This book's fresh perspective on mathematics education is both invigorating and practical. The authors deliver an invaluable resource for educators committed to improving their mathematics instruction. With its user-friendly format and immediate applicability, *Math Workshop, 6–12* is well-suited for teachers seeking to enhance their practice and foster a more dynamic learning environment. This practical approach not only helps in understanding how to implement math workshop but also inspires educators to enrich their own teaching practices.

—Beth Burnap, Division Mathematics Instructional Specialist,
Caroline County Public Schools, Bowling Green, Virginia

If you're looking to implement the math workshop model in your secondary classroom, this book is like having a master teacher show you the ropes. Lempp and Tyler provide a step-by-step approach to prepare you, your classroom, and your students for an engaging math workshop experience. What sets this guide apart is the authors' insightful understanding of common classroom challenges.

The authors provide detailed guidance on the components and structures of math workshop, from how to use reasoning routines and focus lessons to which workshop structure works best for your daily objective. As you progress through the book, you will be prompted to connect the tools and information you have read to your unique teaching practice through a series of reflective questions at the end of each chapter.

Whether you are experienced at math workshop or just looking to get started, this book has the tools, guidance, and inspiration to help you make your math classroom a place where all students can be engaged in their learning.

—Stephanie Burton, Instructional Designer,
Matoaca Middle School, Chesterfield, Virginia

This is exactly what I expected and so much more!

Math Workshop, 6–12 is a textbook, a toolbox full of resources, and a mentor all rolled together. Regardless of whether this is your first encounter with math workshop or you're already on your journey, the authors have designed this book to help you easily access what *you* need to know. It's like having a coach right alongside you.

—Alicia Chilton, High School Math Teacher and Department Leader,
Glen Allen, Virginia

This book is tailored to meet your students' unique needs, offering step-by-step guidance on implementing an effective math workshop in your middle-level classroom. With clear explanations, practical strategies, and actionable tips, this will become your go-to tool for enhancing math education and engaging students. Empower yourself with proven techniques and make math teaching a more dynamic and impactful experience.

—Nichole Criminger, Ed.S., Secondary Math Coach, Lexington County School District One, Lexington, South Carolina

The strategies transform math class into a community of learners. Students become confident communicators while engaging in relevant experiences, while teachers get the small group and individual student time they crave. This book provides instructional ideas that can be used across all content areas!

—Lindsay Ingram, Associate Principal, Glen Allen, Virginia

Math Workshop, 6–12 is an essential resource for educators striving to transform their mathematics classrooms. This book provides a comprehensive road map with clear, actionable strategies to bring math workshop to life. Every page is filled with valuable insights and tools that are immediately applicable, equipping you with the knowledge needed to elevate your mathematics instruction.

—Hilary Morgan, Coordinator of Mathematics, Lexington County School District One, Lexington, South Carolina

As I read this book, I could not help but think *Wow, I wished I had this as a resource for my own study* [in graduate school]. While reading, I found myself thinking about how I could change my lessons as I transition to high school this year. If you are looking for a way to engage your students in class while also making sure every student is getting the help they need, this is the book for you to read! The use of math workshops greatly improved my students' mathematical knowledge and abilities when it came to understanding proportional reasoning. I cannot praise this book enough!

—Brandi Wagner, Math Teacher, Charlottesville City Schools, Charlottesville, Virginia

Math Workshop

Grades 6–12

Five Steps to Implementing a Student-Centered Learning Environment

Jennifer Lempp
Skip Tyler

HEINEMANN • Portsmouth, NH

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To access the Online Resources for *Math Workshop, Grades 6–12*:

1. Go to **http://hein.pub/lempptyler-login.**
2. Log in with your username and password. If you do not already have an account with Heinemann, you will need to create an account.
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STEP
1

Understand Math Workshop

This section answers the what, why, and when of math workshop. It explores what math workshop is (and is not!) and the key benefits of math workshop. It also answers a few important questions:

- What does math workshop look like?
- Why should I implement math workshop in my classroom?
- What are the benefits of using the math workshop model?
- What are the students doing?
- What is the teacher doing?

If you work in a school where you have to convince your administrator, your teammates, or your students' parents why your mathematics instruction looks different, then pull from this section to help make your case. This section provides the big picture—the one that you and your teammates will want to read in order to have a common understanding.

CHAPTERS IN STEP 1

Chapter 1

1

Math Workshop

What, Why, and When?

CONTENTS

What Is Math Workshop?

In education, things seem to constantly be changing. As teachers, we wonder how long the latest new thing is going to be around. We wonder what will replace it. We may wonder why the change has to happen and how much we will be asked to do. We often ask ourselves: "Do I really need to do this, or will it be gone by next year?" "Is this a new initiative?" "I'll outlast this latest new educational fad, right?"

It is fair to ask these same questions about math workshop. However, even if the term *math workshop* is replaced by a new fancy term one day, the philosophy of math workshop is here to stay. It is here to stay because math workshop, in its simplest definition, is quality mathematics instruction.

What is quality mathematics instruction? If we expect that our instruction is going to be strong, then we need to ensure that it reaches all learners; that students are engaged in daily, rich mathematical discussions; and that we allow ample time for students to grapple with mathematical ideas.

Math workshop is a model of instruction that allows for *all* students to be engaged in mathematics. It is more of a philosophy than a curriculum or lesson plan template. It includes accessible mathematical tasks, open-ended problem-solving, small-group instruction, student choice, reflection, discourse, and time for practice of important concepts throughout the year.

Seven Characteristics of Math Workshop

To answer the question, "What is math workshop?" consider the following seven characteristics of successful math workshops (see Figure 1–1). This list is not all-inclusive, and you may find that you want to add more characteristics as you finesse your own workshop structures.

Let's explore each of these characteristics and discuss the research in the hope of further clarifying our thinking around the definition of math workshop.

