

TECHNICAL BRIEF

Technical appendix for:

Getting Algebra Placement Right: Expanding Opportunity and Strengthening Preparation

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1. Introduction

The purpose of this technical appendix is to share detailed results and to more fully describe the sample and methods used in the research included in the brief *Getting Algebra Placement Right: Expanding Opportunity and Strengthening Preparation*. We investigated two main research questions in this brief:

1. What percentage of students are ready for and enroll in Algebra in 8th grade?
2. Which students do better by taking Algebra in 8th grade compared to delaying enrollment until 9th grade?

2. Data

Sample

In this study, we follow a cohort of 7th grade students in the 2022-23 school year to the spring of 9th grade in 2024-25. To be included in the study, students must have met the following three criteria:

1. have observed MAP Growth 6+ Math test scores in the fall and spring of 7th grade (fall 2022 and spring 2023),
2. have an observed spring MAP Growth Algebra test score in either the spring of 8th grade (spring 2024) or spring of 9th grade (spring 2025), but not both years (e.g., they did not repeat Algebra), and
3. attended a middle school where students had the opportunity to enroll in Algebra in either 8th or 9th grade (e.g., the course is offered in both grades).

In total, our analytic sample contained 55,600 students in 452 schools. Table 1 shows the descriptive characteristics of the overall sample as well as the characteristics broken out by whether students enrolled in Algebra in 8th or 9th grade. Using data from the [Common Core of Data](#), Table 2 compares the school-level descriptive statistics of our analytic sample compared to the population of K-8 public schools in 2024-25. The sample of students used in this study was more Latino, more urban, less white, and less suburban and less rural.

Assessments

MAP Growth 6+ Math test

The MAP Growth data for this study are from the NWEA anonymized longitudinal student achievement database. School districts use [NWEA® MAP® Growth™](#) assessments to monitor elementary and secondary students' reading and math achievement and gains, with assessments typically administered in the fall (usually between August and November), winter (usually December to March), and spring (late March through June). The MAP Growth 6+ math test measures general math achievement, focusing primarily on state standards in middle school and high school grades. Test scores are reported in RIT score units. In our study, we use MAP Growth 6+ math test scores for the fall and spring of 7th grade in 2022-23.

MAP Growth Algebra test

The MAP Growth Algebra test is designed specifically to assess Algebra content for students enrolled in a middle or high school Algebra 1 course. Test scores on the MAP Growth Algebra test are also reported in RIT score units, but the scale is not directly comparable to the MAP Growth 6+ math test. In our study, we use MAP Growth Algebra test scores from the

spring of 8th (spring 2024) and 9th grade (spring 2025). We also infer course enrollment timing based on the grade in which an observed MAP Growth Algebra test is taken.

3. Determining Algebra Readiness and Proficiency Cut Scores

Algebra Readiness Cut Score

The Algebra Readiness benchmark is used before students enroll in Algebra to help identify students who appear academically prepared for the course. In this brief, a student is considered ready for Algebra if their MAP Growth 6+ Math score is associated with at least a 50% probability of scoring proficient or higher on a state Algebra end-of-course assessment. We use a 50% threshold as a practical benchmark for placement decisions because it identifies students with at least an even chance of meeting state proficiency standards.

[Linking studies](#) conducted by NWEA that connect **MAP Growth 6+ Math test scores to state Algebra end-of-courses** tests used to establish the readiness benchmark. Specifically, there are updated Math 6+ to Algebra end-of-course cut scores in four states: [Georgia](#) (237), [North Carolina](#) (242), [Ohio](#) (237), and [Texas](#) (236). Appendix A lists the specific linking study table used in this study. The median of the cut scores for 7th grade spring across the four states is a RIT score of **237**.

Algebra Proficiency Cut Score

The Algebra Proficiency benchmark is used after students complete their spring MAP Growth Algebra test to interpret their course outcomes. The proficiency benchmark represents the MAP Growth Algebra score associated with a 90% probability of scoring proficient on the state end-of-course Algebra assessment. Because this benchmark is used to identify students who are highly likely to meet state standards, it uses a more stringent probability threshold.

