

# Calculated Success

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The Project for School Innovation is an initiative of the  
Neighborhood House Charter School, a tuition-free public school  
serving K-8 students in Dorchester, Massachusetts.

This publication was made possible with support from the US  
Department of Education and the Massachusetts Department of  
Education. The views expressed in this document are not necessarily  
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ISBN: # 0-9716495-6-1

*For several years running, Roxbury Prep students have outperformed their peers at every other predominantly African-American school in the state on the high-stakes Massachusetts Comprehensive Assessment System (MCAS) exam.*

## From the Desks of John King and Joshua Phillips

October 6, 2003

Dear Reader,

Thank you for your interest in *Calculated Success*. We all know how important math instruction is, and how many challenges urban schools face in this area. We are very proud of the work Roxbury Preparatory Charter School teachers have done to make ours a school where students consistently excel in mathematics. A typical Roxbury Prep sixth grader may join us with math skills that are two or more years below grade level, but they don't remain there. In fact, for several years running, Roxbury Prep students have outperformed their peers at every other predominantly African-American school in the state on the high-stakes Massachusetts Comprehensive Assessment System (MCAS) exam.

Getting to this point has been a journey for Roxbury Prep, and it continues to take a lot of hard work and dedication. As we prepared to open our doors in 1999, Massachusetts had just begun to administer its MCAS exam. While some educators resisted this shift towards common standards and increased accountability, the founding team at Roxbury Prep welcomed the opportunity to demonstrate our students' capacity for academic excellence. We determined to do whatever it took to attack, head-on, the math achievement gap and, in the process, to prepare our students to achieve at the highest levels on the MCAS and other high-stakes exams.

This resolve led to the creation of a Curriculum Alignment Template, or "CAT," a tool Roxbury Prep teachers use to ensure their curricula are carefully and strategically aligned with key standards. It led us to develop ways to be disciplined about data-analysis—so that every teacher can continually adapt their instruction to meet the needs of their students. It led us to create two separate math classes, one focusing on procedures, and one on problem solving—to sharpen students' skills, while also pushing their mathematical thinking to new levels. It led us to develop new approaches to teacher collaboration—so that teachers from all departments can support each other to help students develop as scholars. Together with other strategies outlined in the following pages, these practices have consistently helped us to work towards closing the achievement gap in mathematics. It is our pleasure to share them with you in this book.

As educators, our bottom line is to help students learn and succeed. Working with the Project for School Innovation (PSI) has given us a rare opportunity to help not only our own students, but students at other schools, too. Showing great leadership and dedication, a wonderful team of Roxbury Prep teachers spent a year working with PSI's highly skilled writers and facilitators to put together this book—researching and exploring what works at Roxbury Prep, so that they could share these practices with other schools. Wherever you are on your journey towards building a math program that works, we hope that *Calculated Success* helps you on your way.

Best wishes,



John B. King, Jr. and Joshua J. Phillips  
Co-Directors, Roxbury Preparatory Charter School

# Roxbury Preparatory Charter School

*Who we are, what we believe, the students we serve, and what they achieve*

**R**oxbury Preparatory Charter School is a public school, serving 180 students in grades six through eight in inner-city Boston. Opening its doors in 1999, Roxbury Prep was founded on the philosophy that all students are entitled to and can succeed in college preparatory programs when: 1) the curriculum is rigorous, engaging, and well-planned; 2) the school emphasizes student character, community responsibility, and exposure to life's possibilities; and 3) a community network supports students' academic, social, and physical well-being.

Roxbury Prep's student body is entirely composed of urban Black and Latino children. Most students live in single-parent households and over 65% qualify for either free or

**Each student at Roxbury Prep has two math classes every day. One class focuses on procedures, and one focuses on problem solving.**

reduced-price lunch. When they enter the school as sixth graders, over a third of Roxbury Prep students are two or more years below grade level.

