/12 grade 9 cohorts and remained stable at 77–78 percent for the 2012/13–2014/15 cohorts (figure 2).

Under the previous 4x4 curriculum, Algebra II completion rates rose for all racial/ethnic groups and remained stable even after the requirement changed with the 2014/15 cohort

The stable trend in Algebra II completion rates by the end of grade 11 by race/ethnicity mirrored the overall trend. However, a greater percentage of Asian and White students than of Black and Hispanic students completed Algebra II. Over the period when Texas was implementing the 4x4 curriculum (2007/08–2013/14), completion rates in Algebra II by the end of grade 11 ranged from 70 percent for the 2007/08 cohort to 81 percent for the 2013/14 cohort for White students, from 53 percent to 71 percent for Black students, and from 59 percent to 77 percent for Hispanic students (figure 3). Asian students had considerably higher completion rates in Algebra II by the end of grade 11 than did students in other racial/ethnic groups, ranging from 87 percent for the 2007/08 cohort to approximately 91 percent for the 2013/14 cohort. Among the 2013/14 grade 9 cohort the percentage of students who completed Algebra II by the end of grade 11 (2016/17) was almost 4 percentage points higher for White students than for Hispanic students and 10 percentage points higher for White students than for Black students. The pattern in Algebra II completion rates by race/ethnicity remained stable with the 2014/15 grade 9 cohort.

Among the 2013/14 grade 9 cohort the percentage of students who completed Algebra II by the end of grade 11 (2016/17) was almost 4 percentage points higher for White students than for Hispanic students and 10 percentage points higher for White students than for Black students

Figure 2. Algebra II completion rates by the end of grade 11 were consistent before and after the new graduation requirements went into effect in Texas in 2014/15, 2007/08–2014/15 grade 9 cohorts

Percent of students
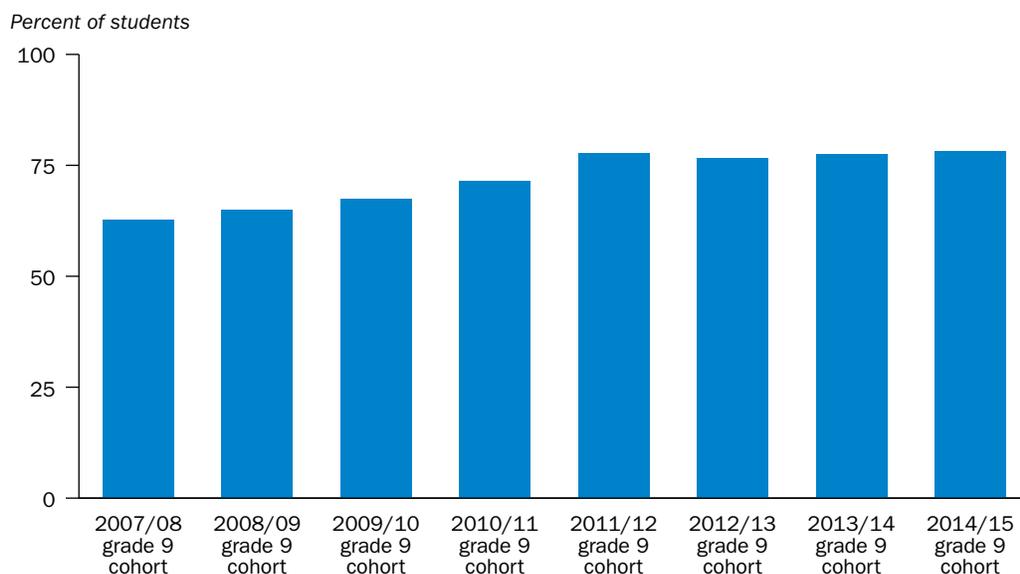
Source: Authors' analysis based on data from the Texas Education Agency, 2007/08–2014/15.

Figure 3. A greater proportion of Asian and White students than of Black and Hispanic students in the 2007/08–2014/15 grade 9 cohorts completed Algebra II by the end of grade 11

Percent of students
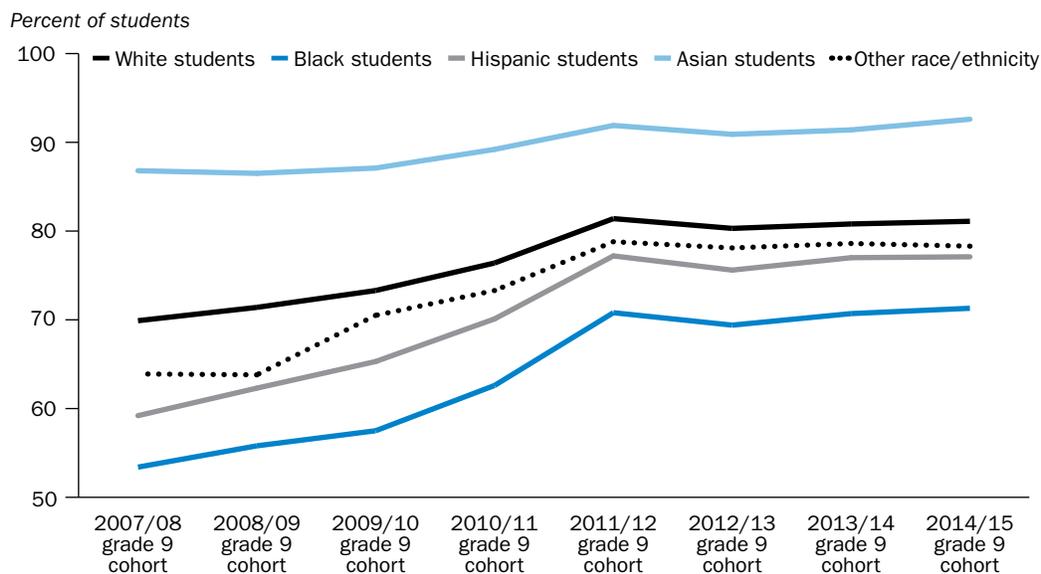
Source: Authors' analysis based on data from the Texas Education Agency, 2007/08–2014/15.

For the 2007/08 cohort, 54 percent of economically disadvantaged students and 70 percent of students who were not economically disadvantaged completed Algebra II by the end of grade 11, a gap of 16 percentage points. For the 2014/15 cohort, these percentages stayed consistent with the previous cohort, at 72 percent and 84 percent

A smaller proportion of students who were economically disadvantaged than of students who were not completed Algebra II, and the proportion remained stable after the new graduation requirements went into effect in 2014/15

Students classified as economically disadvantaged were less likely than students not classified as economically disadvantaged to complete Algebra II by the end of grade 11; however, the gap narrowed slightly over the years (figure 4). For the 2007/08 cohort, 54 percent of economically disadvantaged students and 70 percent of students who were not economically disadvantaged completed Algebra II by the end of grade 11, a gap of 16 percentage points. For the 2014/15 cohort, these percentages stayed consistent with the previous cohort, at 72 percent and 84 percent.