A different set of linking studies that connect **MAP Growth 6+ Algebra test scores to state end-of-courses Algebra** tests used to establish the readiness benchmark. Specifically, there are updated MAP Growth Algebra to Algebra end-of-course linking studies in five states: [Georgia](#), [Florida](#), [New York](#), [Ohio](#), and [Texas](#) (see Appendix B). Across states, an MAP Growth Algebra RIT score of **241** approximately represents the 90th percentile and is the cut score we use to determine Algebra Proficiency.

4. Methods

RQ1. Algebra Readiness & Enrollment

To get a national estimate of the proportion of students who are ready to enroll in Algebra in 8th grade, we used the [2025 MAP Growth norms](#) to see what percentage of students had a 7th grade spring math score that met or exceeded the 237 readiness cut score. According to the 2025 norms, the 7th grade spring math mean score is 223.85 (standard deviation of 19.29). Assuming a normal distribution of student achievement, we would expect approximately 25% of students nationally meet or exceed the Algebra Readiness cut score.

Next, we looked at the Algebra enrollment patterns of 16,800 students in our analytic sample that met or exceeded the cut score of 237 in the spring of 7th grade. Within this group of likely ready students, a quarter were enrolled in algebra in 9th grade-, and three/quarters enrolled in algebra in 8th grade .

RQ2. Algebra Timing

We estimated a set of school-fixed-effects regression models to examine the association between the timing of Algebra course-taking (8th or 9th grade) and MAP Growth Algebra test scores, controlling for 7th grade math achievement and other key covariates. All models included fixed effects for school to control for observed and unobserved, time-invariant school characteristics.

Overall Algebra Timing Impact

First, we estimated the overall impact of Algebra timing on Algebra test scores with and without controls for prior achievement. Across all models, the dependent variable was students' MAP Growth Algebra test score in the spring of the year they took Algebra. In the first model, we only included an indicator of Algebra timing without any additional covariates (1= Algebra taken in 8th grade, 0 = Algebra taken in 9th grade). In the second model, we add covariates for spring 7th grade mathematics achievement, fall-to-spring 7th grade mathematics gain, and controls for the calendar week in which fall and spring assessments were administered. In our final model, we included a set of student-level covariates (race/ethnicity and gender indicators). Standard errors were clustered at the school level to account for within school correlation.

Table 3 presents the regression coefficients from these school fixed effect regression models. Before controlling for prior achievement, we observed a significant and sizable improvement in Algebra test scores for students enrolling in 8th grade Algebra (see Model 1 column in Table 3). However, most of that improvement disappears after controlling for prior math achievement (see Model 2 column). These results illustrate the importance of prior achievement in moderating the impacts of Algebra timing.

Algebra Timing Impact by 7th Grade Decile

To better understand how the impact of Algebra timing varied by prior achievement, we also ran our outcome model separately by 7th grade spring decile. Within each decile, we regressed MAP Growth Algebra test score in the spring of the year they took Algebra on an indicator for whether Algebra taken in 8th grade, the timing of the assessments, a set of student-level covariates (race/ethnicity and gender indicators), and a set of 8th grade school covariates of school percent in poverty, region, and percent of students in different racial/ethnic groups within schools. The coefficients for these regressions are included in Table 4. To make these results more accessible, we calculated the predicted achievement score for each 7th grade decile by algebra timing based on the sample means for each of the covariates in the model. These predicted values are plotted in Figure 2 of the main brief.

