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TAILORING TASKS TO MEET STUDENTS' NEEDS

Thread small changes seamlessly into high-level reasoning tasks to reach all students.

Just as ready-made clothes may not provide a perfect fit for all bodies, math lessons may not be a perfect fit for all students. Published instructional tasks, including problems in mathematics textbooks, often need to be tailored to be meaningful, relevant, or accessible to each student. Ways are possible to take high-level reasoning tasks and modify them to meet students' individual needs. Research emphasizes the importance of implementing high-level tasks that focus on reasoning and problem solving, rather than simply presenting lessons that concentrate on rules with little or no connections to understanding (Stein et al. 2000).

To effectively implement such high-level tasks with students, Smith, Bill, and Hughes (2008) recommend a planning process to help teachers maintain the cognitive demand of tasks. Smith et al. recognized that when students take on high-level tasks, they often need to "draw on their relevant knowledge and experiences to find a solution path" (2008, p. 133). With this need in mind, we consider planning prior to the process described by Smith et al. and focus on what teachers can do to make sure that tasks are relevant and accessible for their own students. In other words, how can we tailor high-quality tasks to fit our students?

We have worked with middle-grade teachers (grades 5–8) across several research projects as they implemented such tasks with their students. We encountered many examples of teachers successfully tailoring lessons to meet students' needs. In analyzing teachers' work, we found four categories of adaptation. We present each category of such tailoring and ask questions for teachers to consider.

1. SWITCH TO A FAMILIAR CONTEXT

Is the task's context familiar to your students so that they can draw on it to engage in deeper problem solving?

Problems that are set in meaningful contexts provide rich opportunities for students to apply knowledge from their lives to learning mathematics; in so doing, they will see their own identities reflected in the math (c.f., Turner and Strawhun 2007). When contexts are neither relevant nor meaningful to students, students may not see a need to engage in and struggle through problem solving (Hiebert 2005). In this case, teachers can either discuss the context in an effort to help students learn about the nature of the situation or change the context to make it relevant.

Often, presenting the problem in a meaningful context involves only minor changes, but teachers must know their students' backgrounds and experiences to develop such relevant situations. The following example illustrates tailoring for a meaningful context in a bilingual (English and Spanish) classroom.

A bilingual teacher used a problem in which the students were asked to determine the likelihood that the Pittsburgh Steelers would win, lose, or tie a football game (Lappan et al. 2002). The teacher's students were English language learners (ELLs) mostly from Mexican families. Their first language was Spanish. Many of these students were not familiar with or interested in American football. When she introduced this problem, they were not ready to discuss probability concepts until learning about the Pittsburgh Steelers and American football. This discussion consumed approximately twenty minutes—time that the teacher perceived as not contributing to their mathematics learning.

Since a change in sports did not affect the math, the next year the teacher changed the team to "Chivas," a professional soccer team that was popular among her students. They immediately began work on the problem, were excited to see "their team's name," and demonstrated greater engagement than the previous year. Rather than spending time talking about an unfamiliar team and the game of football, the students quickly identified with

Reflect and Discuss

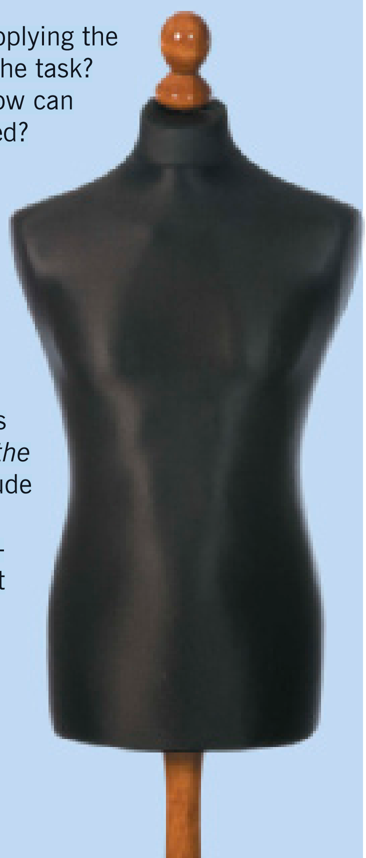
Reflective teaching is a process of self-observation and self-evaluation. It means looking at classroom practice, thinking about what is done and why, and then evaluating whether it works. Collecting information about what goes on in the classroom and then analyzing and evaluating this information will allow teachers to identify and explore their practices and underlying beliefs.

