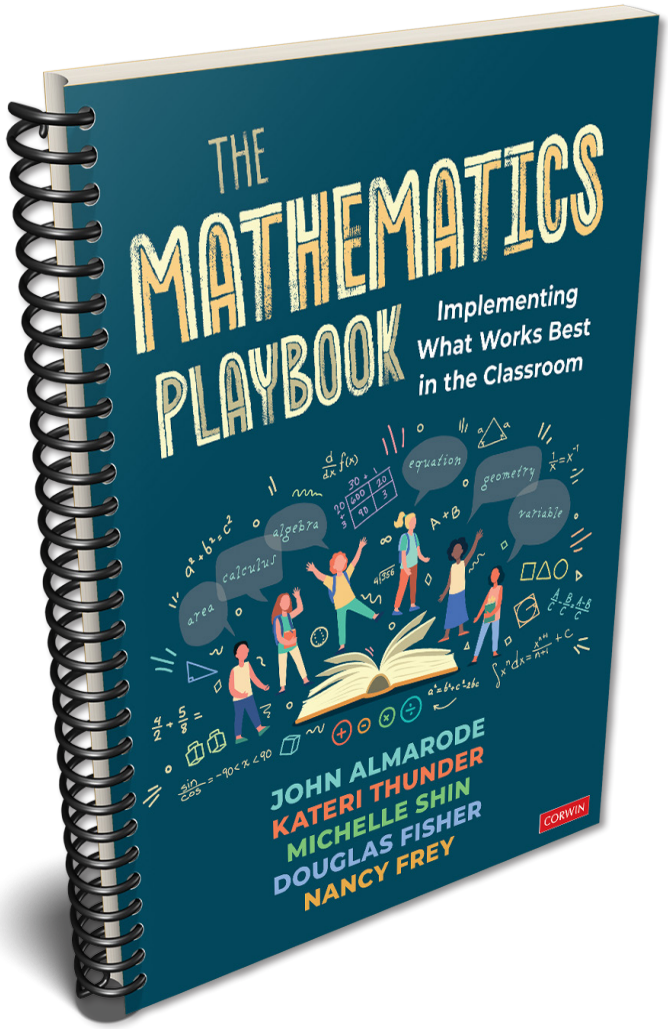

Thank you

FOR YOUR
INTEREST IN
CORWIN

Please enjoy this complimentary excerpt from The Mathematics Playbook.

LEARN MORE about this title!

CORWIN

Introduction

This playbook is about teaching and learning mathematics. Yes, mathematics. Given that we will focus on mathematics, it seems appropriate to start with math.

1. Think of any number, and write it down here: _____.
2. Multiply that number by 3 (you can use a calculator). Write that answer here: _____.
3. Add 45 to the result. Again, calculators are permitted. Answer: _____.
4. Double the answer in #3. Answer: _____.
5. Take your answer from #4 and divide that number by 6. Answer: _____.
6. Subtract your original number (see #1) from the answer in #5. Answer: _____.

Circle your final answer in #6. Hold on to this final number. We will come back and visit this task in just a moment.

This Playbook is not just focused on the content, skills, procedures, conceptual understandings, and application of mathematics, but it is also focused on the teaching and learning of mathematics in our schools and classrooms. From counting to conic sections, patterns to permutations, radii to rational equations, and fractions to fractals, the questions we aim to answer include:

- How do we foster, nurture, and sustain mathematics learning?
- How do we approach the teaching and learning of mathematics to ensure all learners have equity of access and opportunity to the highest level of mathematics learning possible?
- What are the non-negotiables in a high-quality mathematics task?
- How do we know if learners really "get it"? These are the questions we strive to address in this Playbook.

However, these are likely not the only questions you have about your classroom or your students. They certainly are not the only questions we

have about mathematics teaching and learning. Within the daily hustle and bustle in our classrooms, we come face to face with many celebrations and challenges. Those celebrations and challenges likely lead you to this Playbook. As a former high school mathematics teacher, John wondered why learners engaged in mathematics tasks while in class but did not see the value of practice in moving their learning forward. He also enjoyed celebrating moments when learners demonstrated their knowledge, skills, and understanding around, say, linear equations, but he was challenged when that knowledge, those skills, or the understandings did not transfer to different contexts. What celebrations and challenges do you experience in your mathematics teaching and your students' mathematics learning?