Table 1. Descriptive statistics for the analytic sample

	Full Sample		8th Grade Algebra Students		9th Grade Algebra Students	
	Mean	SD	Mean	SD	Mean	SD
MAP Growth spring Algebra test score	238.76	20.14	250.21	16.35	232.53	19.25
7th grade spring math score	227	17.47	239.65	14.96	220.12	14.68
7th grade fall-spring gain score	8.05	8.11	9.55	7.69	7.23	8.21
Female	0.49	0.5	0.49	0.5	0.49	0.5
White	0.36	0.48	0.42	0.49	0.33	0.47
Asian	0.04	0.2	0.07	0.25	0.02	0.15
Black	0.14	0.34	0.1	0.29	0.16	0.37
Hispanic	0.37	0.48	0.34	0.47	0.39	0.49
Other race/ethnicity	0.09	0.29	0.08	0.27	0.1	0.3
School % FRPL	0.54	0.27	0.56	0.26	0.53	0.27
School % Asian	0.04	0.08	0.05	0.09	0.04	0.07
School % Black	0.15	0.16	0.14	0.13	0.15	0.17
School % Hispanic	0.42	0.27	0.43	0.27	0.42	0.28
School enrollment	1349	811	869	320	1610	875
City	0.43	0.5	0.46	0.5	0.41	0.49
Town	0.11	0.31	0.08	0.28	0.13	0.33
Suburb	0.24	0.42	0.26	0.48	0.23	0.42
Rural	0.21	0.41	0.19	0.4	0.23	0.42

Table 2. Comparison of our analytic sample with the national sample of U.S. middle schools

	Population of U.S. public schools	Analytic sample
% School FRPL	58	53
% Asian	4	4
% Black	14	14
% Hispanic	26	37
% White	48	37
City	30	43
Suburb	32	24
Town	9	11
Rural	29	21

Notes. N=77,000 schools for the population of public schools and N=452 schools for the analytic sample.

Table 3. Fixed Effect Models of the Effect of Timing

	Model 1	Model 2	Model 3
Algebra timing (8 th grade enrollment)	20.218*** (0.44)	2.180*** (0.412)	2.117*** (0.412)
7th grade spring math score		0.872*** (0.008)	0.873*** (0.008)
7th grade fall-spring gain score		-0.387*** (0.011)	-0.389*** (0.011)
7th grade spring testing week		0.354 (0.336)	0.385 (0.329)
7th grade fall testing week		-0.141 (0.095)	-0.144 (0.093)
Algebra spring testing week		0.237 (0.188)	0.238 (0.189)
Female			0.927*** (0.141)
Asian			2.884*** (0.311)
Black			0.774** (0.255)
Hispanic			0.199 (0.195)
Other race/ethnicity			0.617* (0.268)
Intercept	231.637*** (0.155)	23.184 (13.86)	20.847 (13.696)
R-squared	0.204	0.488	0.489

Note. N=55,579. Standard errors are shown in parentheses.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table 4: Fixed Effect Models of the Effect of Timing by Decile

	Decile 1	Decile 2	Decile 3	Decile 4	Decile 5	Decile 6	Decile 7	Decile 8	Decile 9	Decile 10
8th grade Algebra	5.634 (3.705)	-2.427 (3.317)	1.917 (1.688)	-0.459 (1.482)	0.902 (1.307)	2.779** (0.998)	3.315*** (0.903)	3.426*** (0.798)	3.970*** (0.809)	5.340*** (1.437)
7th grade spring testing week	1.651 (1.294)	1.701* (0.667)	1.337 (1.034)	-0.02 (1.008)	0.006 (0.481)	-0.73 (0.682)	-0.142 (0.664)	-0.181 (0.637)	-1.468 (0.9)	1.25 (1.234)
Algebra spring testing week	-0.165 (1.344)	0.188 (2.171)	1.631 (1.384)	0.714 (0.706)	-0.4 (0.373)	0.454 (0.302)	0.419 (0.264)	0.256 (0.265)	0.21 (0.263)	-0.323 (0.554)
Female	1.609* (0.737)	1.290* (0.596)	1.621** (0.524)	1.233** (0.456)	0.497 (0.388)	1.170*** (0.338)	1.136*** (0.303)	0.734** (0.259)	0.135 (0.257)	-1.050*** (0.268)
Asian	-1.752 (2.019)	0.909 (2.752)	5.400* (2.116)	5.172** (1.709)	3.085* (1.477)	0.84 (1.089)	2.811*** (0.786)	3.204*** (0.663)	3.005*** (0.516)	3.641*** (0.405)
Black	-0.996 (1.33)	2.354* (1.158)	-0.647 (0.903)	1.763* (0.83)	0.572 (0.758)	0.842 (0.635)	-0.06 (0.599)	0.16 (0.536)	0.146 (0.558)	-0.575 (0.651)
Hispanic	-0.265 (1.19)	1.326 (0.987)	-0.016 (0.84)	0.977 (0.658)	-0.495 (0.587)	0.208 (0.489)	-0.398 (0.446)	0.632 (0.392)	-0.425 (0.359)	-0.855 (0.462)
Other race/ethnicity	-0.616 (1.84)	0.632 (1.463)	1.604 (1.279)	0.917 (0.948)	1.298 (0.823)	-0.305 (0.838)	0.108 (0.641)	0.591 (0.612)	0.858 (0.495)	1.237* (0.619)
Intercept	169.558* (66.567)	163.798* (78.022)	128.424* (53.602)	218.682*** (43.704)	244.629*** (22.209)	250.480*** (26.998)	233.040*** (25.687)	242.591*** (24.963)	291.228*** (32.549)	218.486*** (50.33)
N	3664	4433	4492	5566	5959	6297	6564	6881	6267	5456