Trends in Algebra II completion rates by other student and district characteristics remained stable after the new graduation requirements went into effect in 2014/15

Students with high grade 8 math achievement completed Algebra II by the end of grade 11 at much higher rates than did students with low grade 8 math achievement (see table C1 in appendix C). Students in high–racial/ethnic minority and high-poverty districts completed Algebra II at similar rates as students in low–racial/ethnic minority and low-poverty districts (see table C2 in appendix C). However, there were differences by district community type, with major urban districts generally having the highest completion rates and charter and independent town districts generally having the lowest completion rates. These trends in Algebra II completion rates remained stable across all grade 9 cohorts.

Figure 4. In the 2007/08–2014/15 grade 9 cohorts, a smaller proportion of students who were economically disadvantaged than of students who were not economically disadvantaged completed Algebra II by the end of grade 11

Percent of students
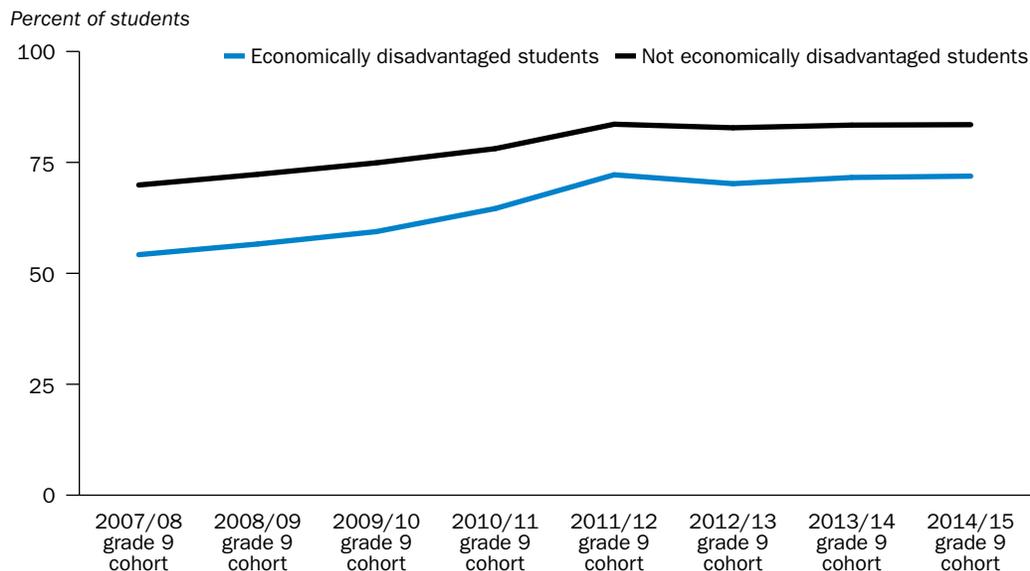
Source: Authors' analysis based on data from the Texas Education Agency, 2007/08–2014/15.

Across all grade 9 cohorts the percentages of Black and Hispanic students who failed Algebra II were approximately twice those of White students and almost three times those of Asian students

Algebra II failure rates remained relatively stable across all grade 9 cohorts among students who completed Algebra II

Algebra II failure rates among students who completed Algebra II remained relatively stable across grade 9 cohorts. The percentage of students failing Algebra II was 14–17 percent over 2007/08–2014/15, with the highest rate for the 2011/12 cohort (figure 5).

Algebra II failure rates in the 2007/08–2014/15 grade 9 cohorts were higher among Black and Hispanic students than among White and Asian students

Across all grade 9 cohorts the percentages of Black and Hispanic students who failed Algebra II were approximately twice those of White students and almost three times those of Asian students (figure 6). For the 2013/14 and 2014/15 grade 9 cohorts, 18 percent of Black students and 19 percent of Hispanic students failed Algebra II compared with 10 percent of White students and 6 percent of Asian students.

Algebra II failure rates also differed by other student characteristics and by district characteristics. In the three grade 9 cohorts assessed under the State of Texas Assessments of Academic Readiness (STAAR™) program (2012/13–2014/15), less than 4 percent of students with high grade 8 math achievement failed Algebra II, whereas 22 percent of students with low grade 8 math achievement failed it (see table C3 in appendix C). Students in high–racial/ethnic minority and high-poverty districts failed Algebra II at higher rates than did students in low–racial/ethnic minority and low-poverty districts (see table C4 in appendix C). Algebra II failure rates also differed across district community types and regions; major urban and charter school districts and districts in south Texas tended to have higher Algebra II failure rates. Trends in Algebra II failure rates by student characteristics and by district characteristics remained stable after the new graduation requirements went into effect in 2014/15.

Figure 5. Algebra II failure rates among students remained relatively stable across the 2007/08–2014/15 grade 9 cohorts
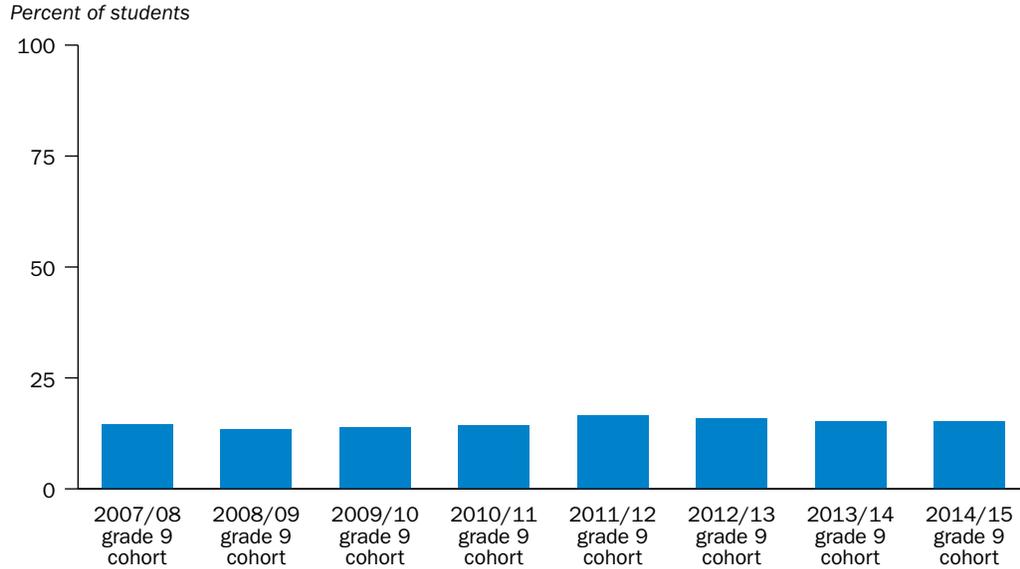
Percent of students