Only 14% of these students scored "proficient" or "advanced" when they took the state's MCAS exam in fourth grade. 81% of those same students met this mark in sixth grade, after only one year at Roxbury Prep.

This is not just strong improvement, it is astounding. This trend continues throughout students' time at Roxbury Prep. In 2003, a greater percentage of Roxbury Prep sixth and eighth graders scored "advanced" or "proficient" than students at any other predominantly Black school in Massachusetts and than all but one of the non-exam public schools in Boston.

What is the secret of this success?

Teachers at Roxbury Prep are dedicated to preparing students to enter, succeed in, and graduate from college. To guide students on this ambitious journey, Roxbury Prep teachers have designed a math program that is rigorous, engaging, and carefully planned so that it is aligned with state and federal standards. Each student at Roxbury Prep has two math classes every day. One class focuses on procedures, and one focuses on problem solving. This balanced approach has resulted in consistent, clear, and remarkable progress in students' math achievement.

To better understand the Roxbury Prep approach to math instruction, together with the benefits of balancing procedures and problem solving, it is helpful to consider an historical perspective on math instruction in the United States.

## An Historical Perspective: The Futility of the Math Wars

The last century of math instruction in the United States has been defined by a protracted battle over how best to teach students. In a 1998 article, *Education World* writer Linda Star described the two primary battle positions:

*On the one side of the conflict are the traditionalists who claim that students should learn math by memorizing and practicing basic facts and skills. On the other side are proponents of what is often called “whole math,” who deride the old “kill and drill” methods of education, claiming that children learn best when they discover, understand, and integrate knowledge through independent exploration.*<sup>1</sup>

Through the decades, math curricula have swung back and forth like a pendulum between these two instructional philosophies, from the holistic “Activity Movement” in the 1930s, to “Back to Basics” in the 1940s, to the “New Math” of the 1960s, followed by a return to “Back to Basics” in the 1970s, and finally a swing back to holism in the 1980s. Schools and their students have been snared in a frustrating pattern of almost constant reforms that fail to achieve significant improvements in student performance.

### Constant Reform, Minimal Progress

Despite this steady stream of reform, students in the United States have made only minimal progress in math compared to their counterparts in other nations around the world. In the mid-1990s, an international study made it clear how bleak the situation was. The Amsterdam-based International Association for the Evaluation of Education (IEA) launched the world’s most comprehensive



Co-director John King checks in with students on their work.

study to date of student abilities in science and mathematics—the Third International Mathematics and Science Study (TIMSS). TIMSS assessed more than a million students from 41 different countries. This study revealed that, while US fourth graders performed well against their international peers—ranking above average in five of six mathematical areas—in subsequent years they were unmatched in the speed of their decline. By the twelfth grade, US students placed near the bottom of the list—outscored only Cyprus and South Africa.<sup>2</sup>

Such reports added fuel to the fire of the math wars. However, some educators were also beginning to realize that, no matter which philosophy was temporarily on the winning side of the math wars, students were *always* on the losing side. Throughout this period, a similar battle had been raging among literacy educators—between those advocating for “whole language” and proponents of phonics instruction. In a 1988 edition of the *Harvard Education Review*, author and educator Lisa Delpit expressed an outright frustration with the language debate—sentiments that would soon be



A student eagerly participates in class.

echoed on the battlefields of the math wars:

*In short, the debate is fallacious; the dichotomy is false. The issue is really an illusion created initially not by teachers but by academics whose world view demands the creation of categorical divisions—not for the purpose of better teaching, but for the goal of easier analysis...those who are most skilled at educating Black and poor children do not allow themselves to be placed in ‘skills’ or ‘process’ boxes. They understand the need for both approaches.<sup>3</sup>*

In a 1998 speech to math educators, Secretary of Education Richard Riley seemed

to pick up on Delpit’s theme, calling for an outright “cease-fire” in the math wars, urging educators instead to focus on excellence and on achieving results with their students,