Reflect on your mathematics teaching and your students' mathematics learning. What questions come to mind? Jot these questions down in the space below so that we can revisit them throughout our work in this Playbook.

Throughout the modules in this Playbook, we will pull together the latest research on what works best and explore the implications of that research on mathematics teaching and learning.

OUR LEARNING INTENTION

We are learning about what works best in mathematics teaching and learning, so that we can implement these ideas, approaches, strategies, and interventions in our classrooms.

However, this goal should not be interpreted to mean that the modules and tasks within this Playbook provide a step-by-step recipe that guarantees students will learn. The purpose of this Playbook is to take a closer look at the creation and implementation of mathematics learning experiences so that we can foster, nurture, and sustain mathematics learning

for all our learners. The potential to maximize student learning in mathematics can only be actualized through effective implementation. The modules of this Playbook focus on expanding our understanding of what that looks like in our classrooms and how we can better use what we know about how students learn. In addition, we will explore how to better engage our learners to self-monitor, self-reflect, and self-evaluate their mathematics learning.

Return to the previous questions you generated about your mathematics teaching and your students' mathematics learning. Take some time and revise those questions into your learning goals for this Playbook. If you are working with your professional learning community (PLC+) team, your grade-level planning team, or your fellow mathematics teachers, develop a shared list of goals.

THE LEARNING PLAN WITHIN THE MODULES

This is a Playbook, which by definition, then, contains a collection of tactics and methods used by a team to accomplish a common goal and get things done (Merriam-Webster, 2023). In the case of this Playbook, the learning intention is to understand what works best in mathematics teaching and learning, so that we can implement these ideas, approaches, strategies, and interventions into our classrooms. Therefore, each of the subsequent modules is designed to support your thinking and decision-making around mathematics teaching and learning in your classroom. But the modules are not necessarily intended to be completed in sequential order or all at once. When athletic coaches and their teams use playbooks to get things done (e.g., score a goal in soccer, score a run in a cricket match, score a touchdown in American football), they select the plays that best fit the *current context or situation*. Likewise, the modules in this Playbook should be used by your team when the current context or situation calls for the module. So, what's the plan?

This Playbook is divided into four parts (Table I.1). The first section of modules will identify and define the elements or strands of mathematics teaching and learning: procedural knowledge, conceptual understanding, and the application of concepts and thinking. Together, we will analyze standards and curricular documents to ensure we integrate all strands of mathematics proficiency into our instruction. This also reflects one of our foundational beliefs underlying this Playbook and our first big idea: Our perspective on mathematics teaching and learning has been far too narrow.

BIG IDEA #1

Mathematics teaching must integrate all aspects of "what it means to learn mathematics."

When we broaden our perspective on what is meant by mathematics learning, our teaching broadens the pathways for learners to engage, represent, and demonstrate their mathematics learning.

ACTIVATING PRIOR KNOWLEDGE

In the space provided, jot down what you think is meant by the statement, *mathematics teaching must integrate all aspects of "what it means to learn mathematics."* What do you think is meant by procedural knowledge, conceptual knowledge, and application of concepts and thinking? We will come back and revise your responses later in this Playbook, if necessary.

The second part of this Playbook focuses on how we translate and communicate mathematics learning to your students. We will spend time thinking about learning and engagement in our mathematics classrooms and what it means to be a good mathematics learner. Both learning and engagement are highly contextualized and will require us to self-reflect on our expectations and then what is communicated to our students.

BIG IDEA #2

The expectations for mathematics learning must be clearly shared with and communicated to our learners.

When students know what they are learning and what successful learning looks like, they are more likely to engage in the learning tasks. However, there are chokepoints, barriers, and pitfalls in learning and engagement. These barriers, as we have discovered in our own work, result in frustration and unproductive struggle. Awareness of these chokepoints to learning, barriers to engagement, and pitfalls in teaching will allow us to proactively adjust our thinking and decision making around mathematics teaching and learning in our classrooms.

ACTIVATING PRIOR KNOWLEDGE

In the space provided, jot down how you share and communicate about the learning in your mathematics classroom. What are barriers, chokepoints, and pitfalls to learning and engagement that you have already identified in your classroom? Again, we will return to your responses later in this Playbook.