	MATH WORKSHOP IS . . .	MATH WORKSHOP IS NOT . . .
Characteristic 1	students doing most of the math.	teachers doing most of the math.
Characteristic 2	students making choices.	teachers assigning worksheets.
Characteristic 3	students enthusiastically talking about their mathematical thinking and reasoning with each other.	students quietly listening to only the teacher.
Characteristic 4	teachers facilitating, clarifying, connecting, monitoring, and collecting data as students solve problems.	teachers showing and telling students how to solve problems.
Characteristic 5	students working collaboratively.	students working in isolation (sharing answers or strategies is cheating!).

Figure 1–1 Seven characteristics of math workshop

continues

	MATH WORKSHOP IS . . .	MATH WORKSHOP IS NOT . . .
Characteristic 6	students persevering through challenging mathematics.	teachers rescuing students when they struggle with challenging mathematics.
Characteristic 7	teachers working with small groups and/or individual students.	teachers solely presenting to the whole class.

Figure 1–1 Seven characteristics of math workshop, *continued*

Characteristic 1: Math Workshop Is Students Doing Most of the Math

In a traditional model of mathematics instruction, the teacher does most of the talking—and subsequently does most of the math. We want students to be doing the thinking and the learning, and to do so we need to engage them in doing the math.

Teachers often say they are exhausted at the end of the day. Who is doing all the work and thinking in the classroom? Who is doing all the talking in the classroom? The teacher or the students? A successful math workshop deeply engages students in the mathematics. This engagement might transpire through a number of structures; for example, some students may be working with the teacher in a small group while other students are exploring mathematics at learning stations. Whatever the arrangement is, it is not the teacher in front of the classroom doing the math; it is the students doing the math.

VIDEO
1 What Is Math Workshop?

Consider the concept of multiplying and dividing fractions. Students need time and opportunities to explore mathematical ideas—using manipulatives to model expressions, showing different representations of expressions, making connections to a real-world context, etc. Students also need autonomy and ownership of the strategies they choose to use. However, in a traditional classroom, the algorithm is presented as the initial piece of instruction, putting the focus on getting a correct answer rather than on making meaning. Students who have only algorithms to work with are likely to forget the rules or mix them up with other rules because they have not been given an opportunity to understand the underlying concepts.

Students are often told to "show your work." Yet, in a traditional classroom, what they are really being asked to do is to "show *my* work"—meaning, "Show me the

way that I, the teacher, showed you how to solve it." In that situation, students see math simply as a procedure. And if math is equal to a procedure, then students think that memorizing procedures will equate to success in mathematics. Just think about it: Those for whom math is simply something to memorize start off by memorizing the steps to solve the two-step equation $2x + 4 = 12$. The goal is to isolate the variable while keeping the equation balanced. To start, circle the variable and undo the addition. Next, undo the multiplication; then, finish the problem by checking your work. Those same students memorize this and are successfully solving two-step equations until they start to look different. What about $9 = 3 - 2x$? What about multistep equations like $2(x + 4) = 12$? In isolation, the steps are effective, but as equations become more complex and ideas are combined, students will end up with misconceptions. No wonder so many students feel that math is too difficult! Are we asking students to think, or are we removing that possibility by providing shortcuts to an answer or emphasizing how to get an answer? "Doing the math" really means "doing the thinking."

Characteristic 2: Math Workshop Is Students Making Choices

In math workshop, you will not see teachers assigning (nor students individually completing) worksheet after worksheet. Rather, you will see students making choices. There is a wide range of choices students might be faced with: They may be choosing which learning station to explore, and/or they may have to decide what task to complete or whom to work with in each station. Students may choose what strategy to use to solve a problem and/or what manipulatives to employ to support their thinking.

Hattie (2023) continues to update his research from 2,100+ meta-analyses of 130,000+ studies to determine the effect that different influences have on student achievement. He has found strong links between giving students academic choices and opportunities to develop awareness of their own learning and their intrinsic motivation to learn and increased engagement.

Students who can choose what their activities are, how long they spend on an activity, and which strategy they use to problem solve are more invested and have more buy-in to their learning. However, remember: *Go slow to go fast*—the transition from fewer to more choices is most effective when it is gradual, sometimes spanning several weeks or even months.

Characteristic 3: Math Workshop Is Students Enthusiastically Talking About Their Mathematical Thinking and Reasoning with Each Other

A classroom of students participating in math workshop is rarely a quiet room. Student discourse is encouraged and respectful dialogue is expected as students engage in *productive mathematical discussions*. Students talk about their thinking and share, listen, and learn from each other. Students value the knowledge of their peers and look to one another as supportive colleagues in their learning environment.

Zwiers and Crawford (2011) list many advantages of conversations that transcend the mathematics classroom; a few are included here.

Conversation

- builds academic language
- builds vocabulary
- builds oral language and communication skills
- builds critical-thinking skills
- promotes different perspectives and empathy
- fosters creativity
- fosters skills for negotiating meaning and focusing on a topic
- builds content understanding
- cultivates connections
- builds relationships
- makes lessons more culturally relevant
- fosters equity
- fosters engagement and motivation
- builds confidence and academic identity
- fosters choice, ownership, and control over thinking
- builds student voice and empowerment.

Wow! Isn't that list exactly what we dream about for all our students? After looking at the list, why would we ever want to walk into a quiet classroom again?

Characteristic 4: Math Workshop Is Teachers Facilitating, Clarifying, Connecting, Monitoring, and Collecting Data as Students Solve Problems

As teachers, our roles may differ based on which math workshop structure we are using (see Chapters 10–12). However, regardless of the structure we choose, there are four roles teachers take on in math workshop:

- facilitator
- clarifier and connector
- monitor
- data collector.

Let's take a moment to look at each of these roles in a bit more depth.

Role 1: The Teacher as Facilitator

At a certain point in our teaching careers, after attending several conferences and participating in professional learning opportunities, we both committed to telling less and asking more. To do this, we started asking questions and probing for students' understanding. The effect it had on our students was remarkable. At first, students responded with frustration, exclaiming, "Just tell me what you want me to do!" However, it wasn't long before students felt motivated by the opportunities and chances to be problem solvers and excited by the chance to explore. They started picking up on our questions and using them with each other.