*We are suffering from an “either-or” mentality. As any good K-12 teacher will tell you, to get a student enthused about learning, you need a mix of information and styles of providing that information. You need to provide traditional basics, along with more challenging concepts, as well as the ability to problem solve, and to apply concepts in real world settings.<sup>4</sup>*

Riley’s remarks didn’t end the math wars by any means. Yet nine months after his speech, a small public school in the Roxbury neighborhood of Boston, Massachusetts, opened its doors, and began to put Riley’s ideas to the test. Rather than devoting itself exclusively to any one instructional philosophy, Roxbury Preparatory Charter School would draw from the best of the best, providing students with rigorous math instruction that focused on both procedures and problem solving.

Year after year, Roxbury Prep students’ dramatic improvements and marked success on state and federal assessments have provided vivid testimony to the benefits of leaving the math wars behind.

### Notes

1. Starr, Linda. “Math Wars!” *Education World*: April 27, 1998
2. Star, 1
3. Delpit, Lisa. “The Silenced Dialogue: Power and Pedagogy in Educating Other People’s Children” *Harvard Educational Review*. Vol. 58 No. 3. 280-298, 1988
4. Riley, Richard. “The State of Mathematics Education: Building a Strong Foundation for the 21st Century” *Conference of American Mathematical Society and Mathematical Association of America*: Thursday, January 8, 1998

## Overview

### *Calculated Success*

During the 2002-03 school year, a team of six teachers from Roxbury Preparatory Charter School worked with the Project for School Innovation (PSI) to explore and document the specific practices that contribute to their students' consistent and remarkable success in mathematics. In the spring, the Roxbury Prep team tested their findings by sharing their ideas and strategies with teachers and administrators from other schools in the PSI network.

This guidebook provides many of the lessons that came out of this process. It is divided into three chapters. The first, *Math Instruction* explores the processes Roxbury Prep teachers follow to assure that each day's lesson is aligned with specific skills, standards, and benchmarks. This chapter also offers insights from Roxbury Prep's dual-math approach, which emphasizes both procedures and problem solving—helping students to build their fluency with basic numeracy, while also stretching their conceptual thinking. The second chapter, *Frameworks for Data-Driven Instruction* explores the specific tools and systems Roxbury Prep teachers use to write rigorous curricula that are specifically tailored, and adaptable, to students' skills, so that students are prepared to achieve at the highest levels on high-stakes assessments. The final chapter, *Literacy in Math* explores three key practices Roxbury Prep teachers use to help students succeed in math by focusing on literacy.



Roxbury Prep students.

### Ten Goals

What happens when math instruction is effective? Roxbury Prep faculty identified a total of ten goals for how they expect to impact student skills, student understanding, and teacher effectiveness. These underlying goals support, focus, and drive all of the instructional practices that are described throughout this book.

#### Student Skills

- 1 Students are able to compute numbers with fluency and accuracy.
- 2 Students are able to apply appropriate math procedures in single- and multi-step problems.



Ms. Saenz confers with a student.

- 3 Students are able to speak and write fluently about math problems and procedures, using accurate mathematical vocabulary.
- 4 Students are able to use graphs, functions, models, and data to interpret and represent change.

#### Student Understanding

- 5 Students understand and can explain how, when, and why to use different math procedures, and what different equations mean.
- 6 Students understand and can explain whether or not an answer is reasonable, and they are able to use this as a way to check their work.
- 7 Students know and are comfortable with various standardized test formats. They are equipped with test-taking strategies, and they are confident in their ability to do well on such tests.

#### Teacher effectiveness

- 8 Teachers are able to develop highly detailed, day-by-day curricula that are aligned with standards that students are expected to meet.
- 9 Teachers are able to tailor their curricula and instruction to students' skills and needs.
- 10 Teachers are able to continually improve math instruction by drawing on each other's expertise and supporting each other across disciplines.