Math Placement: The Importance of Getting It Right for All Students

by Anthony Fong and Neal Finkelstein

Introduction

With the current shift to the Common Core State Standards in Mathematics (CCSS-M), parents, teachers, school administrators, and school board members in California are rethinking math course sequences to ensure that they align with the standards. The CCSS-M, and California's curriculum frameworks that support them, provide a progression of content that builds a strong base of pre-algebra, beginning in grade 5, and focuses on algebra readiness throughout middle school (California Department of Education, 2014). By the time students reach their CCSS-M–aligned grade 9 courses, they are expected to be able to master not only linear algebra, but also quadratic systems. These CCSS-M–aligned sequences are more challenging than those in previous incarnations of California's standards, including the 1997 state standards that school districts followed most recently. For example, while in 2013/14 a student might have taken a course called "Algebra I" in grade 8, starting in 2014/15 much of that content has now been rolled into the CCSS-M for grade 7. Meanwhile, the new CCSS-M–aligned grade 8 course is considerably expanded, not only in content but also in rigor. Notably, the 2014/15 course is called "CCSS-M Grade 8 Math," not "Algebra I."

This shift in the sequencing and rigor of math content is raising questions about how to equitably ensure that all students are placed into the correct math courses at the correct stages in order to be adequately prepared for higher education. Because, historically, there has been a well documented math achievement gap between minority and non-minority students, a central concern during this period of transition to the CCSS-M is ensuring access to appropriate math course sequences for all students. To promote more equitable outcomes, it is critical to look carefully at students from minority backgrounds to ensure their math readiness and their access to appropriate math course sequences, both of which are essential to enabling access to higher education.[1]

Math course trajectories

During these transitional years in which the CCSS-M are being implemented across the state with updated instructional approaches, new math sequences, and new pacing of content, it is a critical time to carefully examine students' course trajectories. Research has shown that math placement decisions for middle school students can have profound effects on their math course trajectories in high school (Oakes, Gamoran, & Page, 1992). Research has also shown that some students benefit from taking more advanced courses earlier in the

This Research Brief has been made possible with generous support from the Silicon Valley Community Foundation. The views expressed are exclusively those of the authors.

WestEd
WestEd.org

middle school grades, allowing them to move more quickly toward calculus by their senior year of high school (U.S. Department of Education, 2007); these students tend to be higher-achieving students who are able to take the more advanced courses at an earlier age. But research has shown that lower-performing students who participate in accelerated sequences (such as being forced to enroll in algebra I in grade 8) may not do so well, repeating courses between grades 8 and 10 and struggling in math throughout high school (Clotfelter, Ladd, & Vigdor, 2013).

Given the new standards, California's history of math acceleration in the middle grades, and the concern for correct placement for all students, in this brief we examine patterns from the past to shed light on considerations for the future. Specifically, we conducted further analyses on data from 24 unified school districts in California that were previously analyzed in an earlier released report (Finkelstein et al., 2012).[2] This additional analysis of a previous dataset was done with a particular focus on the math experiences of minority students: When did minority students take algebra I,[3] how often did they repeat the course, and what proportion of minority students reached calculus by grade 12? The answers to questions like these are critical for ensuring that all students are placed in appropriate courses to enable them to succeed in high school and college.

Background research on the academic disparities between minority and non-minority students

Because this brief focuses on the math placement patterns and achievement of minority students, it is important to first consider the broader context of equity in education, including factors contributing to the achievement gap between minority and non-minority students. Education inputs (such as teacher quality and per-pupil expenditures) are critical to students' success in the classroom, and research has shown that schools with large proportions of African American and/or Hispanic students receive fewer educational resources compared to schools primarily serving White and/or Asian American students. For instance, a 2012 report by the Center for American Progress found large differences in spending between schools with high proportions of African American and Hispanic students versus schools with low proportions of African American and Hispanic students. This was largely due to differences in teacher salaries. New teachers, who are more likely to start out teaching in high-need schools that serve high proportions of African American and Hispanic students, earn comparatively lower salaries. The report found that schools in which students of color accounted for 90 percent or more of the student population spent $733 less per student annually than schools in which 90 percent or more of the student population was White. Differences have also been documented in the quality of the teaching workforce, with minority students commonly taught by teachers who are less skilled than those teaching White students (Lankford, Loeb, & Wyckoff, 2002).