> As teachers, when we act as facilitators, we encourage independence, responsibility, and risk-taking in students.

One teacher told us that in the beginning of her use of math workshop, when she would ask the question, "How do you know?" her students would immediately change their answer because they assumed that they must be wrong. But after asking this question frequently and consistently with every student, her students started to ask *her*, "Don't you want to know how I know?" Some questions to consider asking students to probe their thinking or help them get unstuck might include the following:

- What information do you know?
- What have you done so far?
- Would your strategy work with a different set of numbers?

- How might you prove this to your peers?
- Can you make a model to prove this?
- What other methods might have worked?
- Have you considered all the possibilities? How do you know?

These questions can help to shift students from feeling stuck or as though they "don't get it" to feeling like they have access to the problem. Eventually, the questions don't need to be asked by the teacher as often. Students begin to use them for themselves, building metacognitive skills, a key prerequisite to problem-solving proficiency.

As teachers, when we act as facilitators, we encourage independence, responsibility, and risk-taking in students. Students come to realize that the teacher believes in them and their ability to solve problems. It is the students' responsibility to participate in the learning experience, and with that, students acquire a more solid understanding of the content and are not simply regurgitating the teacher's steps.

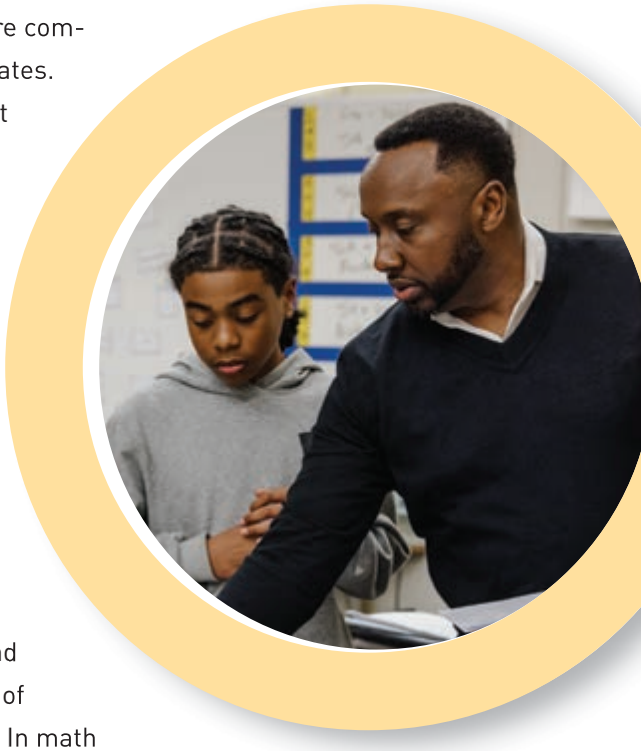
Role 2: The Teacher as Clarifier and Connector

A second role of the teacher during math workshop is to clarify students' ideas and help students to find connections. Our students are still kids; they might not always be able to explain what they are thinking or find the words to express their strategy, even in middle and high school. During these times, our role as clarifier and connector is critical. We can ask thoughtful questions, encourage students to talk with one another, ask whether students agree or disagree, and provide the appropriate vocabulary when paraphrasing a student's thinking. To encourage connections, we can use meaningful, real-world examples, another mathematics concept, a different representation, or another content area. For example, during a discussion on the distributive property, a teacher may ask students to consider how this property relates to area models of multiplication. Helping students to find connections creates important learning moments and instills curiosity. Think about it: How can students be curious if they are focused only on memorizing facts and procedures?

Do not make the mistake, however, of confusing your role as clarifier and connector with taking over a student's thinking. Even the most well-intentioned teachers can fall into this trap, especially due to time pressures. We look at the clock, we see the time ticking away, and we jump in. We take the pencil out of the student's hand, we move the manipulatives around for the student, and we essentially show the student how to do it. We must be aware of and refrain from this behavior.

Role 3: The Teacher as Monitor

During math workshop, we monitor students' participation, being on the lookout for students who might not be engaged, who appear to be working but are "hiding" from doing the task or their learning station, or who might be displaying passive behavior so as to not raise attention. We note which students' voices we hear the most and encourage all students' voices to be heard. To encourage more student participation, we have students turn to partners more frequently; getting students to interact with a partner first will help them feel more comfortable when it comes to talking with a wider range of classmates.



As teachers, we want to create an equitable classroom that meets the needs of every student and helps them learn how to learn. When we ensure that every student has the opportunity and skills to participate, we "teach children habits of mind and help them build cognitive processes and structures so that as they move through school they are able to do complex thinking and independent learning" (Hammond 2014, 126). Giving strategies and processes for all students to use will help develop cognitive skills and assist students in becoming independent learners.

Role 4: The Teacher as Data Collector

As teachers, we know our students' strengths, weaknesses, and learning styles. To get this information, we use multiple forms of assessment and collect some form of data each and every day. In math workshop, recording anecdotal notes during math class (especially during small-group time) is a powerful help in our work. Anecdotal notes

- help us make instructional decisions for the entire class and for individual students
- support us when we need to assign grades and conference with parents
- help us create small groups for future instruction
- remind us of the great things that are going on in the minds of our students long after the day's workshop takes place.

Taking anecdotal notes does not need to be time consuming or cumbersome. If you're wondering what to write down, see Chapter 8 for efficient ways to use anecdotal records with a large number of students.

Characteristic 5: Math Workshop Is Students Working Collaboratively

The important work of mathematics is not done in isolation. Mathematics permeates various aspects of the real world, enabling people from a wide variety of experiences to work together in solving complex problems and making informed decisions. Therefore, we want all students to have these opportunities in the classroom. In a math workshop, you will see students collaborating to solve problems and make sense of the mathematics. Some students feel more comfortable collaborating in pairs, whereas other students may prefer working in larger groups of four or five students.

When students work together, their learning increases. And they don't just learn mathematics—they learn how to work in groups, monitor their own behavior, and interact with peers who have different experiences or ideas.

