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Introduction

A tale describes an old man digging frantically in the night, the ground illuminated by a lantern on the wall in front of his house.

“What are you looking for?” inquired a friend.

“The gold coin that I lost,” replied the old man.

“How did you lose it?” asked his friend.

“I lost it while working behind my house,” he said.

“Then why are you looking for it in the front?” wondered the friend.

“Because there’s enough light to dig here,” answered the man.

For years and years we—Chris Confer and Marco Ramirez—worked as math resource teachers in high-poverty schools in Tucson, Arizona. We often worked together in a handful of schools where we provided mathematics professional development, workshops, and coaching for amazing, hardworking teachers. Like the old man above, we all were searching for that elusive gold coin: a school filled with confident students who could solve mathematics problems, saying, “That’s easy! I can do that . . . and a whole lot more!”

Yes, good things happened in many of our schools. Over and over again we would see high-quality mathematics bubble up—for example, when a grade-level team at one school taught problem solving, or a group of teachers in another school used manipulatives to teach geometry. Children and teachers became excited and hopes would rise. “It really is possible!” we said.

But one by one these fragile bubbles popped before our eyes, for reasons as different as the schools where we worked. Perhaps teachers would change grade levels, or a principal would be reassigned. Hard work would dissipate into wisps of mist, and we
found ourselves beginning the process all over again.

Does this story sound familiar to you? Many teachers, principals, and support people work to the point of exhaustion. They attend meeting after meeting, analyze standards, and write curriculum maps. They align instruction horizontally within grades and vertically between grades. They examine data of all kinds, arrive early at school and stay late, teach, and reteach . . . and in the end, test scores and classroom performance often show only incremental improvement.

Just like the old man in the story above, educators often seem to be digging in the wrong place.

Although the above school improvement strategies can be helpful, they are never sufficient. It is important for educators to set their sights on new, perhaps out-of-the-way places, where the gold actually lies.

Through the school-based research that we have done for nearly two decades, it is clear that all children—even English language learners and children who live in poverty—can succeed in mathematics. For principals, coaches, and teachers across the country the ultimate question remains: What does it take?

° What does it take for the majority of the students in any school to be successful in mathematics?
° And then, what does it take to sustain the success?

We have explored these questions for several decades in many schools in different states. Over time we compiled and adapted school reform and cross-curricular instructional strategies that pay off big dividends in mathematics. Over time we consulted in schools across the country, developed more mathematics program improvement strategies, and discovered how to adjust them for different populations of students and teachers.

In a school in the Tucson Unified School District, we brought together these mathematics program improvement strategies. Building on the work that the previous principal had done to bring together the community, we—Marco as principal, and Chris as instructional coach—worked alongside a group of hardworking teachers. Together we moved a school from “underperforming” to “highly performing” in mathematics in 2004–2005. Pueblo Gardens Elementary School, where about 94 percent of the students were at the poverty level and spoke five different languages at home, had 93 percent of its students meeting or exceeding state standards in third-grade mathematics. Over time other grades scored at high levels. And once the test scores rose, they remained at high levels.

Pueblo Gardens Elementary School, which once was looked down upon by many educators in the district, became an example of success. This high-poverty school with many English language learners hosted districtwide professional development sessions that showcased what their students could do. As a result, students in this high-poverty
school helped teachers from other schools—even affluent schools—realize what high-quality student thinking looks like and sounds like. Consequently, many schools across the district adopted new strategies and benefited.

Most compelling, however, has been watching children become transformed, not only at Pueblo Gardens Elementary School, but at other schools where we have worked. Students learn to confidently solve problems in more than one way. They speak the language of mathematics. And most important, they love math.

Is this simple to do? No.

Is this a silver bullet, an easy cure-all? No.

But can other schools do the same? Absolutely.

We have learned that making sense of mathematics can change the culture of a school and sustain it. We have learned that quality patterns of teaching allow educators to work smarter rather than harder. We have learned that teachers, coaches, and principals who intertwine their roles and together research math instruction realize what is possible for children to achieve.

The Structure of This Book

Each chapter of our book outlines an essential idea that guides our work as we support schools. Each essential idea is clear, doable, and practical; we truly believe that significant change is within the reach of every school.