Note. This model also contained fixed effects for the middle school students attended as well as school-level covariates for the high school students switched to. Standard errors are shown in parentheses.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Appendix A: Algebra Readiness Cut Scores (MAP Growth 6+ to State EOC Algebra Linking Studies)

(A) [Georgia](#)

Table E.1. MAP Growth RIT Cut Scores Linked to GA Milestones EOC Algebra *Proficient Learner* Cut Scores

Assessment		Proficient Learner Cut Scores by Grade				
		6	7	8	9	10
GA Milestones EOC Algebra Spring		525				
MAP Growth Mathematics 6+	Fall	226	230	230	234	233
	Winter	233	235	234	236	236
	Spring	237	237	237	237	237
GA Milestones EOC Algebra Spring		525				
MAP Growth Algebra 1	Fall	226				
	Winter	230				
	Spring	234				

(B) [North Carolina](#)

Table 1. MAP Growth Mathematics 6+ to NC EOC Math 1

Grade	Assessment	Fall RIT	Winter RIT	Spring RIT	Spring Percentile
7	MAP Growth	235–246	240–251	242–253	83–93
8	MAP Growth	235–246	240–251	242–253	74–88
9	MAP Growth	240–251	241–252	242–253	73–87
10	MAP Growth	239–251	241–252	242–253	68–84
11	MAP Growth	239–250	241–252	242–253	65–81

(C) [Ohio](#)

Table 1. MAP Growth Mathematics 6+ to OST EOC Algebra 1

Grade	Assessment	Fall RIT	Winter RIT	Spring RIT	Spring Percentile
7	MAP Growth	230–242	235–247	237–249	75–90
8	MAP Growth	230–242	234–247	237–249	66–84
9	MAP Growth	234–247	236–248	237–249	65–83
10	MAP Growth	233–247	236–248	237–249	60–79

(D) [Texas](#)

Table 1. MAP Growth Mathematics 6+ to STAAR EOC Algebra I

Grade	Assessment	Fall RIT	Winter RIT	Spring RIT	Spring Percentile
7	MAP Growth	229–240	234–245	236–247	74–88
8	MAP Growth	229–240	233–245	236–247	64–82
9	MAP Growth	233–245	235–246	236–247	63–81
10	MAP Growth	232–245	235–246	236–247	58–76

Appendix B: Algebra Proficiency Cut Scores (MAP Growth Algebra to State EOC Algebra Linking Studies)

(A) [Georgia](#)

Table 3.9. Proficiency Projections Based on RIT Scores—MAP Growth Algebra 1 & GA Milestones EOC Algebra