Figure 6. Black and Hispanic students in the 2007/08–2014/15 grade 9 cohorts failed Algebra II at almost twice the rate that White and Asian students did
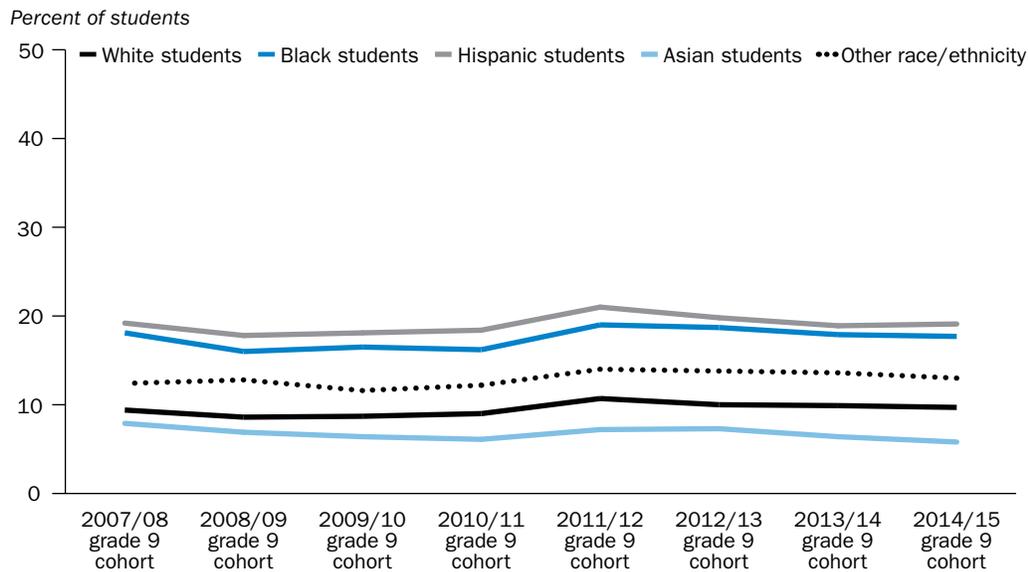
Percent of students

Figure 7. Most students in the 2007/08–2014/15 grade 9 cohorts who did not complete Algebra II by grade 11 either were taking the pre–Algebra II course or had completed only Geometry

Percent of students

Legend: ■ Algebra II alternatives[a] ▢ No third math course[b] ■ Mathematical Models (pre–Algebra II) ■ Other ■ Precalculus
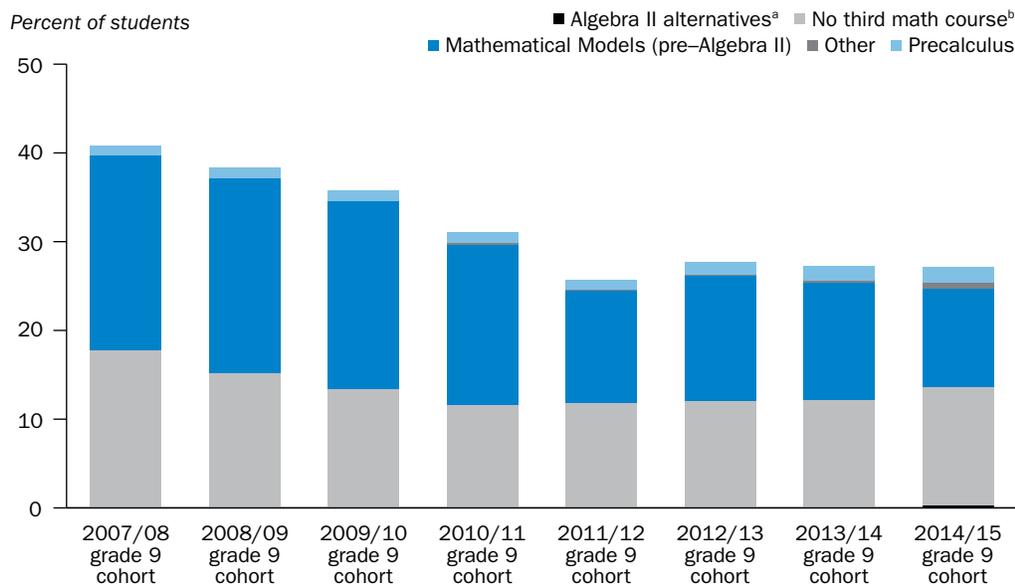
a. Includes Algebraic Reasoning and Statistics (courses created to substitute for Algebra II when the requirement was changed).

b. Includes students who were not taking a math course the year after Geometry or were taking Geometry in grade 11. See box B1 in appendix B for a complete list of third math courses and table C5 in appendix C for the percentage of students who completed the various other math courses.

Source: Authors' analysis based on data from the Texas Education Agency, 2007/08–2014/15.

This study shows that students in the 2014/15 grade 9 cohort—the first cohort to graduate under the new requirements—did not appear to be influenced in their choice of third math course by the HB 5 policy enacted in 2013

Students who did not complete Algebra II after Geometry were taking a pre–Algebra II course, had completed math courses only up through Geometry in the first three years of high school, or completed no math course in the year after Geometry

Cohorts that entered grade 9 before 2010/11 were more likely to have taken the pre–Algebra II course Mathematical Models than any other course as their third math course; however, the percentage of students who took that course decreased over time (figure 7).

Implications of the study findings

HB 5 was designed to provide more flexibility for districts and students while placing greater emphasis on career preparation for students who may not be planning to go to college. This study shows that students in the 2014/15 grade 9 cohort—the first cohort to graduate under the new requirements—did not appear to be influenced in their choice of third math course by the HB 5 policy enacted in 2013. The trend for Algebra II completion and failure rates for the 2014/15 cohort, overall and for student subgroups, was similar to that for the seven cohorts subject to the previous graduation requirements that included Algebra II. Trends by district characteristics also were stable across all cohorts. While HB 5 made room for flexibility in the high school course math curriculum, many districts continued to place students in Algebra II, a math course that is a prerequisite for admission to most colleges and universities in Texas.

Future research could continue to track additional cohorts of students over their high school career to determine whether course-taking patterns change in response to curriculum adjustments that districts may make to address HB 5 or whether taking advantage of the flexibility in course selection translates to other student outcomes, such as dropout rates. For other states making or contemplating similar changes to their graduation requirements, the results of this initial analysis indicate that changes to graduation requirements at the state level do not always translate into immediate changes in practice at the district and school levels or into immediate changes in student outcomes.

Limitations of the study

The study focused on only the first cohort of students who entered high school under the new graduation requirements established by HB 5. Because the outcomes of a new policy may not be realized for several years, including more student cohorts in the analysis could yield different results.

Also, the study timing precluded following the first grade 9 cohort under HB 5 requirements through the fourth year of high school. Ideally, the study would have assessed changes in the percentages of students who completed Algebra II by the end of high school. However, as noted, a majority of students who complete Algebra II do so by the end of grade 11. Following students through all four years of high school would also have enabled analysis of any changes in the rates of high school dropout and enrollment in two-year and four-year colleges. Flexibility in course taking may have a different relationship to dropout rates than did the previous requirement to take three specified math courses that include Algebra II.

Future research could continue to track additional cohorts of students over their high school career to determine whether course-taking patterns change in response to curriculum adjustments that districts may make to address HB 5 or whether taking advantage of the flexibility in course selection translates to other student outcomes, such as dropout rates

Appendix A. Literature review on changes to math graduation requirements

Following publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983), states began to upgrade their graduation requirements in accordance with the report's recommendation that all students complete four years of English, three years of math, three years of science, and three years of social studies. Within the next 10 years, 45 of 50 states raised high school graduation requirements, with the most dramatic increases coming in math and science (Stevenson & Schiller, 1999). A considerable amount of research in the late 1990s and in the 2000s investigated the influence of these higher graduation requirements on students' math course taking and achievement.