In addition to the disparity in education inputs, recent data from the U.S. Department of Education's Office for Civil Rights (2014) have shown that minority students have less access to advanced math and science courses in high school. The data showed that 81 percent of Asian American high school students and 71 percent of White students attended high schools offering a full range of math and science courses, whereas 57 percent of African American students and 67 percent of Latino students attended such schools.

These differences in resources contribute to a well documented math achievement gap between minority and non-minority students (e.g., Jencks & Phillips, 1998; Magnuson & Waldfogel, 2008). Vanneman, Hamilton, Baldwin Anderson, and Rahman (2009) reported achievement gaps between White and African American students in grade 4 and grade 8 *National Assessment of Educational Progress* (NAEP) math scores, with White students outperforming their African American peers. And Finkelstein and Fong (2008) found differences in

high school math course completion rates and math grades across different ethnicities. For instance, the percentage of students who had completed at least three math courses (as necessary for the California State University and University of California A–G subject requirements) by the end of grade 12 was 58.7 percent for White students, 41.7 percent for Hispanic students, and 34.9 percent for African American students (Finkelstein & Fong, 2008). They also found that the average high school math GPA was 2.5 for White students as compared to 1.8 for both African American and Hispanic students.

Given these disheartening disparities in math achievement between minority and non-minority students, the current period of transition to the CCSS offers a timely opportunity to refocus on better supporting academic success for all students. The results that follow are based on an examination of whether, based on historical data, students' race was related to their math placement in middle school.

Additional analysis of existing data on math patterns in California

In 2012, Finkelstein et al. completed an analysis of math course sequences for California students as a way of identifying challenges they faced in passing, with at least a C, the A–G sequence of high school courses that are necessary for access to California's four-year public universities. That 2012 analysis looked carefully at variation in patterns of math success and included sub-analyses by poverty status.

Using the same data, this analysis investigates the differences in math placement among minority and non-minority students. Three central findings follow:

1) Placement into algebra I by grade 8 was important to reaching calculus by grade 12, and high-achieving grade 7 minority students were less likely to reach calculus by grade 12 than their high-achieving grade 7 non-minority peers.

Among the high-achieving grade 7 students in our study sample, students who took algebra I in grade 8 had a much higher chance of taking calculus by grade 12.[4] Specifically, 33.9 percent of the high-achieving grade 7 students who took algebra I in grade 8 went on to take calculus in grade 12. In comparison, only 6.9 percent of the high-achieving grade 7 students who did not take algebra I in grade 8 went on to take calculus in grade 12. This statistically significant difference of 27 percentage points suggests the importance of having high-achieving grade 7 students enroll in algebra I in grade 8.[5]

However, we also found that high-achieving grade 7 minority students were less likely to enroll in calculus by grade 12 compared to high-achieving grade 7 non-minority students (20.6 percent versus 35.8 percent, respectively—with this difference being statistically significant). Given these differences in enrollment in advanced math courses, it is crucial that educators make key math placement decisions correctly—particularly in the middle school grades in which math placement decisions can have profound effects on students' math course-taking trajectories in high school. This concern about accurate placement is also important because previous research has found that math placement decisions differ by ethnicity. For instance, Waterman (2010) found that more than 80 percent of the minority students in his sample were placed in algebra I or below in grade 9 compared with 65.6 percent of White students and 32.1 percent of Asian American students.

2) Academically similar minority and non-minority students were equally likely to repeat algebra I in grade 9.

