Planning Curriculum in Mathematics: Using Your Textbook to Transform Practice

Sohnia Malik, Wayne County RESA
maliks@resa.net

Kristi Hanby, PhD, Wayne County RESA
hanbyk@resa.net

In the week before school started, we unpacked the standards . . .

As teachers of mathematics, many of us have sat in professional development in which we were asked to prioritize and unpack standards in order to identify student learning targets. These learning targets, then, are suggested as the basis on which we build assessments and design lessons. At the same time, you may have wondered when, outside of this one day before school begins, you will find time to do this ongoing work. You may have also wondered if you have enough expertise to enhance what was already designed within the mathematics textbook you use. And if so, how is a curriculum different from the textbook provided by your district to teach mathematics?

As mathematics education consultants, we have found that in order to plan for rigorous, engaging, and equitable mathematics learning, we must dig into what the research in math education says about how students develop a robust understanding of mathematics and use that to inform the curriculum design process. We would agree with administrators who say that a textbook is not a curriculum and yet how a textbook is used to plan for curriculum is often left unclear. Furthermore, if curriculum is not intentionally planned utilizing the textbook, we find that the experiences students engage in from one classroom to the next vary widely, creating potential inequities and setting the stage for challenges down the road.

What does the research say about effective practice in teaching mathematics?

The National Council of Teachers of Mathematics has published eight Effective Math Teaching Practices which would lead to students engaging in the Standards for

Mathematical Practice. (NCTM, 2014) Below, we include a diagram of those eight practices that can be seen in four parts:

- the setting of math goals
- the choosing of mathematics tasks
- the engagement of learners in discourse
- and the use of information from that discourse to inform further planning.

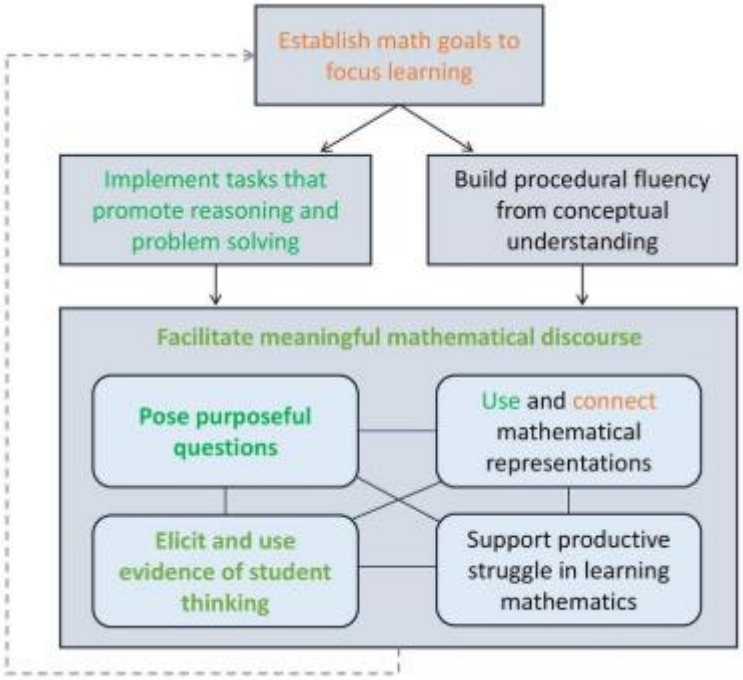

Figure 1. *A teaching framework for mathematics (Huinker & Bill, 2017)*

We propose that at the core of curriculum planning is a group of teachers choosing mathematics tasks that promote problem solving and reasoning, aligned to learning goals and housed in a district document to be utilized by all teachers. Based on NCTM's effective teaching practices, mathematics tasks should promote reasoning and problem solving and build fluency from conceptual understanding. We have found Taking Action from NCTM (2017) to be particularly helpful as a resource for engaging in this work with teams of teachers. In particular, we have utilized resources to support choosing a cognitively demanding task, also described in The Essential Instructional Practices for Early Mathematics (2019). We take some time in this article to describe how practice #5, *Intentionally select and implement cognitively demanding tasks from instructional resources*, is a critical component of curriculum design, while also bearing in mind that the practices described in the document are interdependent on one another.

Cognitively Demanding Tasks (Rigor in Mathematics)

In the Essential Instructional Practices document, the authors describe a task in the following way.