Overall, these studies found that high school graduation requirements influenced the level and number of math courses that students completed (Clune & White, 1992; Finn, Gerber, & Wang, 2002; Schiller & Muller, 2003; Teitelbaum, 2003); however, study findings were mixed on whether graduation requirements influenced student achievement. Most studies found that while increases in math level were associated with gains in math achievement, increases in the number of math courses taken were not (Chaney et al., 1997; Teitelbaum, 2003).

Crucially, several studies found that graduation requirements had a disproportionate influence on marginal students (those who completed only the minimum graduation requirements; Chaney et al., 1997) and racial/ethnic minority and economically disadvantaged students (Domina & Saldana, 2011; Saw & Broda, 2012; Schiller & Muller, 2003). For example, using data from the 1990 National Assessment of Educational Progress in conjunction with the corresponding High School Transcript Study, Chaney et al. (1997) found that increasing high school graduation requirements affected course taking for students who completed the minimum number of courses required to graduate. Although a large proportion of students were already exceeding the graduation requirements, and therefore were unaffected by the changes, students in high-requirement schools who completed only the minimum requirements to graduate completed more advanced math and science courses than students in low-requirement schools.[3]

Similarly, Finn et al. (2002) found that students in general or vocational tracks benefited more from increased graduation requirements than students in the academic track did, with students in general or vocational tracks in high-requirement schools taking more higher-level math courses than students in low-requirement schools did. Domina and Saldana (2011) found that the national trend toward academic intensification disproportionately influenced the math course completion patterns of Black and Hispanic students and economically disadvantaged students. Specifically, they found that between 1982 and 2004, due to increased standards, the rates of enrollment in advanced math courses grew faster for Black and Hispanic students than for White students. The odds of completing Algebra II grew faster for Black and Hispanic students than for White students even after the analysis controlled for changes in family background and grade 10 test scores. The authors found similar evidence to suggest that curriculum intensification also boosted the Algebra II completion rates of economically disadvantaged and low-achieving students. Between 1982 and 2004, the gap in Algebra II completion rates between economically disadvantaged and non–economically disadvantaged students narrowed from 16 percentage points to 11, and the Algebra II completion rate for low-achieving students surged by nearly 30 percentage points.

These increases in math course taking have coincided with increasing rates of college enrollment for Black and Hispanic students. Between 1983 and 2011 the percentage of recent high school graduates who enrolled in a two- or four-year college rose from 38 percent to 67 percent for Black students and from 54 percent to 67 percent for Hispanic students. These patterns suggest that increases in high school graduation requirements have had an influence on college preparation and enrollment for these students (Snyder & Dillow, 2012). Research has shown that racial/ethnic minority and economically disadvantaged students are especially likely to have insufficient access to college preparatory courses and to early and high-quality college counseling (Adelman, 1999, 2006; Venezia, Kirst, & Antonio, 2003).

Nationally, Black and Hispanic high school seniors are considerably less likely than White students to graduate with the coursework, grades, and test scores that would even minimally qualify them for admission to a four-year college (Adelman, 1999; Warburton, Bugarin, Nuñez, & Carroll, 2001). For example, Greene and Forster (2003) found that only 20 percent of Black students and 16 percent of Hispanic students leave high school ready for college, while Cabrera and La Nasa (2001) found that 71 percent of economically disadvantaged students lack the qualifications for college admission. Similarly, Venezia et al. (2003) found that few racial/ethnic minority families and students understood what is needed for entrance to college, and several studies have shown that urban and first-generation college students are especially dependent on their teachers and other nonfamilial adults in making education plans and decisions (Howard, 2003; Stanton-Salazar, 1997; Warburton et al., 2001; Wimberly, 2002).

Taken together, these studies suggest that high school graduation requirements can have a significant influence on students' course-taking patterns, particularly for racial/ethnic minority, economically disadvantaged, and low-achieving students, who are likely to be first-generation college-goers whose parents do not have experience with college admissions or success (Howard, 2003; Stanton-Salazar, 1997; Venezia et al., 2003). Thus, removal of Algebra II as a state high school graduation requirement could have a negative effect on the number of racial/ethnic minority and economically disadvantaged students who graduate ready for college.

Appendix B. Data and methodology

This appendix describes the data and methodology used in the study.

Data

This study used district-level responses to a statewide online survey administered as part of an evaluation of Texas House Bill (HB) 5 conducted in spring 2015 that were provided by the Texas Education Agency (TEA) as well as longitudinal student- and district-level datasets from TEA. Specifically, the study used data from TEA's Public Education Information Management System (PEIMS), statewide student assessment files, and Texas Academic Performance Report (TAPR) files. PEIMS contains student-level data on student enrollment and demographic characteristics, special program participation, and course completion data. Statewide assessment files contain scores and proficiency levels from the State of Texas Assessment of Academic Readiness (STAAR™), and TAPR files contain organizational data for schools and districts.

Table B1. Data files and variables, 2007/08–2014/15

Source	Years of data	Variable
Texas Education Agency (TEA) House Bill 5 district implementation survey	Spring 2015	School year District ID Survey questions
TEA Public Education Information Management System (PEIMS) student enrollment data	2007/08–2016/17	School year School ID Student ID Grade level Race/ethnicity Gender Free or reduced-price lunch eligibility English learner status Participation in special education
TEA PEIMS student course completion data	2007/08–2016/17	School year School ID Student ID Course name Course grade Course subject area Advanced course (yes/no)
State of Texas Assessment of Academic Readiness assessment data	2011/12–2014/15	School year School ID Student ID Grade level Subject or end-of-course assessment Scale score Performance standards (Level III: Advanced, Level II: Satisfactory, Level I: Unsatisfactory)
Texas Academic Performance Reports data	2007/08–2015/16	District ID District percentage of students by race/ethnicity District percentage of students eligible for federal school lunch program District community type[a] Education Service Center region

a. See table B2 for definitions of community types.

Source: Authors' compilation.

To answer research question 1 on how districts are implementing the new graduation requirements, the study used data provided by TEA from a district-level survey, administered in spring 2015, for an evaluation of HB 5 commissioned by the legislature. The survey items of interest to this study focused on the following:

- How districts communicated with parents and students about the new high school graduation requirements, including how they introduced the endorsements offered in the district, the course requirements to complete the endorsements, and the steps taken to help parents and students select an endorsement.
- Whether districts were encouraging students to complete the Distinguished Level of Achievement by requiring them to complete Algebra II.
- Which of the Algebra II replacement courses, if any, districts planned to offer students.

