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Algebra I Placement Strategies

What Methods Best Measure Student Readiness to Enroll in Algebra I Prior to High School?

Superintendent Leadership Forum

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Key Factors in Measuring Student Readiness

What Methods Best Measure Student Readiness to Enroll in Algebra I Prior to High School?

Increase in Middle School Enrollment in Algebra I Results from Importance of Calculus in College Admissions and Preparation

Between 1990 and 2011, the percentage of eighth grade students enrolled in Algebra I rose from 16 percent to 47 percent.[1] Research attributes this increase to the importance of high school Calculus courses in college admissions and preparedness. Accelerating eighth grade students into Algebra I is often the only way that students are able to complete the prerequisites necessary to enroll in Calculus in high school.[2] Completion of advanced math courses, such as Calculus, can lead to a substantial increase in college readiness. This holds especially true for students pursuing STEM majors. Further, a North Carolina study found that students in accelerated math courses were 20 percent more likely in tenth grade to indicate intent to enroll in a four-year college.[3] While middle school enrollment in Algebra I is nationally recognized as a gatekeeper to advanced math courses and college preparation, The Brookings Institution finds that the methods and policies that schools employ to determine which students to accelerate vary greatly across the country.[4]

No National Consensus on Middle School Math Placement Tests, but Common Placement Tests Exist

Many school districts either purchase commonly used placement tests from testing companies or use state-developed placement tests to determine student readiness for Algebra I.

Examples of Placement Tests

Privately-Developed Placement Tests

Placement Test	Total Time Allotted	Test Developer	Example School Districts
Iowa Algebra Aptitude Test[5]	50 minutes	The University of Iowa	• Swampscott Public Schools, MA • Hamilton-Wenham Regional School District, MA • Guilford Public Schools, CT • Middletown City Schools, OH • Montgomery Township School District, NJ

1) Loveless, Tom. "The Algebra Imperative: Assessing Algebra in a National and International Context." *Brown Center on Education Policy at Brookings*. September, 2013. Accessed October 27, 2017. https://www.brookings.edu/wp-content/uploads/2016/06/Kern-Algebra-paper-8-30_v14.pdf.
2) Fensterwald, John. "New twist to old debate on accelerated math." *EdSource*. August 12, 2014. Accessed November 9, 2017. https://edsource.org/2014/new-twist-to-old-debate-on-accelerated-math/66174.
3) Dougherty, Shaun M.; Joshua S. Goodman; Darryl V. Hill; Erica Litke; Lindsay C. Page. "Does more rigorous middle school math coursework change students' college readiness?" *Brown Center on Education Policy at Brookings*. April 27, 2017. Accessed November 3, 2017. https://www.brookings.edu/blog/brown-center-chalkboard/2017/04/27/does-more-rigorous-middle-school-math-coursework-change-students-college-readiness/.
4) Loveless, Tom. "The Algebra Imperative: Assessing Algebra in a National and International Context." *Brown Center on Education Policy at Brookings*. September, 2013. Accessed October 27, 2017. https://www.brookings.edu/wp-content/uploads/2016/06/Kern-Algebra-paper-8-30_v14.pdf.
5) "Iowa Algebra Aptitude Test™ Fifth Edition." *Houghton Mifflin Harcourt*. Accessed November 3, 2017. https://owl.english.purdue.edu/owl/resource/717/05/.

Placement Test	Total Time Allotted	Test Developer	Example School Districts
Orleans-Hanna Algebra Prognosis Test[6]	50-60 minutes	Pearson Assessments	• Albuquerque Public Schools, NM • Lowellville Local Schools, OH • Bloomfield Hills Schools, MI • Stamford Public Schools, CT • Tahoma School District No. 409, WA
Measures of Academic Progress (MAP) [7]	N/A	Northwest Evaluation Association (NWEA)	• Montgomery Township School District, NJ • Kildeer Countryside Community Consolidated School District 96, IL • Williamsburg James City County Public Schools, VA • Edina Public Schools, MN • LaGrange District 102, IL

