

LATINO/A AND BLACK STUDENTS AND MATHEMATICS

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EXECUTIVE SUMMARY

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Too many Americans struggle with mathematics, and far too many in this group are Latino/a and black adolescents, particularly from low-income backgrounds. This paper focuses on how we can better engage these populations in mathematics and improve their achievement, but speaks to the broader challenge of improving math outcomes of all young people. Recent research focusing on mathematics as a social activity rather than as a matter of cognition alone suggests that school instruction in how to “think mathematically” is not a sufficient answer. Using new perspectives on learning outside of school, Rochelle Gutierrez and Sonya E. Irving argue that mathematics teachers need to initiate students into mathematical communities and practices, helping adolescents see themselves as “doers” of mathematics. This paper examines four research areas that challenge and add to the standard math taught in school: ethnomathematics; how adults use learning math outside school; afterschool math programs for youth; and social justice mathematics. Gutierrez and Irving combine these fields and draw out key features to offer a more comprehensive vision of what student-centered learning in mathematics could be and how it could help support Latino/a and black students in particular.

Key findings from this research include:

- > The forms of mathematics that U.S. schools value are not the only mathematics that people use. Different cultures practice different kinds of mathematics, learn them in different ways, and use them for different reasons.
- > How students feel about themselves while doing mathematics is critical to how much they engage with it. Out-of-school experiences can help a person develop confidence, a larger repertoire of math strategies, and a math identity built upon his or her culture or community—all of which contribute to school learning.

- > Small-group learning, which is more common in afterschool programs than in regular classrooms, provides more opportunities for students to explain their thinking, get feedback quickly, and refine their thinking based on a variety of perspectives.
- > Teaching mathematics through social justice issues can motivate adolescents—especially those who have lost interest in traditional mathematics—to learn the math skills necessary to solve complex problems.

To increase achievement among black and Latino/a students, Gutierrez and Irving recommend combining several approaches: build the personal and cultural experiences of learners; nurture self-confidence and mathematical identity; and use real-world problems and peer involvement to increase motivation and mathematical rigor.

STUDENTS IN DIFFERENT CULTURES LEARN AND USE MATHEMATICS DIFFERENTLY

As anthropologists have documented, people around the world do mathematics, including counting, measuring, locating, designing, playing, and explaining. However, as ethnomathematics research shows, the forms of mathematics we value in U.S. schools—Euclidian geometry, Cartesian coordinates, the base-10 counting system—are not the only mathematics that people use. Indeed, different cultures practice mathematics in different ways and for different purposes. Many people use mathematics not just to display knowledge to others in school (i.e., get good grades), but also to accomplish something in everyday life (i.e., solve real-world problems). For example, the residents of the Marshall Archipelago, where sailing is integral to life, use stick charts that rely upon unique geometric and algebraic renderings of the oceans.

Many of the cultures documented in ethnomathematic studies have had no formal schooling. Rather than learning from official “teachers,” people learn sophisticated mathematical methods from others in their communities, who often take them as apprentices and show them how to use math to accomplish certain tasks.

With a focus on the perspectives of learners, recent research points to the importance of students having personal or cultural reference items for learning mathematics. A study of women 14 years and older in the suburbs of Brazil, for example, indicated that the ability to work with familiar objects (e.g., beans, rice, sugar) made doing school math easier.

Such research raises important questions for student-centered approaches to learning mathematics in U.S. schools. For example, would students find mathematics more interesting if they learned the history of math and the different ways that cultures across the world still use math today? Would students who are immigrants learn more if schools encouraged them to use forms of mathematics they knew from their home countries?

STUDENTS ARE MORE MOTIVATED TO DO MATH WHEN THEY FEEL GOOD ABOUT THEMSELVES

Research suggests that how students feel about themselves while doing mathematics is critical to whether or not they engage fully in mathematical activities. Important steps to motivate students who might not otherwise be engaged in mathematics classrooms include developing their confidence, using a larger repertoire of mathematical strategies, and fostering a mathematical identity that builds upon their culture or community.

Afterschool programs seem to offer opportunities for students to develop a kind of identity around mathematics, addressing the call from the Common Core State Standards that students create a mathematical “character.” In one study, students in an afterschool program reported feeling more confident about asking questions, completing homework, and challenging the mathematical justifications of others. This sense of confidence can go a long way toward individuals’ seeing themselves as mathematical people and in persisting in solving difficult math problems. This is especially important in the face of ongoing negative stereotypes among teachers about black, Latino/a, and low-income students as unable to do math.

Studies of Latino/a parents learning mathematics suggest that building upon students’ previous cultural experiences—what some researchers have termed “funds of knowledge”—also can help address issues of equity in schools. One model is for teachers to go into the community and observe and interview families about the kinds of activities (e.g., chores) students do at home. Teachers then can build upon these forms of expertise in the classroom, although it is a time-consuming task.

However, research reveals a repeated pattern across sites when it comes to current practice in mathematics class: students are implicitly taught to ignore their out-of-school experiences. In contrast, the school walls could be more permeable. Just as teachers could visit students’ homes, they could bring students into the community to study how people use mathematics in their everyday lives. Teachers could invite community members into the school to talk about the kinds of things they do and how those relate to mathematics. These approaches might help students build a stronger identity as doers of mathematics and, therefore, increase their interest in knowing how their practices relate to formal, abstract mathematics taught in school.

SMALL-GROUP LEARNING PROVIDES QUICK, CRITICAL FEEDBACK

Learning in small groups, which is more common in afterschool mathematics programs than in typical classrooms and summer schools, has stronger impact on students than does whole-group instruction or a focus on one-on-one tutoring. This suggests that students may benefit from peer interaction as they collaborate with one another to solve non-routine problems—and that they benefit from more opportunities for rigorous mathematics thinking.