When restricting our sample to academically similar minority and non-minority students based on grade 8 achievement, the differences in the rate of repeating algebra I in grade 9 were not statistically significant. For instance, among students who had average grade 8 algebra I GPAs between 3.0

and 3.25 (which is essentially an B/B+) and who scored between 350 and 370 on the grade 8 Algebra California Standards Test (CST)—where 350 to 370 represents the low end of the Proficient performance level—the difference in the rate of repeating algebra I in grade 9 was a statistically insignificant 7.4 percentage points (18.5 percent among minority students versus 11.1 percent among non-minority students). Similarly, when restricting the sample to students who had average grade 8 algebra I GPAs between 2.5 and 3.0 and who scored between 350 and 370 on the grade 8 Algebra CST, the difference was a statistically insignificant 5.3 percentage points (17.5 percent among minority students versus 12.2 percent among non-minority students). This suggests that minority and non-minority students repeat algebra at similar rates when controlling for prior achievement. However, more research is needed on this topic as the lack of statistical significance could be a result of either the reduced sample size or potential measurement error of the math GPAs and CST scores. Measurement error related to math GPAs could be due to teacher's subjective judgment of students' ability; measurement error related to CST scores could be due to standardized tests that may not completely accurately assess students' content knowledge. These sorts of measurement errors can result in math GPAs and CST scores not aligning for a given student. For instance, a student earning math GPAs of 3.7 or higher (A- and above) may achieve Basic (or worse) on that course's CST. Alternatively, a student could score Proficient on the CST but earn math GPAs below 2.0 in the class.

3) Using multiple academic measures is a way to make more accurate decisions for both minority and non-minority students

As described in Finding 2, there may be a lack of alignment between math GPAs and math CST scores for certain students. In fact, we found evidence of this in our data. For instance, among students with a grade 7 math GPA between 1.5 and 2.0 (which is essentially between a C- and a C), 10 percent of these students scored Far Below Basic on the grade 7 math CST, 33 percent scored Below Basic, 35 percent scored Basic, 19 percent scored Proficient, and 3 percent scored Advanced. While a math GPA between 1.5 and 2.0 (which is a C-/C average) by itself may not warrant a promotion to algebra I in grade 8, a compelling argument could be made that the 22 percent of students who achieved at least Proficient on the CST should be promoted. If placement policies for minority or non-minority students were to be based on only one of these measures, it is conceivable that students who may be well suited for accelerated math sequences may not be placed into the correct courses.

Recommendations for accurate and equitable math course placement practices

When making math placement decisions it is important to take multiple measures into consideration.

Given the importance of middle school math placement decisions in determining students' high school math course trajectory, we urge educators to consider multiple measures when making placement decisions. This can include using *both* course grades and standardized test scores as academic measures, particularly because there are often instances when these two measures do not align perfectly. Even with multiple measures in place, educators still must be sure to examine students' progress frequently to ensure that adequate supports are in place, and to redirect students' course trajectories when warranted.

When reviewing students' academic performance for the purposes of making placement decisions, objective criteria should be applied in a systematic way for all students.

While school systems redesign their math course sequences to align with the CCSS-M, particular care should be taken to develop objective placement criteria that are applied uniformly. For example, Huang, Snipes, and Finkelstein (2014) suggest using the California State University/University of California Math Diagnostic Testing Project (MDTP)

tests—which are designed to measure student readiness for a broad range of math courses—to assist with the placement process. Looking at students at the mastery level (70 percent correct on four content strands) on the MDTP test enabled the research team to identify grade 7 students who had a 50/50 chance of passing algebra I in grade 8. This kind of objective assessment, coupled with other measures, can serve as the basis for common placement policies across school sites within a district.

Correct math placement must be free of all sociodemographic bias—select the right course at the right time for students and reevaluate students' progress often.

Given the well documented differences in math outcomes for minority students, it is vital to place students in the right course at the right time to enable complete math sequences throughout high school for *all* students. A combination of careful placement policy, objective measures of math progress, and frequent assessment of progress are critical to getting students on a course trajectory that prepares them for the transition into postsecondary education.

References

ACT. (2007). *Rigor at risk: Reaffirming quality in the high school core curriculum*. Iowa City, IA: Author.

California Department of Education. (2014). *Common Core State Standards in Mathematics frameworks*. Sacramento, CA: Author.

Center for American Progress. (2012). *Unequal education: Federal loophole enables lower spending on students of color.* Washington, DC: Author.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2013). *Algebra for 8th graders: Evidence on its effects from 10 North Carolina districts* (Working Paper). Washington, DC: National Center for Analysis of Longitudinal Data in Education Research.