Collaboration is an important skill that traditionally has not been fostered enough in mathematics classrooms. Students are often put in pairs or small groups to work together in other content areas; however, mathematics, for the most part, can still be a very isolated subject that is presented as black or white, right or wrong. When students talk to one another, they improve their own reasoning and are exposed to other strategies. When students work together, their learning increases. And they don't just learn mathematics—they learn how to work in groups, probe each other's thinking, have opportunities to develop deeper understandings as they discuss problems, monitor their own behavior, and interact with peers who have different experiences or ideas.

Characteristic 6: Math Workshop Is Students Persevering Through Challenging Mathematics

We have all seen what happens when students have not had the opportunity to struggle productively with concepts: either hands shoot up for help just seconds after we've given an assignment, accompanied by complaints of "I don't get it!" or quiet disengagement sets in as students pull back and watch to see if someone else will solve the problem. In these moments, it can be easy to tell (or show) the first step, just to get students started. However, in doing this, we are stealing from students the opportunity to struggle. And we may be sending an unintended, harsh message: *You can't do this without me*.

In math workshop, we support students in persevering through challenging problems; we recognize that a student's struggle is a part of the learning process. We want students to realize that a part of the process is getting wrong answers and learning from those experiences, and we communicate this to students. As a result, students develop the mindset that they are capable of doing great things in mathematics.

The National Council of Teachers of Mathematics' (NCTM) *Principles to Actions* (2014b) supports productive struggle as an effective teaching and learning practice. "Effective mathematics teaching supports students in struggling productively as they learn mathematics. Such instruction embraces a view of students' struggles as opportunities for delving more deeply into understanding the mathematical structure of problems and relationships among mathematical ideas, instead of simply seeking correct solutions" (48).

In order for students to truly understand math, our teaching must focus on students' understanding of the concepts and not the application and memorization of rules and procedures. We can encourage students to solve problems creatively while we act as a facilitator and encourage critical thinking by asking purposeful questions. The emphasis is on the learning process and not just getting a correct answer. Errors and confusion are a natural part of learning that should be embraced.

Boaler et al. (2016) also state that productive struggle is important for learning and that teachers should avoid bailing students out too quickly. They suggest that teachers can help students develop a growth mindset and build perseverance by providing opportunities for productive struggle and encouraging them to keep trying, even when faced with difficult problems.

In math workshop, students develop the mindset that they are capable of doing great things in mathematics.

We must allow the opportunity for student exploration of strategies (and this may very well include some productive struggle!). The methods they use could be shared with the class, discussed, put under scrutiny, and revised. Students defend their strategy, choose to abandon their strategy if it lacks consistent results, or find another, more useful strategy. True number sense will allow a student to have a variety of strategies at their disposal. In Chapter 5, you will see student work samples that highlight different approaches to solving tasks. Students will select the strategy that makes the most sense to them. This strategy may differ from the one the teacher may prefer, and that is okay! Students who show the greatest proficiency in mathematics will be the students who have the knowledge of when to use the strategy that best fits their purpose.

Characteristic 7: Math Workshop Is Teachers Working with Small Groups and/or Individual Students

In math workshop, while students are working collaboratively in learning stations or delving into rich problem-solving with one another, the teacher is working with small groups of students, referred to in this book as small-group instruction, or with individuals. The small groups are determined by what the teacher has observed as well as other data points. The teacher may also meet with one student during this time (considered a math conference or an interview) as a way to help clarify thinking or interject about a misconception.

Math workshop teachers recognize that there are a lot of students in the classroom, and no two students are exactly alike.

Math workshop teachers recognize that there are a lot of students in the classroom, and no two students are exactly alike. Presenting to the whole class at once is like shooting for the middle and hoping for the best. However, in shooting for the middle, you are missing many other students—those who may be struggling or have gaps and those who may be in need of enrichment. Of course, as teachers we try to do in-the-moment adaptations of our lessons based on the questions students ask or the facial expressions they make. Still, we are left trying to adapt for many students. In Chapter 8, we will discuss how to restructure class to get these students into smaller groups and find out more about what each student knows and does not yet know, giving us opportunities to better address the individual needs of our students and to quickly make adjustments when necessary. In this way, differentiation can take place.

A Recommended Resource: *Principles to Actions*, National Council of Teachers of Mathematics, 2014

Principles to Actions describes eight Mathematics Teaching Practices that research indicates need to be consistent components of every mathematics lesson. Math workshop aligns with and supports this research and the belief that we must develop mathematical understanding and self-confidence in all students.

Reflect on It!

Take a moment to reflect on your own experiences as a math student. Think about the teachers you have had and the classes you have taken in your lifetime. As a student, which of these characteristics were present? Which were not? How did that set the tone for what math meant to you?

Three Math Workshop Structures

You may already be feeling that the seven math workshop characteristics match your own philosophy about what math class should include. At the same time, these characteristics may feel different from your own experiences as a student in mathematics. You might also be wondering how these characteristics look when you are considering a unit or lesson.

This book focuses on three math workshop structures that we have found most successful in our instruction and coaching. Figure 1–2 provides an overview of these three structures; each is discussed in greater detail in the section "Step 4: Choose a Workshop Structure for What You Need." The individual components that make up the structures will be explored in step 3. As you read this book, you will become well versed in the components and structures and will be able to move from one to the other, selecting which structure best matches your students' needs at any given time.

You'll find a printable version of the overview of the three structures (Figure 1–2) in the online resources for this book.

<table>
<tr><th>TASK AND SHARE</th><th colspan="2">FOCUS LESSON, SMALL GROUP, AND LEARNING STATIONS</th><th colspan="2">SMALL GROUP AND LEARNING STATIONS</th></tr>
<tr><td>REASONING ROUTINE</td><td colspan="2">REASONING ROUTINE</td><td colspan="2">REASONING ROUTINE</td></tr>
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<tr><td>STUDENT REFLECTION</td><td colspan="2">STUDENT REFLECTION</td><td colspan="2">STUDENT REFLECTION</td></tr>
</table>

Figure 1–2 Three math workshop structures: an overview

Reflect on It!