The survey was administered from late March to early May 2015 through a unique hyperlink in an email sent to all superintendents of public school districts in Texas (including charter school districts) that included at least one school with grades 9–12. Superintendents could designate one or more staff to complete the survey on their behalf. The survey consisted of 44 fixed and open-ended response items. The study team obtained access to survey responses through a public information request to TEA. A copy of the survey is in appendix A of the evaluation report available on TEA's website.[4]

To answer research questions 2–4 on trends in Algebra II completion and failure rates and on what third math course students took, the study used data on students enrolled in Texas public high schools during 2007/08–2016/17 provided by TEA: linked longitudinal student-level data on course completion, course failure, math achievement, and demographic characteristics. Students who first entered grade 9 in 2007/08–2014/15 were followed longitudinally to assess trends in Algebra II completion rates, Algebra II failure rates, and non–Algebra II third math course completion rates over time. District-level characteristics used in the comparisons were obtained from the publicly available Texas Academic Performance Reports housed on TEA's website. Table B2 describes TEA's classification of districts by community type.

Of the 1,098 Texas K–12 districts with a high school, 890 completed the survey used to answer research question 1, for a response rate of 81 percent. The school districts responding to the survey were representative of all school districts in the state on characteristics such as district community type, district size, state accountability rating in the 2013/14 school year, and student demographic group proportions in the district, including economically disadvantaged students, English learner students and students in special education, and race/ethnicity (table B3).

For research questions 2–4, the study followed eight cohorts of grade 9 students who entered a Texas public school during 2007/08–2014/15 and had the opportunity to complete Algebra II by the end of grade 11 in 2009/10–2016/17.[5] Only students who were continuously enrolled in any Texas public high school for three consecutive years were included in the analyses so that the study could accurately assess whether students had completed or failed Algebra II or any other potential math courses by the end of grade 11. The 2014/15 cohort is the first cohort to graduate under the new Foundation High School Program requirement (see in box 1 in the main text). Earlier cohorts graduated under the Minimum, Recommended, or Distinguished Graduation Program requirements. Table B4

Table B2. Texas Education Agency's district community type classification, 2014/15

Community type (number of districts)	Description
Charter school district (195)	Charter school districts are open-enrollment districts chartered by the commissioner of education, with final approval for operation provided by the State Board of Education. Established by the Texas Legislature in 1995 to promote local initiative, charter school districts are subject to fewer regulations than other public school districts. Generally, charter school districts are subject to laws and rules that ensure fiscal and academic accountability but do not unduly regulate instructional methods or pedagogical innovation. Like other public school districts, charter school districts are monitored and accredited under the statewide testing and accountability system.
Independent town (70)	A district that (a) does not meet the criteria for classification in any of the previous subcategories, (b) is in a county with a population of 25,000–99,999, and (c) has an enrollment that is the largest in the county or is at least 75 percent of the largest district enrollment in the county.
Major suburban (79)	A district that (a) does not meet the criteria for classification as major urban, (b) is contiguous to a major urban district, and (c) has an enrollment that is at least 3 percent of the enrollment in the largest contiguous major urban district or with at least 4,500 students. Alternatively, a district that (a) does not meet the criteria for classification as major urban, (b) it is not contiguous to a major urban district, (c) is in the same county as a major urban district, and (d) has an enrollment that is at least 15 percent of the enrollment in the largest major urban district in the county or with at least 4,500 students.
Major urban (11)	A district that (a) is located in a county with a population of at least 900,000, (b) has an enrollment that is the largest in the county or is at least 75 percent of the largest district enrollment in the county, and (c) has an enrollment that is at least 35 percent students who are economically disadvantaged.
Nonmetropolitan, fast growing (30)	A district that (a) does not meet the criteria for classification in any of the previous subcategories, (b) has an enrollment of at least 300 students, and (c) has an enrollment that has increased by at least 20 percent over the past five years.
Nonmetropolitan, stable (177)	A district that (a) does not meet the criteria for classification in any of the previous subcategories and (b) has an enrollment that is equal to or greater than the median district enrollment for the state.
Other central city (41)	A district that (a) does not meet the criteria for classification in either of the previous subcategories, (b) is not contiguous to a major urban district, (c) is in a county with a population of 100,000–899,999, and (d) has an enrollment that is the largest in the county or is at least 75 percent of the largest district enrollment in the county.
Other central city, suburban (163)	A district that (a) does not meet the criteria for classification in any of the previous subcategories, (b) is in a county with a population of 100,000–899,999, and (c) has an enrollment that is at least 15 percent that of the largest district enrollment in the county. Alternatively, a district that (a) does not meet the criteria for classification in any of the previous subcategories, (b) is contiguous to another central city district, (c) has an enrollment that is at least 3 percent of the enrollment in the contiguous other central city district, and (d) has an enrollment that is equal to or greater than the median district enrollment for the state of 864 students.
Rural (453)	A district that (a) does not meet the criteria for classification in any of the previous subcategories and has either (a) an enrollment of between 300 and the median district enrollment for the state and an enrollment growth rate over the past five years of less than 20 percent or (b) an enrollment of fewer than 300 students.

Source: Adapted from Texas Education Agency website: http://tea.texas.gov/acctres/analyze/1415/level.html.

compares the characteristics of the students in each of the cohorts. Table B5 presents the characteristics of districts in which students in each cohort are enrolled.

Methodology

To answer research question 1, the study team used descriptive statistics to describe how districts in Texas are responding to HB 5 with regard to advanced math course offerings and dissemination of information about the new graduation requirements.

To answer research questions 2 and 3 on trends in outcomes, the study team calculated Algebra II completion and failure rates by the end of grade 11 for students in public high

Table B3. Characteristics of Texas districts responding to the House Bill 5 evaluation survey, spring 2015

District characteristic	Percent of responding districts	Percent of all districts in the state
Community type[a]		
Charter school district	11.9	16.4
Independent town	6.6	5.7
Major suburban	6.9	6.5
Major urban	0.8	1.0
Nonmetropolitan, fast growing	3.3	2.6
Nonmetropolitan, stable	16.4	14.8
Other central city	3.6	3.3
Other central city, suburban	13.6	13.5
Rural	36.5	36.3
District size (enrollment)		
50,000 or more students	1.9	1.5
25,000–49,999 students	3.5	2.5
10,000–24,999 students	5.1	4.7
5,000–9,999 students	6.9	5.7
3,000–4,999 students	8.5	7.4
1,600–2,999 students	11.8	11.2
1,000–1,599 students	13.0	11.8
500–999 students	19.7	20.1
Fewer than 500 students	29.2	35.0
State accountability rating		
Districts that met standard	89.4	87.4
Districts that met alternative standard	2.1	2.8
Districts with improvement required	7.3	9.0
Districts not rated	0.7	0.8
Student demographics		
Economically disadvantaged	60.1	60.2
English learner student	17.8	17.5
In special education program	8.7	8.5
American Indian	0.4	0.4
Asian	4.0	3.8
Black	12.8	12.7
Hispanic	51.9	51.8
Two or more races/ethnicities	1.8	1.7
White	29.1	29.4

Note: Of the 1,098 Texas K–12 districts with a high school, 890 (81 percent) completed the survey. Values may not sum to 100 because four districts were missing district characteristic data or had rounding error.

a. See table B2 for definitions of district community types.

Source: Adapted from American Institutes for Research (2015).