Each chapter ends with three stories that reflect the essential idea through three voices: the voice of a principal, the voice of a coach, and the voice of a teacher. The stories in this book describe the tools that we have used to help schools carve out their own unique paths to similar destinations.

No story in this book is that of a specific school, educator, or student with whom we have worked; we appreciate the trust that educators have offered us and respect the confidentiality that allows all of us to do our best. Each story, however, rings true because principals, coaches, and teachers across the country have surprisingly similar struggles, issues, and challenges. Each story reflects the common concerns, perspectives, and insights of hardworking, dedicated educators who truly want the best for their students.

We offer these ideas in the hope that they may help principals, coaches, and teachers release the potential that lies within each student—and each other. We know that success is possible when educators search for that gold coin in a different place. Without a doubt, abundant possibilities surround us all.

Chris Confer and Marco Ramirez
Tucson, Arizona
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Chapter 1

Keep the End in Mind

You must be the change you want to see in the world.

—Mahatma Gandhi

Schools, mathematics, and children are our all-consuming passion. We are consultants who embed our lives in schools, working with children, to “be the change” that we want to see. While supporting principals, coaches, and teachers, we keep an eye on the future’s horizon, to glimpse the world where our children will someday live and, ideally, thrive.

Spin the clock backward in time to the 1950s and imagine schools in black-and-white images: desks in rows, students listening to lectures, and blackboards and workbook pages filled with computations. No wonder—at that time, adults needed basic skills in computation and literacy to do repeated tasks, jobs that are now completed in nanoseconds with computers and technology. Think back to the United States and its post–World War II society: more localized, predictable, and structured than today’s global, wildly shifting, interdependent economy. The mathematics of the 1950s—its cousin “arithmetic”—served that era but is not sufficient for this one.

Today the Common Core State Standards for Mathematics have redefined our goals, mirroring the new needs of the twenty-first century. While maintaining important focus on core content and skill fluency, the CCSS also include practices such as reasoning, problem solving, perseverance, and justification, as well as application and understanding of concepts. “Being the change” requires educators to step in this new direction, shift their thinking . . . and make a journey.
The End in Mind

Say you plan a family trip: the first thing you agree on is the destination. You might consider driving from Maine to Miami along the shoreline to enjoy the view. Or maybe you’ll consider driving through Norfolk, Virginia, for your favorite coconut cake at the No Frill Bar and Grill. Doesn’t matter much, because you know that driving south will get you to your destination. Everyone agrees where Miami is.

However, even within a single school, hardworking educators aim for mathematical destinations as different as Des Moines, Los Angeles, and Paris—all at the same time.

Although common standards and common assessments are an important beginning, mathematics instruction will change significantly when principals, coaches, and teachers agree on what standards and mathematical practices look like in the classroom: What does high-quality work and thinking look like and sound like? What does it take to accomplish the standards?

Educators use common words—in very different ways. What does rigor mean from classroom to classroom?

- Pages filled with problems?
- Doing fifth-grade mathematics in fourth grade?
- Using different approaches or tools when solving problems?

And what does problem solving mean?

- Teachers guiding students through problem-solving steps?
- Students finding a correct answer to a word problem? . . . to multistep problems? . . . to problems that cross Common Core domains and clusters? . . . to complex real-world problems with more than one answer?

Most important, what one teacher considers high-quality work varies greatly from what the teacher next door considers high-quality work (see Figure 1.1). Of course, students are adaptable, and they quickly figure out how to get an A from a particular teacher. But “learning the teacher” cannot substitute for learning mathematics.

Mr. Westmoreland gives his fourth graders packets of math problems that students solve alone. When you walk into his classroom, it is usually silent, and you see Mr. Westmoreland moving from student to student, quietly correcting errors. Ms. Saenz has her fourth graders solve problems in groups of four. Her classroom is noisy, and her colleague across the hall sees her classroom as “chaotic.”

One year, the principal held Mr. Westmoreland up to the staff as having an exemplary classroom, and the coach worried about Ms. Saenz’s “lack of focus.” The next year,
a new principal praised Ms. Saenz’s emphasis on cooperative learning, and the instructional coach encouraged Mr. Westmoreland to stop teaching through pages filled with calculation problems.