Do you already use small-group instruction in your classroom? If so, what benefits do you see? What are students doing in your classroom while you work with small groups or individuals?

Why Math Workshop?

Why implement math workshop in your classroom? Math workshop has many benefits, but in a nutshell, it provides an opportunity for

- **Differentiation:** provides students with targeted differentiated instruction based on individual student needs
- **Small-group instruction:** provides opportunities for immediate feedback, personalized learning, and teacher knowledge of student understanding
- **Student choice:** encourages independence, autonomy, responsibility, and student ownership and supports them as mathematicians
- **Academic discourse:** provides students with engaging learning experiences that promote mathematical thinking, discourse, and a positive disposition toward mathematics
- **Continued practice of big ideas:** supports connections of mathematical ideas and helps students develop a deeper understanding and mastery of content.

The Benefits of Differentiation

Students come into class with a range of background knowledge, interests, strengths, socioeconomic circumstances, and languages—it's no wonder addressing the needs of all learners can often feel overwhelming. *Differentiation* is defined by Tomlinson and Imbeau (2010) as classroom practice that has a balanced emphasis on individual students and course content. In math workshop, differentiation is purposeful and plentiful, and it happens for everyone, not just for students who are considered mathematically gifted or for students with special needs. Differentiation is not just a buzzword—it is at the center of the entire philosophy of math workshop.

The modifications of four curriculum-related elements are at the core of differentiation—content, process, product, and affect (Tomlinson and Imbeau 2010). When considering differentiation of the **content**, we consider district, state, and national standards; student understandings based on assessment data; and whether a student has an Individualized Education Plan (IEP). When differentiating the **process**, we allow for multiple ways for students to make sense of the content. To differentiate the **product**, we give students a variety of ways to demonstrate their knowledge. When considering **affect,** we observe student behavior and work to drive students in a positive direction. The math workshop model of instruction takes all these modifications into account.

As math workshop teachers, we understand the mathematics, and we are thoughtful about how to support the learning of the content. We carefully examine assessment data, get to know students well, and make intentional adjustments in order to meet the needs of all students in the classroom. We are thoughtful about the process and the product: we create a classroom community that respects a variety of choices, perspectives, and strategies, and we encourage and celebrate diverse thinking. And we are attuned to affect: we know a growth mindset can help students develop a deeper understanding of math concepts and build problem-solving skills, and we promote growth mindset by emphasizing the importance of effort and perseverance, providing opportunities for productive struggle, and avoiding bailing students out too quickly (Dweck 2006). We know that everyone can be a math person!

> In math workshop, differentiation is purposeful and plentiful, and it happens for everyone, not just for students who are considered mathematically gifted or for students with special needs.

Compare this to a more traditional model of instruction: The teacher is standing in front of the classroom, showing students how to do the math. Every student is expected to work on the same practice problem, every student is assigned the same worksheet, and every student is given the same test. In this model of instruction, a small amount of differentiation may take place. The teacher may gauge the understanding of the class based on student responses and facial expressions. She may adjust the numbers that students are using, try to say it in another way, or modify students' questions. However, trying to do this in the moment with dozens of students can be a daunting—if not impossible—job.

What about students who are good at hiding during math class? You know them; you might have been one yourself. These students do nothing outwardly

disobedient. They may appear to be listening and paying attention. They may even make eye contact and smile. However, they often feel lost during the whole-class lesson. They do not answer any questions. Instead, they wait the teacher out, and they wait their friends out. They know that someone else will answer the question, and then they will be off the hook—they will be safe. You might see these students sharpening a pencil that is already sharp, throwing away a tissue that wasn't really used, or using the restroom even though they don't have to. As teachers, we likely can all identify these behaviors during our math lessons.

We often pour our hearts and souls into reaching our students. As a result, we are devastated when our instruction doesn't reach all our students. Rather than becoming frustrated or hurt when we see behaviors like those described previously, we can adjust what we're doing to help these students feel safe enough to engage. How? In *Tools for Engagement: Managing Emotional States for Learner Success*, Eric Jensen (2003) describes the difference between an average teacher and a great one:

> An average teacher may be reaching, at any given time, fifty to seventy percent of the audience. A great teacher may be reaching, at any given time, fifty to seventy percent of the audience, *but a different fifty to seventy percent each time!* In other words, the great teacher uses a variety of activities and instructional methods to ensure that they reach different learners at different times. Over the course of a week or a month, the great teacher will eventually reach all learners. The average teacher, however, will still be reaching the same learners over and over again. The average teacher, too, will lump learners by their ability into a bell curve at grading time, convinced that the differences among learners are because of differences in effort or ability, not because of teaching! (22)

We have the opportunity to break away from traditional instruction and redesign what our classroom can look like and feel like. Great teachers make intentional decisions about how to vary instructional activities, and math workshop is here to help. It provides the mathematics instruction that students need when they need it by creating small groups for learning, offering student choice, and allowing enough time for students to grapple with a concept by spiraling or looping back.

When differentiation is taking place, students are more actively engaged in the lesson. Students who are engaged in their learning will undoubtedly be more successful. When engagement goes up and anxiety goes down, learning happens!

"Math workshop has allowed me to diversify learning opportunities for my students within the classroom. I have seen a profound impact in my students' attitudes toward math this year."

— EIGHTH-GRADE TEACHER

Reflect on It!

How are you meeting individual student needs in math class? What are your successes and challenges with differentiation?

The Benefits of Small-Group Instruction

Small-group instruction is important for many reasons. As Hattie et al. (2016) explain in their book *Visible Learning for Mathematics: What Works Best to Optimize Student Learning, Grades K–12*, small-group instruction is a strategy that has a positive effect on learning outcomes. The effect size for small-group instruction is above the "hinge point" of what works best in education and is therefore considered a research-based strategy educators should use. When done effectively, it can have a greater impact on student achievement compared to other options.