State-Developed Placement Tests

Placement Test	Test Developer	Example School Districts
State of Texas Assessments of Academic Readiness (STAAR) [8]	Texas Education Agency	Aledo Middle School, TX
Massachusetts Comprehensive Assessment System (MCAS) [9]	Massachusetts Department of Elementary and Secondary Education	Swampscott Public Schools, MA
Mathematics Diagnostic Testing Project (MDTP) [10]	University of California-San Diego	33 percent of California school districts[11]

Many Districts Rely on a Combination of Placement Metrics to Determine Which Students to Enroll in Algebra I

Rather than depend on a single placement test score, many school districts develop their own rubric or matrix based on a combination of metrics to determine which students to accelerate into Algebra I. Commonly used metrics include:

- Grades
- Study skills
- State standardized test scores
- Cumulative math test scores
- Teacher recommendation
- Parent recommendation
- Behavior

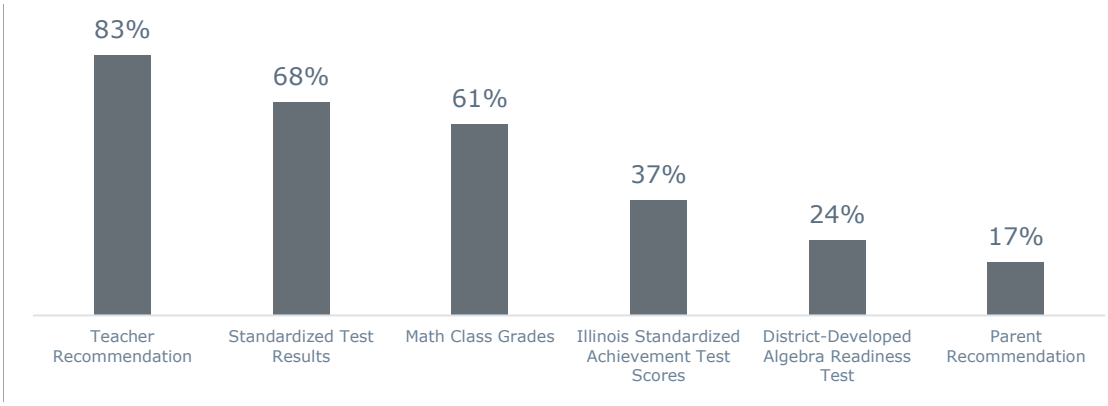
A study of 54 Illinois school districts found that the majority of districts used a combination of three placement criteria (i.e., teacher recommendation, standardized test results, and math class grades).[12] A

6) "Orleans-Hanna Algebra Prognosis Test, Third Edition." *Pearson*. Accessed October 27, 2017. https://www.pearsonassessments.com/learningassessments/products/100000448/orleans-hanna-algebra-prognosis-test-third-edition.html.
7) "Map Skills." *NWEA*. Accessed October 27, 2017. https://www.nwea.org/map-skills/.
8) "STAAR Mathematics Resources." *Texas Education Agency*. Accessed October 27, 2017. https://tea.texas.gov/student.assessment/staar/math/.
9) "Massachusetts Comprehensive Assessment System." *Massachusetts Department of Elementary & Secondary Education*. November 8, 2017. Accessed October 27, 2017. http://www.doe.mass.edu/mcas/tdd/math.html.
10) "Mathematics Diagnostic Testing Project." *UC San Diego*. Accessed October 27, 2017. https://mdtp.ucsd.edu/.
11) Gao, Niu and Sara Adan. "Math Placement in California's Public Schools." *Public Policy Institute of California*. November, 2016. Accessed November 9, 2017. http://www.ppic.org/publication/math-placement-in-californias-public-schools/.
12) "Offering a First Year Algebra Course in Illinois Middle Schools." *Illinois State Board of Education*. April 17, 2008. Accessed October 27, 2017. http://206.166.105.35/career/pdf/imsp/algebra_middle_school.pdf.