Research on afterschool mathematics programs also suggests that when students work in small groups, they receive feedback more quickly than they would from a teacher in a large class, and they are more likely to be engaged in higher-level problem solving and making connections to the real world. Students in small groups have more opportunities to explain their thinking, clarify their ideas, and justify their strategies to one another. They can hear, challenge, and build upon a variety of other perspectives as they refine their own thinking.

SOCIAL JUSTICE ISSUES CAN TEACH STUDENTS COMPLEX MATHEMATICAL CONCEPTS

It is always easier to engage students in subjects they care about. Teaching mathematics to Latino/a and black students using social justice issues, which start with contexts familiar to students and appeal to their sense of fairness, can motivate them to learn the mathematical skills necessary to solve complex problems. This appears to be an especially effective approach to reengaging students who may have lost interest in mathematics. It not only connects with their personal and cultural experiences; it also shows the practical applications of mathematics outside the classroom.

The goal is for students to develop mathematical arguments that, when accompanied by representations of data, they can use as they seek to convince others to take certain action to solve a deeply felt problem. For example, a class of sixth graders in one study compared their overcrowded school with

the magnet school serving wealthier students one floor below. They calculated the number of students per square foot in both schools and presented it to the school board to ask for help in rectifying the inequity.

Although this form of learning may sound more like what you might see in a social studies classroom, mathematics teachers have tried and succeeded with it for a surprising number of topics, including geometry, calculus, and statistics. But more rigorous research is needed to show just how effective it is in raising student achievement.

EFFECTIVE MATH EDUCATION FOR LATINO/A AND BLACK ADOLESCENTS

Gutierrez and Irving found common themes across the fields of mathematics learning they reviewed. Drawing on these, they recommend four key elements for expanding student-centered approaches to math education and improving math achievement among underserved groups.

BUILD UPON FAMILIAR CONTEXTS AND THE PERSONAL AND CULTURAL EXPERIENCES OF LEARNERS TO MAKE MATH MEANINGFUL.

Traditionally, mathematics teachers have tended to ignore the personal and cultural experiences of learners and offered few meaningful connections to the real world. By contrast, student-centered approaches might encourage mathematics learners to draw upon familiar games, hobbies, community practices, or effective approaches from other countries. Rather than relying on negative stereotypes of their students, educators would need to learn about which experiences are most meaningful to them. Typically, community members who know students deeply have facilitated processes like these. Community walks, projects that allow students to apply mathematics to problems in their lives, and more personal conversations with students all would help teachers improve student-centered learning for black and Latino/a adolescents.

NURTURE CONFIDENCE AND A MATHEMATICAL IDENTITY IN LEARNERS.

Black and Latino/a adolescents, like all young people, reap the benefits of programs that attend to their academic and their social/emotional needs. Learners show more confidence and are better able to find an answer—and they can reflect on how reasonable that answer may be when they have opportunities to: be active in a learning space; use the languages they speak at home; use mathematics to analyze social injustices; and build upon familiar contexts and personal and cultural experiences. Incorporating the history of mathematics and the views of community members can go a long way toward helping students see that mathematics is not a singular entity, that many cultures have created (and are still creating) it, and that we can combine our personal identities with mathematical ones.

USE AUTHENTIC PROBLEMS AND PEER LEARNERS TO INCREASE MATHEMATICAL RIGOR.

Most mathematics education involves learning procedures to solve problems with one correct answer, even though problems in the real world almost always involve many overlapping variables and the solutions can be far from clear cut. By beginning with problems grounded in the interests of Latino/a and black students, we make it more likely that they will engage in higher-order thinking. Broad social issues might be the most motivating. In addition, it is helpful for adolescents to work with peers in groups, where they can hear different strategies, refine their thinking, and justify their ideas to others—just as in real-life collaborations.

LEVERAGE COMMUNITY MEMBERS TO PERSONALIZE CURRICULA AND CHALLENGE NOTIONS OF “NOVICE” AND “EXPERT.”

Bringing in community members, particularly older people who may be unfamiliar with today's mathematics curricula, strategies, and technology, can be more helpful than it might at first appear. Adolescents can “teach” adults about things with which they are familiar, even as they learn from individuals who have a lifetime of knowledge of how mathematics relates to the real world. This blurring of our ideas of novice and expert can help students develop meaningful personal relationships and offer opportunities to “try on” math identities.

The research reviewed in this paper is a starting point for building student-centered approaches to improving mathematics learning for Latino/a and black youth. However, the lack of literature and of longitudinal data on large groups of these populations is a disadvantage. Gutierrez and Irving recommend scaling up the most successful projects and following them for longer periods so that more Latino/a and black adolescents can benefit. In addition, to better understand which formats best serve which purposes, they stress the need to develop more rigorous assessments, pilot them with students of varying ages, and cover a broader range of mathematical topics. And, they conclude, if we are to take seriously the idea of placing Latino/a and black students at the center of learning, they recommend engaging the broader public in the endeavor, especially community-based organizations that have vested interests in supporting youth.

Students at the Center synthesizes existing research on key components of student-centered approaches to learning. The papers that launch this project renew attention to the importance of engaging each student in acquiring the skills, knowledge, and expertise needed for success in college and a career. *Students at the Center* is supported generously by funds from the Nellie Mae Education Foundation.

To download *Latino/a and Black Students and Mathematics* and all papers in the *Students at the Center* series, go to the project website: www.studentsatthecenter.org



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