VIDEO
2 Benefits of Small-Group Instruction

Small-group instruction enables us to address the diverse needs in our classroom of learners, improves the confidence of students, and increases opportunities for academic success. Using small groups, we can more easily gather an abundance of information on each student—something that is overwhelmingly difficult when teaching an entire class at once. It is during small-group instruction that we get to know so much more about student thinking. We get to know students' approaches to tasks, their learning preferences/styles, the vocabulary that they possess, and what they connect to in real life and in their previous mathematics experiences. It is during this time that we can also evaluate student understanding, take anecdotal notes, and make mental notes about future grouping possibilities.

The math workshop model of instruction encourages small-group interactions. Small groups in turn provide students with the opportunity for "just-right" math instruction and the opportunity to problem solve with their peers. In two of the math workshop structures presented in this book, the Focus Lesson, Small Group, and Learning Stations Structure (see Chapter 11) and the Small Group and Learning

Stations Structure (see Chapter 12), the teacher pulls math groups for focused small-group instruction. However, small-group instruction does not only take place during these teacher-led groups. Students can learn by working together—learning doesn't have to be limited to teacher-student interactions. Our philosophy in math workshop is that students will learn from and with one another when given the opportunity to share and discuss. Hence, we must not forget that small-group instruction also takes place during learning stations and other group activities happening in math workshop.

Small groups provide students with the opportunity for "just-right" math instruction and the opportunity to problem solve with their peers.

There are also times when a teacher will find the smallest version of group instruction—conferences or interviews—beneficial. This component of math workshop entails just one student meeting individually with the teacher. There are times when you will want to touch base with one student to conduct an interview-style assessment, clarify a student's thinking, discuss a student's strategy, or help correct a misconception. This one-on-one meeting can be a powerful time to observe student understanding and assess a student's needs. This is a personal time between teacher and student—a time when you can more deeply communicate your confidence in a student's ability. While meeting one-on-one with students may seem like a luxury in our busy schedules, sometimes this one-on-one interaction is crucial—and a math workshop model of instruction helps make it possible.

Think about the following scenario in a middle school classroom. Students have been working in small groups at learning stations to investigate various aspects of solids. A teacher wants to know if students can compute the volume and surface area of two- and three-dimensional figures. The next day, students are working on a rigorous task. Instead of reviewing student work that has been completed, the teacher can conference with these students for a couple of minutes and ask questions such as the following:

- What is the difference between volume and surface area?
- Is it possible for the volume and surface area of a figure to be equal? Why?
- For which solids can the volume be found using the same formula? Why?
- What is the difference between the volume formula for prisms and pyramids? Why?

Do students understand the larger conceptual idea of volume and surface area? Can they tell us that the volume of all prisms use the same formula? Can they see

and explain the differences between the volume formula for prisms and pyramids? Or is their understanding at a simpler level? Having students explain the difference between volume and surface area to us with explanations like, "It's like I am wrapping a birthday present" or "It's like I'm filling up a sandbox with sand" will tell us more about a student's understanding of the concept than simply checking solutions to problems on a worksheet for accuracy. It is well worth our time to have a few moments with a student, listening to them explain their reasoning and their misconceptions, and take notes about their progress. We can even use a simple check-off chart to collect data and document student understanding. Figure 1–3 shows a chart we might use to note when a student recognizes and understands the vocabulary, explains which formula to use in practical situations, and shows that they know how to apply the formula.

STUDENT NAME	CONCEPT: SURFACE AREA AND VOLUME OF 2-D AND 3-D FIGURES				
	DEFINES VOCABULARY	IDENTIFIES FIGURE	APPLIES FORMULA	USES PRACTICAL ANALYSIS	INTERPRETS RESULTS
Jamal	X	X	X		
Sofia	X	X	X	X	X
Aisha	X	X			
Javier	X	X	X		
Lisa					
Tyrone	X	X	X	X	
Priya					
Lucas	X	X			
Fatima	X				
Andrej					
Thomas	X	X	X	X	X
Isabella	X	X	X		

Figure 1–3 ○ Recording observations during small-group instruction

Reflect on It!

Differentiating instruction and small-group instruction are the most important steps a school can make to improve core instruction (Buffum, Mattos, and Weber 2009). How can knowing this help your school make the change to math workshop?

Cathy Seeley in *Faster Isn't Smarter* (2015) explains that "student engagement involves switching on a student's brain so that she is interacting with mathematics in deep, thoughtful, and meaningful ways" (218). In small groups, whether in small-group instruction with the teacher or in learning stations with peers, students' time on task is maximized, as is the opportunity to talk to one another. Small groups promote social interaction—an important part of the learning process. Most of the learning that we have done in our lives has been done through social interactions with others. Why not make this the case in mathematics? Why is learning in mathematics often so isolating? Instead, math workshop offers a social environment in which small groups of students "switch on their brains" and work with one another and with the teacher. In this social environment, students are more engaged, make more connections, and are more open to learning.

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The Benefits of Student Choice

Earlier in the chapter, we visited the idea of choice when it comes to understanding the "what" of math workshop. Dacey, Lynch, and Salemi (2013) explain that when students are able to make choices, having a sense of control in the classroom, it will lead to an increase in interest and a positive attitude in class. When students have choice in their learning, they feel more confident and more competent. As teachers, we send a message of respect to students when we provide them with options.

Many teachers steer away from student choice for fear of complete chaos in the room. Choice does not mean that students can do whatever they want, wherever they want, and with whomever they want. In the same way that we might offer a younger child

the choice between a blue sweater or a green sweater—but not a swimsuit—on a winter day, we can offer our students choices that give them a sense of respect and validate their feelings by allowing them to make the selection. The same is true for students in math workshop.

Our role in math workshop includes making expectations and procedures clear, giving students opportunities to practice the routines, and providing feedback to students in making appropriate choices. In turn, choices empower students, help them take ownership of their learning, and keep students engaged and excited about the mathematics they are exploring.

Choices You Can Offer Students

- Which topics to study
- Which tasks to complete
- What materials to use
- With whom to partner
- Where to work
- How long to work on a particular task
- The order in which to complete assignments
- How to represent and present ideas
- How to demonstrate what is understood

(Dacey, Lynch, and Salemi 2013)

The Benefits of Academic Discourse

The person doing the most talking is the person doing the most learning. In reflecting on this during our early years of teaching, it was rather disturbing to realize that the people doing the most talking during math class were not students. We, the teachers, were the ones who talked the most. We were working very hard to show the mathematics another way, to say it another way. We wanted to get each and every one of our students nodding in understanding. And when they didn't all nod, we thought that in doing it just one more time, then maybe, just maybe, they would all understand it.