Table B4. Characteristics of incoming grade 9 students in sample Texas districts, by 2007/08–2014/15 grade 9 cohort

Student characteristic		Incoming grade 9 cohort							
		2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Total	Number	324,988	323,104	328,655	330,260	335,544	344,666	352,015	364,923
Gender									
Female	Percent	48.5	48.3	48.3	48.4	48.5	48.3	48.7	48.5
	Number	57,459	156,054	158,839	159,827	162,818	166,586	171,319	177,194
Male	Percent	51.6	51.7	51.7	51.6	51.5	51.7	51.3	51.4
	Number	167,529	167,050	169,816	170,433	172,726	178,080	180,696	187,729
Race/ethnicity									
Asian	Percent	3.3	3.5	3.4	3.7	3.8	3.7	3.7	4.0
	Number	10,638	11,296	11,296	12,178	12,812	12,824	13,144	14,637
Black	Percent	14.9	14.5	13.4	13	13.1	13	12.9	12.7
	Number	48,532	46,944	43,995	42,911	43,783	44,932	45,402	46,530
Hispanic	Percent	45.2	45.9	47.8	48.7	49.3	50.2	50.6	51.1
	Number	146,884	148,283	157,142	160,955	165,511	173,155	177,999	186,665
Other	Percent	0.3	0.3	2.0	2.0	2.0	2.0	2.1	2.1
	Number	1,070	1,056	6,735	6,633	6,742	7,082	7,289	7,608
White	Percent	36.3	35.8	33.3	32.6	31.8	31	30.7	30
	Number	117,864	115,525	109,487	107,583	106,696	106,673	108,181	109,483
Other									
In special education	Percent	11.1	10.9	10.3	9.6	8.9	8.7	8.4	8.3
	Number	35,917	35,168	33,934	31,687	29,966	29,818	29,529	30,346
English learner student	Percent	7.9	7.0	6.8	6.9	6.6	6.8	7.2	8.3
	Number	25,816	22,574	22,226	22,848	22,149	23,275	25,433	30,203
Economically disadvantaged (eligible for federal school lunch program)	Percent	43.3	43.7	46.0	45.8	46.6	47.1	46.9	45.9
	Number	140,751	141,234	151,317	151,322	156,466	162,180	164,969	167,649
Grade 8 math achievement[a]									
High-achieving students	Percent	na	na	na	na	na	11.2	12.2	14.8
	Number	na	na	na	na	na	38,684	42,853	53,989
Low-achieving students	Percent	na	na	na	na	na	50.6	47.3	46.2
	Number	na	na	na	na	na	174,496	166,346	168,548

na is not applicable because the State of Texas Assessment of Academic Readiness (STAAR™) was not implemented until 2011/12.

a. High-achieving students scored at the Level III: Advanced standard and low-achieving students scored below the Level II: Satisfactory standard on the Grade 8 STAAR Mathematics or Algebra I end-of-course exam.

Note: Percentages may not sum to 100 because of rounding.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Table B5. Characteristics of sample districts in which grade 9 students were enrolled, by 2007/08–2014/15 grade 9 cohort

District characteristic		Incoming grade 9 cohort							
		2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Student demographics[a]									
High–racial/ethnic minority	Percent	53	52.1	51.6	51	50.8	51	50.1	51.7
	Number	334	337	340	344	340	341	342	340
Low–racial/ethnic minority	Percent	13.5	13.8	13.7	14.3	13.6	13.3	13.4	12.8
	Number	379	384	379	379	377	376	375	375
High poverty	Percent	38.5	37.4	37.5	36.4	37.3	37.5	37.9	37.2
	Number	335	342	343	350	342	349	348	348
Low poverty	Percent	34.9	36.1	37.6	37.4	35.8	35.6	36.5	36.9
	Number	370	377	378	373	371	372	365	366
Community type[b]									
Charter school district	Percent	1.3	1.5	1.8	2.1	2.3	2.7	3.1	3.5
	Number	115	126	131	128	124	127	126	121
Independent town	Percent	5.9	5.4	5.8	5.6	5.2	5.0	4.8	4.9
	Number	70	71	71	68	70	70	67	70
Major suburban	Percent	34.0	34.2	34.5	34.7	35.2	34.3	34.1	34.1
	Number	78	78	78	78	79	80	79	79
Major urban	Percent	18.5	18.4	17.8	17.5	17.3	18.1	17.9	17.9
	Number	10	10	10	10	10	11	11	11
Nonmetropolitan, fast growing	Percent	1.4	1.3	1.6	1.5	0.8	0.7	0.8	0.5
	Number	20	21	29	27	27	31	30	28
Nonmetropolitan, stable	Percent	7.5	7.0	6.8	6.7	6.0	5.6	5.6	5.8
	Number	228	227	217	213	192	182	182	177
Other central city	Percent	15.2	15.3	15.1	15.2	15.9	16.0	16.2	15.9
	Number	39	39	38	38	40	41	41	41
Other central city, suburban	Percent	13.1	14.0	13.5	13.7	14.1	14.3	14.3	14.2
	Number	152	154	151	151	161	165	164	163
Rural	Percent	3.1	2.9	3.1	3.1	3.1	3.2	3.2	3.2
	Number	377	375	381	393	397	396	401	407
Region									
Central	Percent	10.3	10.4	10.6	10.6	10.3	10.4	10.5	10.7
	Number	140	142	142	142	140	144	143	143
East	Percent	27.3	27.3	27.2	27.1	27.3	27.2	27.4	27.7
	Number	162	166	163	161	161	161	160	161
West	Percent	6.7	6.7	6.6	6.6	6.4	6.3	6.2	6.0
	Number	92	92	93	93	92	90	90	90
North	Percent	31.4	31.3	31.5	31.5	31.7	31.6	31.6	31.5
	Number	357	359	360	362	360	362	363	360
Panhandle	Percent	4.2	4.1	4.2	4.2	4.1	4.1	4.2	4.1
	Number	160	161	160	161	160	160	160	158
South	Percent	20.1	20.1	19.8	19.9	19.9	20.1	19.9	19.8
	Number	178	181	188	187	187	186	185	185

a. High–racial/ethnic minority districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students whose race/ethnicity is Black, Hispanic, or other; low–racial/ethnic minority districts are in the bottom third of the distribution. High-poverty districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students classified as economically disadvantaged; low-poverty districts are in the bottom third of the distribution.

b. See table B2 for definitions of district community types.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

schools in Texas by cohort. Differences in trends by gender, race/ethnicity, economically disadvantaged status, and achievement on grade 8 math standardized test on the State of Texas Assessment of Academic Readiness (STAAR™) were calculated, as well as differences in trends by district characteristics including percentage of racial/ethnic minority students, percentage of economically disadvantaged students, district community type, and Texas region (see definitions in box 1 in the main text). Each district in Texas reports to one of 20 Education Service Center regions in the state; these were then categorized into six major regions of the state (map B1).

Finally, to answer research question 4, the study team identified the third math courses students completed after Geometry. If students had not completed a third math course by the end of grade 11, the math course that students completed in grade 11 was reported. Then differences in the percentages of students completing each course for each cohort of students were examined. Box B1 lists the math courses approved by the Texas State Board of Education that fulfill the third math course requirement for high school graduation.