Finkelstein, N. D., & Fong, A. B. (2008). *Course-taking patterns and preparation for postsecondary education in California's public university systems among minority youth* (Issues & Answers Report, REL 2008–No. 035). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory West.

Finkelstein, N., Fong, A., Tiffany-Morales, J., Shields, P., & Huang, M. (2012). *College bound in middle school and high school? How math sequences matter.* Sacramento, CA: The Center for the Future of Teaching and Learning at WestEd.

Jencks, C., & Phillips, M. (Eds.). (1998). *The Black-White test score gap.* Washington, DC: Brookings Institution Press.

Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis, 24*(1), 37–62.

Lawyers' Committee for Civil Rights of the San Francisco Bay Area. (2013). *Held back: Addressing misplacement of 9th grade students in Bay Area school math classes*. San Francisco, CA: Author.

Magnuson, K., & Waldfogel, J. (Eds.). (2008). *Steady gains and stalled progress: Inequality and the Black-White test score gap.* New York: Russell Sage Foundation.

Oakes, J., Gamoran, A., & Page, R. (1992). Curriculum differentiation: Opportunities, outcomes, and meanings. In P. W. Jackson (Ed.), *Handbook of research on curriculum* (pp. 570–608). New York: Macmillan.

U.S. Department of Education. (2007). *America's high school graduates: Results from the 2005 NAEP high school transcript study* (NCES Publication No. 2007-467). Washington, DC: Author.

U.S. Department of Education. (2014). *Expansive survey of America's public schools reveals troubling racial disparities* [Press release]. Retrieved from

http://www.ed.gov/news/press-releases/expansive-survey-americas-public-schools-reveals-troubling-racial-disparities

Vanneman, A., Hamilton, L., Baldwin Anderson, J., & Rahman, T. (2009). *Achievement gaps: How Black and White students in public schools perform in mathematics and reading on the National Assessment of Educational Progress* (NCES 2009-455). Washington, DC: U.S. Department of Education.

Waterman, S. (2010). *Pathways report: Dead ends and wrong turns on the path through algebra*. Los Altos, CA: Noyce Foundation.

This Research Brief has been made possible with generous support from the Silicon Valley Community Foundation. The views expressed are exclusively those of the authors.

Endnotes

1. In our analysis we define minority students as being Hispanic and African American students.

2. The dataset used in this analysis was originally obtained from the California Partnership for Achieving Student Success (Cal-PASS). The dataset contained data on 24,279 students who were in grade 7 in the 2004/05 school year. It followed these students for six years through the 2009/10 school year. The data contained demographic characteristics, course enrollment data, course grades, and California Standards Test (CST) results.

3. In our analysis of *algebra I* patterns found in our previously collected data, we are referring to courses that, in general, were less rigorous than current CCSS-M–aligned courses.

4. *High-achieving* was defined as having a grade 7 math grade point average (GPA) of at least 3.0 and grade 7 scores on the California Standards Test of either Proficient or Advanced. We focused solely on high-achieving students here because they are more likely to be promoted from one course to the next each year.

5. In our sample of high-achieving grade 7 students, we found that 8.2 percent of the high-achieving grade 7 students did not enroll in algebra I in grade 8. This is cause for concern because students who do not take algebra I by grade 8 are much less likely to be able to take calculus by grade 12.

Suggested citation: Fong, A., & Finkelstein, N. (2014). *Math Placement: The Importance of Getting it Right for all Students.* San Francisco: WestEd.

This Research Brief has been made possible with generous support from the Silicon Valley Community Foundation. The views expressed are exclusively those of the authors.

WestEd — a national nonpartisan, nonprofit research, development, and service agency — works with education and other communities to promote excellence, achieve equity, and improve learning for children, youth, and adults. WestEd has 16 offices nationwide, from Washington and Boston to Arizona and California, with its headquarters in San Francisco. For more information about WestEd, visit WestEd.org; call 415.565.3000, or toll-free (877)4-WestEd; or write: WestEd | 730 Harrison Street | San Francisco, California 94107-1242.