What we failed to recognize for some time was that as long as we were talking and doing the math, the students were neither talking about the math nor doing the math. And it needed to be the other way around: discourse—classroom discussion—is essential to learning. In *Talk Moves*, Chapin, O'Connor, and Anderson (2013) state that "when a teacher succeeds in setting up a classroom in which students feel obligated to listen to one another, to make their own contributions clear

and comprehensible, and to provide evidence for their claims, that teacher has set in place a powerful context for student learning" (9). We couldn't agree more!

A classroom community that supports diverse thinking, encourages cognitive conflict, and respects various strategies and solutions is a classroom full of learners. Getting students to explain their thinking helps them better understand the mathematics. They begin to realize that there are alternate ways of doing mathematics and that they don't need to simply replicate the way they've seen a teacher do math. Through discourse, students are exposed to alternate strategies and receive feedback on their reasoning. And—may it be of no surprise—all of this happens during math workshop.

One of our fears as teachers is that, when encouraging more discussion in our classrooms, the amount of talk will increase but it won't be about anything of educational significance. After all, we don't want students to talk if it means being off task. We want the discussion to move students forward in their mathematical thinking. We want discussion that promotes engagement, helps students reason, and supports students in making meaning of the mathematics.

Another fear we may have is that students, when engaging in talk, will share the wrong answer with each other. What if they are talking, but they are telling each other the wrong thing? A teacher once shared this concern with me, and we were prompted to think about what happens when the accurate "thing" is shared. Does this mean that all students then know how to do it? If only it were that easy, right? We concluded that it's okay if students, while grappling with important mathematical ideas, make errors and discuss these errors with one another. Encourage students to understand that mistakes can be a great tool for learning. This is how to support students in developing critical-thinking skills! It is a mindset change for teachers to accept a role as a facilitator and let the students own the learning.

To help alleviate fears when it comes to discourse—and simultaneously address the reality that many students struggle with *how* to talk about mathematics—we can facilitate student discussions.

To help alleviate fears when it comes to discourse—and simultaneously address the reality that many students struggle with *how* to talk about mathematics—we can facilitate student discussions and give models and examples of how to have math conversations with each other. After all, many students do not have experiences discussing mathematics with peers. Consider using talk moves (see Figure 1–4) to support this discussion. These moves, as

described by Chapin, O'Connor, and Anderson (2013), transition students from simply talking to sharing, discussing, arguing, listening, reflecting, and self-monitoring.

While these talk moves are not the only "moves" that can be used to support classroom discourse, they serve as a good place to start. Begin by choosing one of the talk moves and using it more often in your classroom. This helps students start to value the thoughts of others, see each other and themselves as valuable contributors to the learning that is taking place, and successfully use talk in math workshop. Keep introducing new talk moves and add them to an anchor chart, display a talk moves poster in the front of the classroom, or provide printed prompts that students can keep at their seat.

Figure 1-4 Math Talk Moves poster (download at http://hein.pub/TalkMoves)

The Benefits of Continued Practice of the Big Ideas

We have sat with countless school teams while planning for mathematics. As teachers, we realize that we have a huge curriculum and a wide range of students, many of whom may not yet be prepared for the curriculum being introduced. One of the biggest concerns is moving on too quickly when we feel that students still need time to grapple with the mathematics on hand. However, the huge amount of curriculum presses the need to cover more in a short period of time. Teachers often say, "If I don't move on, I will never be able to get it all in." We all recognize that students need time to explore mathematics, and that not every child will master a concept at the same time. In math workshop, learning stations allow continuous exposure to and practice of the big ideas in mathematics.

A team of seventh-grade teachers who had not yet embraced math workshop shared that they were concerned about moving ahead and teaching how to solve more difficult two-step equations. Several students were struggling with understanding how to apply the inverse properties when solving basic two-step equations and confused the order in which the properties should be applied. The teachers felt that they only had two choices: continue to provide more examples

until everyone "got it," even if that meant falling behind in pacing, or move on to more complicated problems with hopes that the students would eventually catch on or come for extra help after school. These teachers discussed the cons of each in some heartfelt and passionate conversations. Staying on topic would not challenge students who understood the concept and were ready to move on. Moving to more complicated two-step equations would frustrate students who didn't understand and would eventually cause learning gaps that would reappear later in the year and in future math courses.

Teachers often say, "If I don't move on, I will never be able to get it all in." We all recognize that students need time to explore mathematics, and that not every child will master a concept at the same time. In math workshop, learning stations allow continuous exposure to and practice of the big ideas in mathematics.

After reviewing assessment data, they carefully planned and created learning stations that gave students opportunities to collaborate on engaging work that supported the concepts of inverse operations and solving equations. Students, working in small groups, got to select stations that were appropriate for them based on their own self-assessment of their learning. One station focused on modeling solving equations using manipulatives and algebra tiles. Another station provided a mixture of leveled problems that focused on the procedures and justifications and not the answers. The final station included practical applications with the problems presented in context. During these stations, teachers were able to pull students into focused math conferences and work one-on-one to address skills specific to each student. Over the next few weeks, the teachers moved a great number of their students forward in their understanding. Time was spent supporting students and meeting them where their learning was growing. The students enjoyed having choices in their learning, and the stations remained a part of their classroom choices for spiraling back during future topics.

Through math workshop, students have opportunities to continually practice what is being taught. Math workshop reinforces the fact that the development of mathematical ideas takes place throughout the year and is not isolated to one particular unit or lesson. Math workshop helps support students in making connections among mathematics concepts—remember that short-term performance of a mathematical idea should not be confused with conceptual understanding.