Course	Start Percentile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.		Proficient	Prob.		Proficient	Prob.
MAP Growth Algebra 1	5	234	202	No	0.01	204	No	<0.01	204	No	<0.01
	10	234	208	No	0.03	210	No	0.01	212	No	<0.01
	15	234	212	No	0.07	214	No	0.04	216	No	<0.01
	20	234	215	No	0.12	218	No	0.09	220	No	<0.01
	25	234	218	No	0.19	221	No	0.15	224	No	<0.01
	30	234	220	No	0.28	224	No	0.25	227	No	0.02
	35	234	223	No	0.38	226	No	0.33	229	No	0.08
	40	234	225	No	0.46	228	No	0.41	232	No	0.28
	45	234	227	Yes	0.54	231	Yes	0.55	234	Yes	0.50
	50	234	229	Yes	0.62	233	Yes	0.63	237	Yes	0.80
	55	234	231	Yes	0.69	235	Yes	0.71	239	Yes	0.92
	60	234	233	Yes	0.75	238	Yes	0.82	242	Yes	0.99
	65	234	235	Yes	0.81	240	Yes	0.87	245	Yes	>0.99
	70	234	237	Yes	0.86	242	Yes	0.91	247	Yes	>0.99
	75	234	240	Yes	0.93	245	Yes	0.96	250	Yes	>0.99
	80	234	243	Yes	0.96	248	Yes	0.98	254	Yes	>0.99
	85	234	246	Yes	0.98	252	Yes	0.99	257	Yes	>0.99
	90	234	250	Yes	0.99	256	Yes	>0.99	262	Yes	>0.99
	95	234	256	Yes	>0.99	263	Yes	>0.99	269	Yes	>0.99

Note. Prob. = Probability.

(B) [Florida](#)

Table 3.7. Proficiency Projections Based on RIT Scores—Algebra 1

Pct	Spring RIT Cut	Fall			Winter			Spring		
		RIT	Projected Proficiency		RIT	Projected Proficiency		RIT	Projected Proficiency	
			Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
5	235	202	No	0.01	204	No	<0.01	204	No	<0.01
10	235	208	No	0.02	210	No	0.01	212	No	<0.01
15	235	212	No	0.06	214	No	0.03	216	No	<0.01
20	235	215	No	0.1	218	No	0.07	220	No	<0.01
25	235	218	No	0.16	221	No	0.13	224	No	<0.01
30	235	220	No	0.25	224	No	0.21	227	No	0.01
35	235	223	No	0.35	226	No	0.29	229	No	0.04
40	235	225	No	0.42	228	No	0.37	232	No	0.2
45	235	227	Yes	0.5	231	Yes	0.5	234	No	0.39
50	235	229	Yes	0.58	233	Yes	0.59	237	Yes	0.72
55	235	231	Yes	0.65	235	Yes	0.67	239	Yes	0.87
60	235	233	Yes	0.72	238	Yes	0.79	242	Yes	0.98
65	235	235	Yes	0.78	240	Yes	0.85	245	Yes	>0.99

(C) [New York](#)

Table 3.5. Proficiency Projections Based on RIT Scores—Algebra I

Pct	Spring RIT Cut	Fall			Winter			Spring		
		RIT	Projected Proficiency		RIT	Projected Proficiency		RIT	Projected Proficiency	
			Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
5	229	202	No	0.02	204	No	0.01	204	No	<0.01
10	229	208	No	0.08	210	No	0.04	212	No	<0.01
15	229	212	No	0.16	214	No	0.11	216	No	<0.01
20	229	215	No	0.25	218	No	0.21	220	No	0.01
25	229	218	No	0.35	221	No	0.33	224	No	0.08
30	229	220	No	0.46	224	No	0.45	227	No	0.28
35	229	223	Yes	0.58	226	Yes	0.55	229	Yes	0.5
40	229	225	Yes	0.65	228	Yes	0.63	232	Yes	0.8
45	229	227	Yes	0.72	231	Yes	0.75	234	Yes	0.92
50	229	229	Yes	0.78	233	Yes	0.82	237	Yes	0.99
55	229	231	Yes	0.84	235	Yes	0.87	239	Yes	>0.99
60	229	233	Yes	0.88	238	Yes	0.93	242	Yes	>0.99
65	229	235	Yes	0.92	240	Yes	0.96	245	Yes	>0.99
70	229	237	Yes	0.94	242	Yes	0.97	247	Yes	>0.99
75	229	240	Yes	0.98	245	Yes	0.99	250	Yes	>0.99
80	229	243	Yes	0.99	248	Yes	>0.99	254	Yes	>0.99
85	229	246	Yes	0.99	252	Yes	>0.99	257	Yes	>0.99
90	229	250	Yes	>0.99	256	Yes	>0.99	262	Yes	>0.99
95	229	256	Yes	>0.99	263	Yes	>0.99	269	Yes	>0.99

Note. Pct = percentile; Prob. = probability.