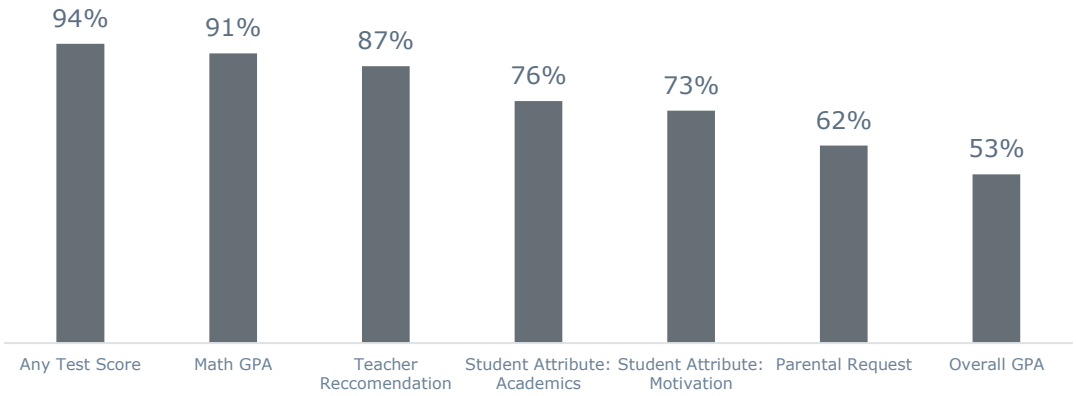
2015-2016 study of 199 California school districts revealed that test scores were the most common metric used to determine placement, followed by math GPA and teacher recommendation. Eighty percent of the California districts that used test scores for placement used a combination of two or more test scores.[13]

Example Placement Criteria

Algebra I Placement Metrics Considered at 54 Illinois School Districts[14]



Math Placement Metrics Considered at 199 California School Districts[15]



Lowellville Local Schools, OH Requirements to Enroll in Algebra I in Eighth Grade[16]

Metric	Required Result for Placement
Orleans-Hanna Algebra I Prognosis Test	Score of 80 or above
Seventh Grade Cumulative Math Grade	An A or a B
Behavior	No out-of-school suspension and no more than one in-school suspension while in seventh grade
Seventh Grade Standardized Math Test	Proficient or above

13) Gao, Niu and Sara Adan. "Math Placement in California's Public Schools." *Public Policy Institute of California*. November, 2016. Accessed November 9, 2017. http://www.ppic.org/publication/math-placement-in-californias-public-schools/.

14) "Offering a First Year Algebra Course in Illinois Middle Schools." *Illinois State Board of Education*. April 17, 2008. Accessed October 27, 2017. http://206.166.105.35/career/pdf/imsp/algebra_middle_school.pdf.

15) Gao, Niu and Sara Adan. "Math Placement in California's Public Schools." *Public Policy Institute of California*. November, 2016. Accessed November 9, 2017. http://www.ppic.org/publication/math-placement-in-californias-public-schools/.

16) "Requirements to Participate in Algebra I as an 8th Grader." *Lowellville School District*. November 7, 2016. Accessed October 27, 2017. http://www.lowellville.k12.oh.us/userfiles/25/my%20files/revised_____requirements%20to%20participate%20in%20algebra%20i%20as%20an%208th%20grader%2011-7-16.pdf?id=22164.

Use of Holistic and Objective Measurements Decreases Algebra I Placement Bias

One study of incoming college students revealed that 24 percent of students in math courses were misplaced due to reliance on standardized placement tests as the sole measurement of student readiness.[17] While this study does not focus on middle school students, it emphasizes the need to assess additional criteria to determine student readiness for courses. Use of multiple metrics creates a more holistic view of student readiness by allowing students to demonstrate their capabilities in several settings and preventing students from being disadvantaged by one test day or test anxiety.[18]

While sole use of placement tests to determine placement is not recommended, many studies indicate that placement tests should be incorporated into a holistic placement process due to their objectiveness. A study of a North Carolina school district's math placement process revealed that universal use of a placement test with a minimum score required for acceleration reduced the race, ethnicity, and income bias of accelerated math courses.[19] Similarly, a Vanderbilt University study showed that universal screening processes (i.e., a standardized nonverbal test with a definitive scoring system), in place of teacher and parent recommendations, greatly increased the number of racial and ethnic minorities placed in gifted student programs courses.[20] A Maryland school district achieved the same result after the elimination of parent and teacher recommendations.[21] Thus, in order to reduce disadvantages, Algebra I placement methods should rely on more than one metric, including an objective test.