What is high-quality student work in mathematics? This question must be answered first. Once they agree on a destination, educators can discuss how they are going to get there.
When we begin our work at a new school, our first step is to ask the teachers, the coach, and the principal to bring samples of “high-quality student work” to a meeting. The differences in what the educators bring can be eye-opening.

Mr. Westmoreland brought to the meeting a sheet of fifty problems that a student, Gerard, had completed neatly with no errors. “Gerard is my best student,” he told the group. “And I only had to tell him how to make common denominators once.”

In contrast, Ms. Saenz brought a group poster that her students had made, showing how they identified equivalent fractions using paper fraction pieces.

As the coach, the principal, and the teachers examined the student work, the discussion—led by a protocol—took an interesting turn. “I like Gerard’s neatness,” Ms. Saenz commented, “and he certainly can multiply the numerator and denominator by the same number. But,” she mused, “I can’t tell whether he knows what equivalency means.”

Ms. Saenz’s work brought forward other comments: “I like the idea of cooperative work,” Mr. Westmoreland said, “but I wonder whether all the students in the group understand what is on the paper. And the students won’t have those pieces when they take the test. Don’t they have to be able to solve the problem by making common denominators?”

“Ah,” we thought as we once again recognized a group taking that crucial first step—educators uniting around a common concern, asking the important question: “What should our ‘end in mind’ be?”

Goals for Students

When we begin our work in any school, our goal is for its students, regardless of their socioeconomic status, to be mathematically competitive with other students in the United States. And we understand at a deep level that in this global, technological, mathematically based economy, all students—even those who may never have traveled outside their state—will one day have to compete for jobs with their peers in Japan or India or anywhere else in the world.

These are the goals for students that we promote and that many schools ultimately identify:

° Think and reason effectively
° Solve problems accurately, flexibly, and efficiently
° Communicate clearly using mathematical language and representations
° Demonstrate skills and knowledge on performance assessments as well as standardized tests
Think and Reason Effectively

Do children need to “think and reason” in mathematics?

Don’t children need to memorize computation procedures and basic facts?

Figure 1.2

Answering the questions in Figure 1.2 honestly and directly is enormously important from the start. Educators and the American public are well aware that silver bullets and bandwagons abound, throwing the baby out with the bathwater and leaving children dripping in the puddles that remain. Leaving these questions unanswered derails countless mathematics improvement programs and muddies innumerable professional conversations.

We begin our work at all schools by confronting these two important questions. And we make clear that the answer to both questions must be a resounding “Yes!”

- Yes, children must think and reason, and make sense of mathematics—in the same way that they comprehend text when reading.
- And, yes, children must become efficient with skills and procedures—in the same way that they become fluent readers.

Our goal is always to have a balanced approach to mathematics, to make sure that the pendulum gently sways in the middle around sense-making. Extremist pendulum swings serve no one—certainly not the children. From the start of any school improvement relationship, we make it abundantly clear that fluent skills and understanding of concepts are important. The Common Core State Standards also make this connection explicit.

Mathematics must be a tool that children and adults can use to accurately solve problems. Otherwise algorithms and skills lie dormant in the classroom, or even worse, they are applied incorrectly. And children—especially children of poverty—may have less motivation to memorize material that is not useful or obviously applicable in their lives.
In contrast, when children are invited to use their skills and knowledge to solve interesting problems, mathematics becomes an exciting and lively puzzle. And when students understand the purpose for learning basic facts, they are more likely to make the effort.

Keeping the balanced approach clear from the start defuses teacher and parental anxiety, and most of all, is an accurate portrayal of what mathematics is. Yes, students will develop conceptual understanding. And, yes, students will learn their basic facts and computation. Most important, children who have both abilities can become capable, competent, and confident.

Figure 1.3 is the visual reminder that we use to model the intersection of thinking and reasoning, problem solving, and efficient skill development that guides all of our work. This graphic remains in the forefront of all discussions about improving mathematics, to continually highlight the critical role of both conceptual understanding and skill fluency in problem solving.

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James Hiebert (1997) explains the importance of conceptual development this way:

Knowing mathematics, really knowing it, means understanding it. When we memorize rules for moving symbols around on paper, we may be learning something, but we are not learning mathematics. When we memorize names and dates we are not learning history; when we memorize titles of books and authors we are not learning