Map B1. Texas Education Service Centers by region, 2017
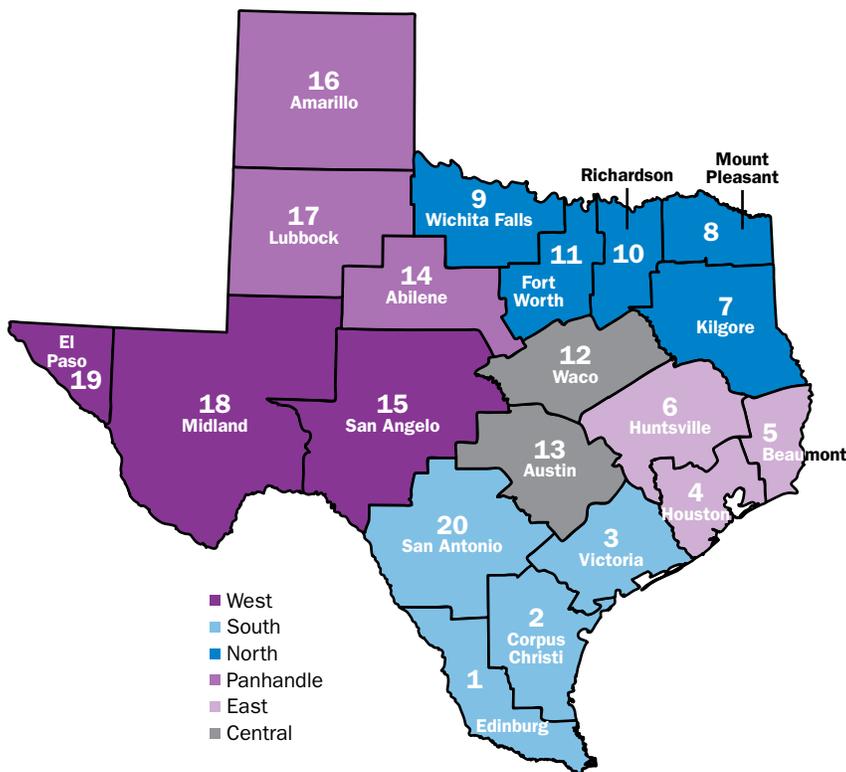
Source: Authors' compilation using Texas Education Agency data.

Box B1. Courses that Texas public high school students may complete to fulfill the third math course requirement under House Bill 5 since 2014/15

- Accounting II
- Advanced Placement Computer Science
- Advanced Placement or International Baccalaureate Mathematics Course
- Advanced Quantitative Reasoning
- Algebra II
- Algebraic Reasoning
- Applied Mathematics for Technical Professionals
- Digital Electronics
- Discrete Mathematics for Computer Science
- Discrete Mathematics for Problem Solving
- Engineering Mathematics
- Financial Mathematics
- Independent Study in Mathematics
- Manufacturing Engineering Technology II
- Mathematical Applications in Agriculture, Food and Natural Resources
- Mathematical Models with Applications
- Mathematics for Medical Professionals
- Precalculus
- Robotics II
- Robotics Programming and Design
- Statistics
- Statistics and Business Decision Making
- After the successful completion of Algebra II, a math course endorsed by an institution of higher education as a course for which the institution would award course credit or recognized as a prerequisite for a course for which the institution would award course credit.
- After the successful completion of Algebra I and Geometry, a locally developed math course or other activity, including an apprenticeship or training hours needed to obtain an industry-recognized credential or certificate.

Source: Texas Administrative Code, § 74.12 (2017).

Appendix C. Detailed results tables

This appendix includes tables with additional details on the findings presented in the main body of the report, as well as results by student subgroups. Table C1 presents the percentage of students who completed Algebra II, by student characteristics and grade 9 cohort.

Table C1. Percentage of Texas high school students who completed Algebra II by the end of grade 11, by student characteristics and 2007/08–2014/15 grade 9 cohort

Student characteristic	Incoming grade 9 cohort							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Total	63.1	65.4	67.8	71.9	78.2	76.9	77.8	78.2
Gender								
Female	66.3	69.2	71.4	75.4	81.9	80.7	81.8	82.1
Male	60.1	62.0	64.4	68.7	74.8	73.3	74.2	74.5
Race/ethnicity								
Asian/Pacific Islander	86.8	86.5	87.1	89.2	91.9	90.9	91.4	92.6
Black	53.4	55.8	57.5	62.6	70.8	69.4	70.7	71.3
Hispanic	59.2	62.3	65.3	70.1	77.2	75.6	77.0	77.1
Other	63.9	63.8	70.5	73.3	78.8	78.1	78.6	78.3
White	69.9	71.4	73.3	76.4	81.4	80.3	80.8	81.1
Economically disadvantaged status								
Eligible for federal school lunch program	54.2	56.6	59.4	64.6	72.2	70.2	71.6	71.9
Not eligible for federal school lunch program	69.9	72.3	74.9	78.1	83.6	82.8	83.4	83.5
Grade 8 math achievement[a]								
Low-achieving students	na	na	na	na	na	70.1	70.8	70.7
High-achieving students	na	na	na	na	na	98.9	98.9	98.7

na is not applicable because the State of Texas Assessment of Academic Readiness (STAAR™) was not implemented until 2011/12.

a. High-achieving students scored at the Level III: Advanced standard, and low-achieving students scored below the Level II: Satisfactory standard on the Grade 8 STAAR Mathematics or Algebra I end-of-course exam.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Table C2 presents the percentage of students who completed Algebra II, by district characteristics and grade 9 cohort.

Table C2. Percentage of Texas high school students who completed Algebra II by the end of grade 11, by district characteristics and 2007/08–2014/15 grade 9 cohort

District characteristic	Incoming grade 9 cohort							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Student demographics[a]								
High–racial/ethnic minority	60.5	62.6	65.8	69.4	74.2	73.6	75.3	75.4
Low–racial/ethnic minority	61.6	62.2	66.7	71.0	76.0	73.8	74.7	75.7
High poverty	60.2	61.2	64.8	68.4	73.1	73.2	75.0	74.2
Low poverty	64.3	65.2	67.6	73.1	77.5	75.4	77.0	77.8
Community type[b]								
Charter school district	57.9	57.0	63.4	65.7	67.3	68.8	70.6	70.9
Independent town	57.0	58.6	60.6	64.3	71.6	68.2	70.4	71.3
Major suburban	63.4	65.2	67.4	72.5	78.8	78.4	79.6	79.9
Major urban	66.2	70.7	72.2	76.4	82.8	82.9	83.7	84.2
Nonmetropolitan, fast growing	63.1	70.0	67.7	72.4	75.6	79.6	78.1	80.3
Nonmetropolitan, stable	58.0	59.3	63.0	66.2	73.1	69.7	71.8	73.5
Other central city	58.7	61.8	64.9	70.2	77.3	74.9	76.2	75.3
Other central city, suburban	61.2	63.1	66.2	70.5	77.5	74.3	75.2	74.6
Rural	63.6	63.9	67.6	70.6	76.3	74.0	75.5	75.2
Region								
Central	59.9	60.8	64.4	68.2	74.0	73.5	77.9	76.8
East	61.3	62.7	65.0	68.1	73.1	73.4	73.0	72.8
North	59.5	60.0	63.8	68.0	74.5	72.0	74.0	74.3
Panhandle	64.3	64.3	68.0	71.4	77.2	75.5	75.2	74.7
South	60.6	62.9	66.9	70.6	75.4	72.5	74.0	74.8
West	61.6	63.4	67.3	68.3	75.7	71.9	73.0	75.9

a. High–racial/ethnic minority districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students whose race/ethnicity is Black, Hispanic, or other; low–racial/ethnic minority districts are in the bottom third of the distribution. High-poverty districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students classified as economically disadvantaged; low-poverty districts are in the bottom third of the distribution.

b. See table B2 in appendix B for definitions of district community types.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Table C3 presents the percentage of students who failed Algebra II, by student characteristics and grade 9 cohort.