Oh, one quick and final comment about this second part of the Playbook. Did you notice that learning was listed before engagement? That is on purpose. Circle, highlight, or underline the three times *learning and engagement* are listed together in the above paragraph. We will explain the significance of the pairing and the specific order of the pairing at the start of the second part of this Playbook.

The third part of this Playbook takes an up-close look at the design and implementation of mathematics experiences and tasks.

BIG IDEA #3

Mathematics teaching and learning must be reflected in rigorous mathematical experiences and tasks.

By the time we arrive at this part of the Playbook, whether you start your journey here or have worked your way through the previous modules, this is where the "rubber meets the road." Together, we will take a close-up look at the specific experiences and tasks we design and implement in our classrooms. What are the characteristics of rigorous mathematics tasks? This includes infusing more discussion, dialogue, and talk into mathematics learning. Consistently quiet mathematics classrooms are mathematics classrooms in which learning is compromised.

Furthermore, how do we scaffold those tasks to ensure all learners have access to the highest level of learning possible? If you flip back to p. 2, one question you may have generated was about the "readiness" of certain learners for specific content, skills, and understandings. How do we support learners that are not ready, YET? Part three of this Playbook will investigate how to scaffold a mathematics experience or task so that all learners make progress toward the learning goal. The emphasis here will be that all learners are working toward the same learning outcomes. Their path toward those outcomes may look different from their peers.

We will close out this third part of the Playbook by addressing the "pink gorilla" in the room: practice. How do we help learners see the value in practice? Not just any practice, but practice that moves mathematics learning forward.

ACTIVATING PRIOR KNOWLEDGE

In the space provided, describe a mathematics experience or task that you felt was VERY successful in your classroom. Then describe a mathematics experience or task that was a complete disaster. No judgment, we've all been there. How are these two episodes similar? How are they different? We come back to this response when we get to Part 3 of this Playbook.

From there, we enter the final part of this Playbook. This final part focuses on the role of generating visible evidence of and for mathematics learning.

BIG IDEA #4

Mathematics teaching and learning requires the generation and interpretation of evidence.

We will look at the value in making student thinking visible so that we can answer the question "Where to next?" One specific module looks at ways to interpret the evidence our learners generate and make purposeful, intentional, and deliberate decisions about where to go next in mathematics teaching and learning. We spend so much time on "data" but very little time on what to do with that data! This Playbook aims to rectify this problem. Finally, we will devote considerable attention to the role of self-monitoring, self-reflection, and self-evaluation through effective feedback in developing self-regulated mathematics learners. These learners know what to do, when they don't know what to do, and we are no longer their math teachers.

TABLE I.1 ● The Mathematics Playbook overview.

PART 1	
Module 1	What are the elements of mathematics teaching and learning?
Module 2	How do I identify the elements of mathematics teaching and learning for my classroom?
Module 3	How do I evaluate the inclusion of all aspects of mathematics teaching and learning into my classroom?
PART 2	
Module 4	What is a mathematics learner, and what makes a mathematics learner in my classroom?
Module 5	What is an *engaged* mathematics learner?
Module 6	What are the misalignments, misconceptions, and missed opportunities in mathematical learning and engagement?
PART 3	
Module 7	What are the characteristics of a rigorous mathematics task?
Module 8	How do I facilitate Math Talk in my classroom?
Module 9	How do I implement worked examples into my classroom?
Module 10	How do I scaffold mathematics tasks in my classroom?
Module 11	How do I integrate deliberate practice into my classroom?

(Continued)

(Continued)

PART 4	
Module 12	How do I generate evidence of and for learning in my classroom?
Module 13	How do I notice the evidence in my classroom?
Module 14	What is the role of feedback in my classroom?
Module 15	How do I develop self-regulated learners?

LEARNING WITHIN THE MODULES

We make two assumptions about your learning journey in this Playbook. First, you are an educator, whether that be a preservice teacher, an instructional assistant, teacher, teacher leader, instructional coach, or curriculum specialist that has or will have a direct connection to mathematics teaching and learning. Second, we assume that you have noticed that your learners, and maybe even you, seek to enhance the learning of your students in mathematics. You may be prompted by data suggesting areas of growth or opportunity in your professional practice. You may be motivated simply because you have set this as a professional goal and are looking to refresh, rejuvenate, or revive your mathematics teaching and your students' learning. Or you may be motivated because you are not as comfortable or confident in your mathematics teaching. If these assumptions fit your current professional learning journey, this Playbook is for you.

