

Broad Exposure to Mathematics Content Matters More for Students in Racially Diverse Classrooms¹

Erin R. Ottmar, Timothy R. Konold, Robert Q. Berry,

David W. Grissmer, and Claire E. Cameron

This study examines whether exposure to mathematics content differentially contributes to mathematics achievement in fifth grade depending on the racial composition of the students in the classroom. The study found that as exposure to more diverse content increases, the racial mathematics achievement gap in the classroom narrows, suggesting that increasing opportunities to learn broad mathematics content for students in racially diverse classrooms may be beneficial.

Less than half of fourth graders demonstrate mathematical proficiency (National Assessment of Educational Progress, 2013). In addition, achievement gaps exist between Caucasian students and students of color. These gaps may be partially explained by unequal exposure and opportunities to learn (OTL) particular mathematics content.

The Common Core Standards recommend that students should receive instruction covering a broad spectrum of content, including number and operations, algebra, geometry, measurement, and data analysis and probability. However, research has found that many teachers tend to overemphasize basic number and operations (DNO) and do not teach students more diverse content year after year.

Further, studies have found that instruction may vary depending on whom they are teaching. Serious disparities appear to exist between student achievement and OTL related to race. Studies have found that African American and Hispanic students are more likely to be given instruction that primarily emphasizes numbers and operations and basic computation skills, with little depth in other mathematics content. In contrast, students in more Caucasian classrooms tend to spend less time on these basic skills and more time on higher order thinking skills and additional content such as geometry, measurement, and algebra (BNO). However, little is known about how exposing students to different content strands contributes to their mathematics learning.

The Study

This study examined the relations between exposure to specific mathematics content and student achievement, and explored whether exposing students in more racially diverse classrooms to more content beyond numbers and operations was related to higher student achievement.

Participants were selected from the publically available Early Childhood Longitudinal Study (ECLS-K) data set. Data was collected from 5,181 fifth grade students and 2,838 teachers from 1,523 schools across the United States.

Content Developing Numbers and Operations (DNO)

- Skills and procedures to solve routine problems
- Basic math concepts
- Place value with whole numbers
- Numbers and Operations
- Estimating quantities
- Reasoning and solving problems

To measure exposure to mathematical content, teachers were asked to report about how often they taught students 24 different instructional practices and content during mathematics class. These items were then grouped into three categories: Developing Numbers and Operations (DNO), Beyond Numbers and Operations (BNO), and Instructional Practices.

¹This research brief is based on the following published study: Ottmar, E.R., Konold, T.R., Berry, R.Q., Grissmer, D.W., & Cameron, C.E. (2013). Increasing equity and achievement in fifth grade mathematics: The contribution of content exposure. *School Science and Mathematics, 113*(7), 345-355.

Content Beyond Numbers and Operations (BNO)

- Geometry
- Measurement
- Data analysis, statistics, and probability
- Using measuring instruments
- Algebra and functions
- Fractions

Student mathematics achievement was directly measured using a standardized assessment. Teacher and student demographic information was also provided. In addition to classroom content exposure and classroom racial composition, the researchers accounted for: student factors including initial mathematics achievement, gender, race, maternal education, and socioeconomic status; teacher factors, such as teacher education and years teaching; and school factors, such as location and whether the child attended public or private school.

Findings

On average, teachers emphasize basic number and operations content far more than other content areas. They report teaching numbers and operations content, on average, between three to five days per week, but only reported teaching students geometry, algebra, measurement, and data analysis content one or two times every few weeks.

Results show that more reported exposure to content beyond numbers and operations was related to students' improved achievement, but more time spent teaching basic numbers and operations did not contribute to learning. Further, students in classrooms with few students of color did not show increased scores with more exposure to basic numbers and operations content as their peers in more racially diverse classrooms. However, for all students, more time exposed to content beyond numbers and operations (e.g. geometry, measurement, algebra) was related to improved achievement.

Practical Implications

The racial inequities that currently exist in mathematics education with regards to instruction may limit some students' opportunities to learn. This study demonstrates the positive contribution of exposing students, especially minority students, to more diverse mathematical content beyond numbers and operations. Increasing the amount of time that students in racially diverse classrooms spend learning more broad content may provide them with opportunities to learn and practice necessary content and skills that are required to be successful in higher-level mathematics.

An alternative explanation could be that teachers respond to low-scoring students, who are more likely to be members of historically disadvantaged racial groups, with greater amounts of basic instruction. Yet overall, our results suggest that exposing students to more broad instruction that develops both concepts of numbers and operations and geometry, algebra, measurement and statistics is associated with increases in their mathematical proficiency. These results are important because when teachers overemphasize numbers and operations, they potentially sacrifice time that they could be spending on other mathematical concepts. For teachers and administrators, these findings suggest that modifications of pacing guides should be made to ensure that all students, especially those in more racially diverse classrooms, are receiving a balance of instruction in all areas of mathematics.

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