Table C3. Percentage of Texas high school students who failed Algebra II, by student characteristics and 2007/08–2014/15 grade 9 cohort

Student characteristic	Incoming grade 9 cohort							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Total	14.6	13.5	13.9	14.2	16.6	15.8	15.3	15.3
Gender								
Female	11.8	11.0	11.2	11.3	13.3	12.7	12.2	12.3
Male	17.4	16.2	16.6	17.1	20.0	19.0	18.4	18.4
Race/ethnicity								
Asian	7.9	6.9	6.4	6.1	7.2	7.3	6.4	5.8
Black	18.1	16.0	16.5	16.2	19.0	18.7	17.9	17.7
Hispanic	19.2	17.8	18.1	18.4	21.0	19.8	18.9	19.1
Other	12.4	12.8	11.6	12.2	14.0	13.8	13.6	13.0
White	9.4	8.6	8.7	9.0	10.7	10.0	9.9	9.7
Economically disadvantaged status								
Eligible for federal school lunch program	19.2	17.5	17.8	17.9	20.4	19.3	18.8	19.2
Not eligible for federal school lunch program	11.9	11.1	11.2	11.6	13.7	13.3	12.6	12.4
Grade 8 math achievement[a]								
Low-achieving students	na	na	na	na	na	22.2	22.1	22.5
High-achieving students	na	na	na	na	na	3.2	3.5	3.6

na is not applicable because the State of Texas Assessment of Academic Readiness (STAAR™) was not implemented until 2011/12.

a. High-achieving students scored at the Level III: Advanced standard and low-achieving students scored below the Level II: Satisfactory standard on the Grade 8 STAAR Mathematics or Algebra I end-of-course exam.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Table C4 presents the percentage of students completing Algebra II who failed Algebra II, by district characteristics and grade 9 cohort.

Table C4. Percentage of Texas high school students completing Algebra II who failed Algebra II, by district characteristics and 2007/08–2014/15 cohort

District characteristic	Incoming grade 9 cohort							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Student demographics[a]								
Low–racial/ethnic minority	7.1	6.2	6.2	6.1	8.0	7.1	7.5	7.4
High–racial/ethnic minority	15.4	15.3	14.8	14.4	16.8	15.5	15.7	15.7
High poverty	14.3	14.5	13.7	12.7	15.7	14.1	13.6	14.7
Low poverty	8.1	7.5	6.8	7.6	9.1	7.8	7.8	8.2
Community type[b]								
Charter school district	20.9	21.2	17.7	17.7	17.5	15.6	16.0	17.3
Independent town	10.8	10.8	11.5	10.5	12.6	11.3	12.2	11.2
Major suburban	13.4	12.3	12.4	13.4	15.8	14.6	15.1	15.2
Major urban	19.8	17.1	17.3	18.1	18.8	18.9	18.1	18.4
Nonmetropolitan, fast growing	9.4	10.1	6.1	7.0	9.9	5.5	10.9	8.6
Nonmetropolitan, stable	10.0	8.7	8.9	9.1	11.1	11.3	10.5	10.6
Other central city	13.8	12.9	13.9	14.5	18.0	16.4	16.2	16.0
Other central city, suburban	9.7	9.6	10.1	9.6	12.4	11.2	11.2	11.4
Rural	6.1	6.2	6.6	6.2	8.0	6.8	7.1	7.4
Region								
Central	10.2	10.2	10.7	10.3	10.9	10.0	11.5	11.4
East	13.6	11.8	10.2	11.4	13.2	12.8	12.4	10.9
North	9.1	9.2	8.5	8.0	10.3	9.6	10.2	10.4
Panhandle	5.9	6.1	7.5	6.7	9.2	7.7	7.0	7.4
South	14.4	14.4	13.9	13.8	16.0	14.1	13.6	14.3
West	7.9	7.9	9.1	9.5	10.1	8.2	9.6	11.0

a. High–racial/ethnic minority districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students whose race/ethnicity is Black, Hispanic, or other; low–racial/ethnic minority districts are in the bottom third of the distribution. High-poverty districts are in the top third of the distribution of all Texas districts in the percentage of enrolled students classified as economically disadvantaged; low-poverty districts are in the bottom third of the distribution.

b. See table B2 in appendix B for definitions of district community types.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Table C5 presents the percentages of students who completed various math courses after Geometry by grade 9 cohort.

Table C5. Types of third math courses that Texas high school students completed after Geometry, by 2007/08–2014/15 grade 9 cohort

Course type	Incoming grade 9 cohort							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Algebra II	59.2	61.6	64.2	68.9	74.3	72.3	72.8	72.8
Algebra II alternatives	na	na	na	na	na	na	0.1	0.3
Mathematical Models with Applications	22.0	21.9	21.1	18.0	12.6	14.1	13.3	11.1
Precalculus	1.1	1.3	1.2	1.3	1.1	1.4	1.6	1.9
Other	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.6
No third math course[a]	17.7	15.2	13.4	11.6	11.8	12.0	12.0	13.3

na is not applicable because students were required to take Algebra II as their third math course until the 2013/14 cohort.

a. Includes students who were not taking a math course the year after Geometry or were taking Geometry in grade 11.

Source: Authors' analysis based on data from Texas Education Agency, 2007/08–2014/15.

Notes

1. High grade 8 math achievement means that a student scored at the Level III: Advanced standard on the grade 8 State of Texas Assessments of Academic Readiness Mathematics or Algebra I end-of-course exam.

2. The majority of students begin Algebra I in grade 9 and take Algebra II in grade 11 if they follow a normal progression and pass each prerequisite course. However, some students take Algebra I in grade 7 or 8, and a few students wait until grade 10.

3. High-requirement schools are those in which students must complete at least three years of math and science courses in order to graduate, whereas low-requirement schools are those in which students are required to complete fewer than three math and science courses to graduate.

4. For a copy of the survey see TEA's evaluation report at http://tea.texas.gov/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=25769823287&libID=25769823385.

5. Grade-level retention in Texas high schools does not necessarily represent the repetition of a full year, because high school programs are structured around individual courses. So although high school students may be retained in a grade level from one year to the next, they may only need to repeat a single course and could catch up the following year (Texas Education Agency, 2017).

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