(D) [Ohio](#)

Table 3.13. Proficiency Projections based on RIT Scores—Algebra 1

MAP Growth Algebra 1 to OST Algebra 1											
Grades	Start %ile*	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.		Proficient	Prob.		Proficient	Prob.
9–12	5	235	202	No	0.01	204	No	<0.01	204	No	<0.01
	10	235	208	No	0.02	210	No	0.01	212	No	<0.01
	15	235	212	No	0.06	214	No	0.03	216	No	<0.01
	20	235	215	No	0.10	218	No	0.07	220	No	<0.01
	25	235	218	No	0.16	221	No	0.13	224	No	<0.01
	30	235	220	No	0.25	224	No	0.21	227	No	0.01
	35	235	223	No	0.35	226	No	0.29	229	No	0.03
	40	235	225	No	0.42	228	No	0.37	232	No	0.18
	45	235	227	Yes	0.50	231	Yes	0.50	234	No	0.38
	50	235	229	Yes	0.58	233	Yes	0.59	237	Yes	0.73
	55	235	231	Yes	0.65	235	Yes	0.67	239	Yes	0.89
	60	235	233	Yes	0.72	238	Yes	0.79	242	Yes	0.98
	65	235	235	Yes	0.78	240	Yes	0.85	245	Yes	>0.99
	70	235	237	Yes	0.84	242	Yes	0.89	247	Yes	>0.99
	75	235	240	Yes	0.92	245	Yes	0.94	250	Yes	>0.99
	80	235	243	Yes	0.95	248	Yes	0.97	254	Yes	>0.99
	85	235	246	Yes	0.98	252	Yes	0.99	257	Yes	>0.99
	90	235	250	Yes	0.99	256	Yes	>0.99	262	Yes	>0.99
	95	235	256	Yes	>0.99	263	Yes	>0.99	269	Yes	>0.99

*%tile = Percentile.

(E) [Texas](#)

Table 3.12. Proficiency Projections Based on RIT Scores—Algebra I & Algebra I

Grade	Percentile	Spring RIT Cut	Fall			Winter			Spring		
			RIT	Projected Proficiency		RIT	Projected Proficiency		RIT	Projected Proficiency	
				Meets	Prob.		Meets	Prob.		Meets	Prob.
Algebra I	5	234	202	No	0.01	204	No	<0.01	204	No	<0.01
	10	234	208	No	0.03	210	No	0.01	212	No	<0.01
	15	234	212	No	0.07	214	No	0.04	216	No	<0.01
	20	234	215	No	0.12	218	No	0.09	220	No	<0.01
	25	234	218	No	0.19	221	No	0.15	224	No	<0.01
	30	234	220	No	0.28	224	No	0.25	227	No	0.02
	35	234	223	No	0.38	226	No	0.33	229	No	0.08
	40	234	225	No	0.46	228	No	0.41	232	No	0.28
	45	234	227	Yes	0.54	231	Yes	0.55	234	Yes	0.50
	50	234	229	Yes	0.62	233	Yes	0.63	237	Yes	0.80
	55	234	231	Yes	0.69	235	Yes	0.71	239	Yes	0.92
	60	234	233	Yes	0.75	238	Yes	0.82	242	Yes	0.99
	65	234	235	Yes	0.81	240	Yes	0.87	245	Yes	>0.99
	70	234	237	Yes	0.86	242	Yes	0.91	247	Yes	>0.99
	75	234	240	Yes	0.93	245	Yes	0.96	250	Yes	>0.99
	80	234	243	Yes	0.96	248	Yes	0.98	254	Yes	>0.99
	85	234	246	Yes	0.98	252	Yes	0.99	257	Yes	>0.99
	90	234	250	Yes	0.99	256	Yes	>0.99	262	Yes	>0.99
	95	234	256	Yes	>0.99	263	Yes	>0.99	269	Yes	>0.99