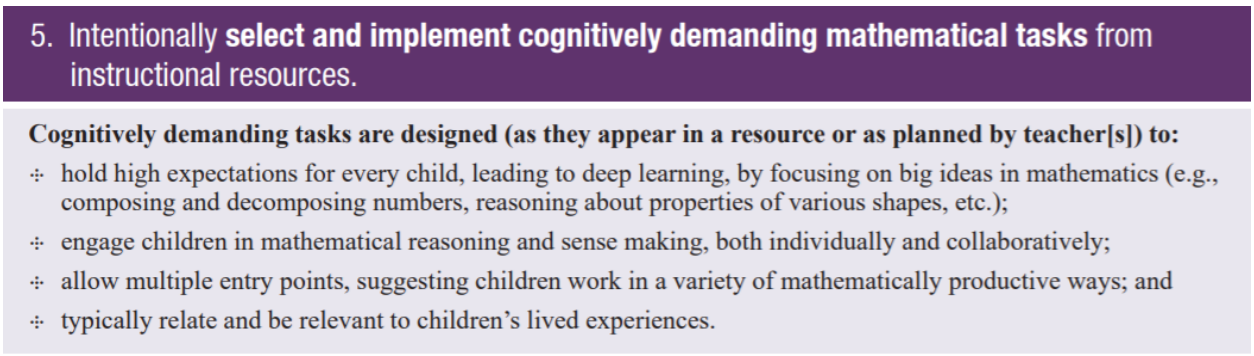

Figure 2: *Description of a cognitively demanding task from the Essential Instructional Practices for Early Mathematics (Practice #5)*

The authors of the document expand after the description of a task to include how students and teachers engage in tasks in the classroom. For now, we will focus on choosing a task that fits these criteria.

Steps to Choosing a Task and Planning a Curriculum

1. Find your focus and dig into your textbook

The learning target for the lesson informs the choice of a task. Ask yourself, what is it you want students to understand within the big idea in mathematics and in alignment with a content standard. Seek out a problem that is relevant and/or relatable to students' lives and can engage them in thinking conceptually. For example, for a sixth grade lesson aligned to the standard below, we chose the associated problem. When the lesson was taught, it just so happened that the Arts, Beats, and Eats Festival was coming up! But either way, the students enjoyed listening to some Caribbean music when class first started.

Standard	Mathematics Task
6.EE.B.4 - Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	You sell instruments at the Caribbean music festival. Today you sold 12 sets of maracas, 6 sets clavas of, and some *djembe* drums. In total, you made $326. How many *djembe* drums did you sell? Write an equation you can use to find the number of drums. Explain why the equation works.

The problem allowed for multiple entry points. Many students began by determining how much had been made from the maracas and clavas, subtracting that amount from $326. They then used division to determine the amount of djembe drums had been

sold. Some were able to write the total as an expression and a few wrote an appropriate equation with the number of djembe drums as the unknown. The discussion was powerful for these students and helped them to engage in authentic mathematics in which they were able to connect many ideas. Within each lesson in a textbook, we find that a task is often available and aligned to the learning target, but is not always part of the design of the textbook lesson. Sometimes it's in the practice problems, and sometimes it's in the ancillary resources associated with the text. Below, are two examples of tasks chosen from a math text or its ancillary resources, which we believed to be aligned to the given learning objective.

	Learning Objective	Mathematics Task
2nd Grade	Compare two three-digit numbers based on meanings of hundreds, tens, and ones.	*Two students are being asked to compare 337 and 325. Amal says 337 represents a larger amount. Saleh says 325 is the larger number. Who is correct? Use numbers, math tools or words to explain your answer.*
4th Grade	Compare two fractions with different numerators and denominators by comparing to a benchmark fraction.	*Destiny and Jasmine are sisters. They get the same allowance. Destiny spent 2/5 of her money at a football game. Jasmine spent 6/10 of her money on clothing. Who spent less? Or did they spend the same amount? Justify your answer.*

Figure 3: *Mathematical tasks, aligned to the learning objective for a second and fourth grade math lesson*

2. Attend to Relevance

Too often, our students are asked to solve problems which are devoid of context or are embedded in a context that is not relatable to their own experiences. So, we encourage modifying tasks when necessary to ensure students can relate to and engage with the task. Sometimes it can be as simple as placing a student's name in the problem. Sometimes it means altering the context to be more relatable. At times, there are tasks that are relatable to some students, but not all. This is an opportunity for students to hear from others and build an understanding of new and interesting aspects of the world around them they might not have encountered in their own experience. For example, recently we were working with a group of learners to solve a problem that involved a pasture with horses. When we asked learners to say what they noticed in an image of the problem, one learner mentioned a paddock. It was a word not many had thought to use, but it's appropriate and together we added a new word to our vocabulary! Try to ensure that the representation of students' experiences within

tasks varies over time and does not unintentionally under-represent particular groups, especially those that are historically marginalized.