Incorrect Placement of Eighth Grade Students in Algebra I Results in Poor Academic Performance

A California study tracked the success of students accelerated into Algebra I in eighth grade who were within the lowest 10 percent of the state math scores. The study revealed that students who were in the lowest 10 percent of the state math scores before placement into Algebra I did not improve their scores after acceleration into Algebra I. Furthermore, their GPAs fell as a result of acceleration.[22] A similar study conducted by Duke University of a school district in North Carolina tracked students who scored in the lowest 20 percent of a cumulative math test. The study looked at both students who were accelerated into Algebra I in eighth grade and students who were not accelerated. The study found that accelerated, low-performing students' Algebra I cumulative test scores were approximately one-third of a standard deviation lower than low-performing students who completed Algebra I in ninth or tenth grade.[23]

This pattern of accelerating students before they are prepared for Algebra I exists on a national level. A study by the National Center for Education Statistics found that in 2005, approximately 29 percent of students who scored at the tenth percentile or lower on the National Assessment of Education Progress were enrolled in Algebra I or a more advanced math course in eighth grade.[24] The Brookings Institution estimates that one-third of accelerated students return to the non-accelerated track each year.[25] Thus, acceleration of unprepared middle school students often results in poor academic performance, low standardized test scores, and/or departure from the accelerated math track.

17) Markle, Ross and Steve Robbins. "A Holistic View of Course Placement Decisions- Avoiding the HS GPA Trap." *Educational Testing Service*. March, 2013. Accessed November 9, 2017. https://www.ets.org/s/successnavigator/pdf/holistic_view_course_placement_decisions.pdf.

18) "Critical Academic Indicators: What to Look for in Your Students to Ensure Future Success." *Hanover Research*. August 26, 2014. Accessed November 9, 2017. http://www.hanoverresearch.com/2014/08/26/critical-academic-indicators-what-to-look-for-in-your-students-to-ensure-future-success/.

19) Dougherty, Shaun M.; Joshua S. Goodman; Darryl V. Hill; Erica Litke; Lindsay C. Page. "Does more rigorous middle school math coursework change students' college readiness?" *Brown Center on Education Policy at Brookings*. April 27, 2017. Accessed November 3, 2017. https://www.brookings.edu/blog/brown-center-chalkboard/2017/04/27/does-more-rigorous-middle-school-math-coursework-change-students-college-readiness/.

20) Dynarski, Susan. "Why Talented Black and Hispanic Students Can Go Undiscovered." *The New York Times*. April 8, 2016. Accessed November 9, 2017. https://www.nytimes.com/2016/04/10/upshot/why-talented-black-and-hispanic-students-can-go-undiscovered.html.

21) McGee, Kate. "Montgomery County Gives More Students A Chance At 'Gifted' Status." *WAMU*. May 24, 2017. Accessed November 9, 2017. https://wamu.org/story/17/05/24/montgomery-county-gives-students-chance-gifted-status/.

22) Sarah D. Sparks. "Studies Question Value of Early Algebra Lessons." *Education Week*. April 20, 2012. Accessed November 3, 2017. https://www.edweek.org/ew/articles/2012/04/20/29aera.h31.html.

23) Vigdor, Jacob. "Solving America's Math Problem." *Education Next*. 2013. Accessed November 16, 2017. http://educationnext.org/solving-america%E2%80%99s-math-problem/.

24) Loveless, Tom. "The Algebra Imperative: Assessing Algebra in a National and International Context." *Brown Center on Education Policy at Brookings*. September, 2013. Accessed October 27, 2017. https://www.brookings.edu/wp-content/uploads/2016/06/Kern-Algebra-paper-8-30_v14.pdf.

25) Dougherty, Shaun M.; Joshua S. Goodman; Darryl V. Hill; Erica Litke; Lindsay C. Page. "Does more rigorous middle school math coursework change students' college readiness?" *Brown Center on Education Policy at Brookings*. April 27, 2017. Accessed November 3, 2017. https://www.brookings.edu/blog/brown-center-chalkboard/2017/04/27/does-more-rigorous-middle-school-math-coursework-change-students-college-readiness/.