Each module begins with a self-assessment and then introduces a specific goal, an explanation of the ideas within the module to establish the focus for the learning (a learning intention). The module then continues with modeling how to take the research and translate the findings into the reality of your specific school or classroom. There will be many examples across all grade levels. Examples will cover primary, elementary, middle school, and high school content, skills, practices, dispositions, and understandings. We seek to provide a wide range of examples to show that what works best in mathematics teaching and learning, as well as works best across all grade levels.

Each module offers you an opportunity for practice and application with a variety of concepts, skills, understandings, and grade levels. The practice section encourages you to write your answers and discuss them with your team, if possible. Although using this book as part of your personal learning is possible, creating and implementing what works best in mathematics is best done collectively with colleagues. One benefit of this collaboration is the opportunity to engage in critical dialogue regarding what this looks like for you and your learners. These critical conversations will provide feedback on your professional learning journey.

COLLABORATING TO CREATE AND IMPLEMENT HIGH-QUALITY SUCCESS CRITERIA

The most effective way to create and implement mathematics learning experiences so that we can foster, nurture, and sustain mathematics learning for all our learners is to work collaboratively with your grade-level team, mathematics department, or PLC+. We believe that the work of this Playbook is an essential component of the work you do in your PLC+. The use of these five guiding questions of PLC+ will keep the focus relentlessly on the learning of our students:

- Where are we going?
- Where are we now?
- How do we move learning forward?
- What did we learn today?
- Who benefited and who did not benefit? (Fisher et al., 2020, p. 8)

In PLC+, teachers identify learning outcomes and discuss ideas for mathematics instruction. They meet to review student work and figure out if their efforts have been fruitful. They also talk about students who need additional scaffolding to be successful. This discussion is all informed and supported by rigorous mathematics tasks. We must ensure that we all have high expectations, focus on a common understanding of what learning and engagement look like, activate the conversation around learning, and ensure equity of access and opportunity to learning for all students (Table I.2).

TABLE I.2 ● How the Mathematics Playbook supports the work of PLC+.

PLC QUESTION	MATHEMATICS PLAYBOOK MODULE
Where are we going?	Module 1: What are the elements of mathematics teaching and learning? Module 2: How do I identify the elements of mathematics teaching and learning for my classroom? Module 4: What is a mathematics learner, and what makes a mathematics learner in my classroom? Module 15: How do I develop self-regulated mathematics learners?
Where are we now?	Module 3: How do I evaluate the inclusion of all aspects of mathematics teaching and learning into my classroom?

(Continued)

(Continued)

PLC QUESTION	MATHEMATICS PLAYBOOK MODULE
How do we move learning forward?	Module 5: What is an *engaged* mathematics learner? Module 6: What are the misalignments, misconceptions, and missed opportunities in mathematical learning and engagement? Module 7: What are the characteristics of a rigorous mathematics task? Module 8: How do I facilitate Math Talk in my classroom? Module 9: How do I implement worked examples into my classroom? Module 11: How do I integrate deliberate practice into my classroom?
What did we learn today?	Module 12: How do I generate evidence of and for learning in my classroom? Module 13: How do I notice the evidence in my classroom? Module 14: What is the role of feedback in my classroom?
Who benefited and who did not benefit?	Module 10: How do I scaffold mathematics tasks in my classroom?

This resource is available for download at **resources.corwin.com/themathematicsplaybook**.

Before we close, flip back to the initial mathematics task in this module. Was your final answer 15? Go ahead, try different numbers to see if you always arrive at 15. Amazing, right? This initial task serves as a metaphor for our learning journey in this Playbook. Regardless of your initial number, the specific numeric operations will lead you to the final answer of 15. The numeric operations or decisions in this initial task mathematically change your starting number to 15. Likewise, regardless of the initial starting point of our learners, their encounters and experiences in our schools and classrooms have the potential to have a positive effect on their mathematics learning. They allow all learners the access and opportunity for successful mathematics learning. Just like the initial mathematics task in this module, these encounters and these experiences are purposeful, intentional, and deliberate. They are by design, not by chance. That is the power we have as mathematics teachers. That is the hope we have as mathematics educators. What follows in these modules, across the pages of this Playbook, is a close-up look at the decisions we make each and every day to ensure that our students have a great mathematics teacher, not by chance but by design.

Now, let's get started!