3. Entry points and opportunities for connections

A task is a problem for students to solve independently and collaboratively, in a way that makes sense to them. You may have heard them called low floor, high ceiling task. Tasks are meant to allow access to every student and also provide opportunities to extend understanding regardless of their current understanding of the concept. So, consider that students will solve the chosen problem in different ways, but in doing so, regardless of their strategy, they are building a conceptual understanding and knowledge of how mathematics works. Some may draw a picture or use math tools, where others might count or find friendly numbers to work with. As students share their strategies for solving, consider how you might ask questions in which students justify their thinking and draw attention to the connections between those different representations. In this way, tasks provide opportunities for all students to engage, as well as chances to expand their understanding over time.

Putting It All Together

Think of the curriculum process as long-term and collaborative. Once your team has chosen a task and used it for a lesson, you will want to design a method for tracking the task and any modifications your team makes. With a common location for tracking the tasks, you build curriculum over time and ensure its availability in following years. We have included one example of a curriculum document that can be used for just that purpose. This curriculum document, built over time to reflect learning based in the Everyday Mathematics textbook, includes unpacked learning objectives, student I Can statements, cognitively demanding tasks, teacher guiding questions, and vocabulary to support the lesson. In addition, the document allows teacher choice in determining practice opportunities and a number sense routine each day.

Unit 3: Fraction Concepts, Addition and Subtraction (5 Weeks)								
Lessons:	**Learning Objective(s):**	**Student Objective(s):**	**Math Vocabulary & Tools:**	**Implement Math Task(s) from EDM4:**	**Supplemental Math Task Options:**	**Guiding Questions & Strategies to Support Struggling Learners:**	**Select Practice Opportunities:**	**Implement Mental Number Sense Routine: (Write in Plans)**
3-1	1. Interpret a fraction as division of the numerator by the denominator. 2. Solve word problems involving division of whole numbers that produce answers in the form of a fraction or mixed number. 3. Use visual fraction models or equations to represent the problem.	1. I can interpret a fraction. 2. I can solve word problems that produce answers in the form of a fraction. 3. I can use models or equations to represent the word problem.	**Vocabulary in the Launch:** model **Tools:** fraction circles, baggies for storage **Vocabulary in the Summarize:** fair share	-3.1 Math Task TE pgs. 221-222 Observe student thinking during Explore and Summarize portions of the task for **Formative Assessment**	-3.1 Supplemental Math Task - Observe student thinking during Explore and Summarize portions of the task for **Formative Assessment**	- Ask guiding questions such as: *What is the problem asking? What are you stuck on? How can you use _____ to show the problem? How can you prove that to me? What model can you use to represent the problem? How can you partition ___ so everyone can get the same amount? What equation represents your picture? What patterns do you notice in the equations?*	-MJ pg. 71 -MM pg. 80 (Home links) -MM pg. 79 -MM pg. 78 -MJ pg. 73 (math boxes) -Activity Card 28	

Figure 4: *Image of the example curriculum document, with information aligned to one lesson within a fifth grade unit.*

The process of building curriculum will take intentional support and attention over an extended period of time, but we have found it to be invaluable work in providing equitable and ambitious learning for all students. We also think it is worth

bearing in mind that, “teachers can maximize the effectiveness of available materials. . . and implement effective learning experiences regardless of which materials are being used.” (Westwood-Taylor, 2016). And so, we are more inclined to support the robust use of a set of mathematics texts than go searching for a new or better version. As we begin the early phases of implementing the curriculum built in Wayne County, we see the evidence of much work starting to pay off. Student engagement and independence in problem solving has improved and summative assessments scores are starting to show that students are learning mathematics that will provide many opportunities for them down the road.