In turn, thanks to the time math workshop lends to observing and assessing student performance, a math workshop teacher better knows which students are showing mastery of the content and which have yet to do so. Students who need more support in mastering a skill can be supported in focused math groups. In addition, the teacher can intentionally choose learning stations that offer students meaningful practice with those skills.

When Does Math Workshop Happen?

Math workshop happens each and every day in your classroom. Making math workshop work for you will be easier if your team works collaboratively and there is a well-established professional learning community (PLC) at your school. "PLCs, when done well, support the thinking, decision making, and learning in our schools and classrooms," as Fisher et al. (2020) explain. However, even if you are teaching solo in a one-room schoolhouse, implementing math workshop is still doable and worth it. Whether you are working in a team or individually, consider creating a larger professional learning community of math workshop teachers by networking at conferences or social media. Once you start on this path, it's likely you'll never go back.

Remember, math workshop is more of a philosophy than a prescribed lesson plan. It is not something that is done once a week or for test review. The beauty of math workshop is that it becomes a part of who you are as a mathematics teacher. When we use math workshop as our model of instruction, we believe in a student's right to a deep, conceptually based education. We believe that students learn from exploration. We believe that all students are bright, talented, and wonderful thinkers. We believe that students can and should learn from one another through collaboration and rich mathematical discourse. And we believe in the power of preparing students to become problem solvers!

Math Workshop: Voices from Experience

Finally, don't just take our word for it. In fact, don't just take the researchers' words for it, either. Throughout this book, you'll find the voices of teachers, parents, and, more importantly, students expressing the benefits of math workshop. They are hooked. With time, you will be, too! You won't just be teaching

mathematics in a math workshop model because of what is said in this book; you will be convinced that math workshop is a better way for all students to learn and a more effective and efficient way for all teachers to teach. Read what a few people have to say now:

"Math workshop reaches students where they are. Sometimes, I feel that I was choosing activities for my class based on where the 'middle of the row' learning was. This did not allow for students to move forward who were ready or [for pinpointing] misconceptions for those students who may have been behind in the content. I feel comfortable now knowing that I am not the only one providing answers or prescribing a certain way of solving something."

—*Eighth-grade teacher*

"Honestly, I thought a math workshop approach was something that was meant for elementary teachers. Then I tried it this year, and WOW! What a difference it made for my students. They do more problems and stay more involved in our lessons than ever before."

—*Algebra II and geometry teacher*

"I think math is really interesting this way because you get to pick up the information in a more fun way rather than just learning it through worksheets. You get to apply it to life situations."

—*Sixth-grade student*

"I haven't liked math in any other year. My teacher is doing math workshop this year and it's totally different. We still do lots of math, but it isn't so boring, and it doesn't feel like I'm so confused when it's time to take a test."

—*Algebra I student*

"My child used to hate math. Now she loves it! She always has so much to say about the games that she played in math that day. I love that she isn't so insecure anymore."

—*Parent of a sixth grader*

Our Story (A Unified Journey in Transformative Math Education)

In our early teaching years, we found ourselves following the traditional path of instruction, teaching math just as it had been taught to us. Standing before our students, we introduced the topic, demonstrated how to do it on the board, and had them work on a few problems independently. We would share a few math tricks to make it "easier" for students to obtain the answer. We expected students to learn mathematics the way we showed them. Generally speaking, we thought we were doing what would help students. After all, we cared about them, and we felt passionate about being teachers.

As we gained experience and developed confidence in our teaching, we began to realize that the method we were using to teach mathematics led to mere replication, not genuine understanding. We listened to students and reflected on what felt successful about our teaching. We began using math workshop in our classrooms—although we didn't call it that then. We worked to establish learning stations and small-group instruction that helped us get to know our students and meet their needs better. Upon reflection, we didn't choose the most powerful math activities or take advantage of the data to really dig into individual needs at first. That took time to develop.

Collaborating with dedicated teachers and "borrowing" ideas from the countless amazing colleagues we worked with over the years, we transformed our instruction and became more intentional and purposeful for students. We worked to engage students at the beginning of the class, empowering them to take ownership of their learning while gradually relinquishing control of the content. We refined and expanded our collection of engaging stations, discarding ineffective ones. We helped students understand that math was more than getting answers. Students who once grappled with math found success and joy, shedding anxiety and discovering their potential as thinkers and problem solvers. We were creating a personalized environment that allowed students to truly comprehend mathematics.

Reflect on It!

In what ways do you make your math instruction engaging and purposeful for students?

Jennifer first shared this transformative approach in her book *Math Workshop* (2017) for grades K–5, which has been read by thousands of primary and elementary teachers. However, the philosophy and the structures of math workshop are not restricted to grades K–5. In every grade, K–12, we have witnessed enhanced teacher efficacy and positive impacts on students in classrooms that use math workshop. After reading Jennifer's K–5 book, Skip, a secondary math supervisor and former secondary math teacher, recognized many of the things he had already been doing in his classroom and in his work with secondary teachers. Math workshop is a universal method that transcends age, benefiting learners across different grade levels. While this book is tailored to secondary teachers, classrooms, and students, the foundational ideas are the same as those in that original book for grades K–5. This is because all of us—young children, adolescents, and even adults—learn best when we are trusted to make choices about our learning, when we are engaged, and when we have a safe and supportive learning environment.

We live in a society where it is socially acceptable to say, "I'm not good at math" and "Math just isn't my thing." As educators, we must work to change that mindset. If we teach the way we were taught, we will continue to create a generation of students who believe they are not good at mathematics. We must help our students learn differently and help them to believe in themselves. We are excited to share how math workshop can be incorporated into your secondary classrooms. Our hope is that math workshop continues to inspire you as profoundly as it has for us.

Reflect on It!

It is not acceptable for our students—or anyone!—to say they are not good in mathematics. What are you doing as a math teacher to "change the story" and help students feel successful in mathematics?

CONNECTING THE CHAPTER TO YOUR PRACTICE

- Consider what you've learned about math workshop so far. How is your classroom similar to math workshop? How might it be different?
- What pieces of math workshop already fit with your philosophy and/or current structure?
- What is something that you want to change about your current structure of mathematics instruction?