The following questions are suggested prompts to help you, the reader, reflect on this article and on how the author's ideas might benefit your classroom practice. You are encouraged to reflect on the article independently as well as discuss it with your colleagues.

Identify a problem-based task from your curricular material that has not met your expectations for students' learning and consider whether you could tailor it to meet your students' needs. As you think about ways to adapt the task, analyze it on the basis of the following four questions, in addition to those posed on pp. 552–54:

1. What differences do you see in your students as they respond to different contexts of story problems?
2. How do you determine if your students are applying the background knowledge needed to engage in the task?
3. In the learning materials for your students, how can school objectives or district goals be supported?
4. What adjustments for your students' literacy knowledge and skills can be made to specific lessons?

You are invited to tell us how you used "Reflect and Discuss" as part of your professional development. The Editorial Panel appreciates the interest and values the views of those who take the time to send us their comments. Letters may be submitted to *Mathematics Teaching in the Middle School* at **mtms@nctm.org**. Please include "Readers Write" in the subject line. Because of space limitations, letters and rejoinders from authors beyond the 250-word limit may be subject to abridgment. Letters are also edited for style and content.



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the context and engaged in mathematical thinking. To make this seemingly minor change, the teacher needed to know her students' sport and team so that a math problem could engage rather than distract.

2. SUPPLEMENT FOUNDATIONAL GAPS

Do your students have the necessary knowledge of the mathematics content (e.g., concepts, processes, terminology, and so on) to engage in the task?

Although many instructional materials are designed to provide students with opportunities to build prerequisite content knowledge, gaps in their knowledge are often found. Many factors (e.g., student mobility, teachers omitting intended curriculum from previous years or units, students not truly learning previous intended curriculum) can impede students as they advance to more complex mathematical content.

Regardless of what our students *should* know, teachers often begin lesson planning anticipating that their students may be missing some knowledge required to engage in a given task. To implement a lesson or unit, teachers must identify the missing knowledge and provide supplemental materials to bridge the gap between students' understanding and lesson expectations.

In one example, the textbook task asked students to develop understandings of linear relationships by using graphs and tables and by thinking about the numbers generated by the relationships (Lappan et al. 1998). The task involved the purchase of appliances on installment plans. Students needed to write symbolic equations based on the problem descriptions, then symbolically manipulate the equations. Because they had difficulty translating the words into symbols, the teacher modified an activity to help students make meaning of algebraic phrases in preparation for solving equations symbolically.

In the supplemental activity, the teacher gave each group of students a collection of index cards with terms such as *product, sum, quotient, difference, double, divide by 2*, and *multiply by 1/2*. Each table in the room had a different set of cards. Students worked in teams and identified the correlating operation for each term. When directed, representatives from each table placed their index cards on the board under the appropriate operation: addition, subtraction, multiplication, and division. Groups and individuals made suggestions about moving index cards that they thought were in the wrong place.

Through the discussion, students made connections between mathematical language and operations. They then created algebraic phrases and wrote the corresponding symbolic statements and vice versa to strengthen their understanding of the connection between algebraic words and symbols. After experiencing the process of connecting algebraic symbols to algebraic words, students were able to translate the word problem in the textbook into a symbolic equation and continue with the lesson.

3. INCORPORATE OVERARCHING GOALS

Is the task's purpose aligned with the identified learning targets for your students?

As teachers reflect across a unit or a school year, they often recognize that overarching goals for the year (e.g., developing communication or problem-solving skills) need more or less attention—especially in states that have grade level expectations (GLEs) or other forms of curricular frameworks. It is possible that inconsistencies exist between the nationally available materials and the GLEs (Reys 2006) or that GLEs alert teachers to areas that need additional focus. When specific learning needs are evident, a teacher might identify a goal for a particular lesson that differs from those provided in the materials. In these cases, materials need to be *repurposed*.

One student used a document camera to present her group's solutions to the pizza lesson.

One teacher repurposed materials to ensure that her students' learning reflected the state's GLE and assessment requirements, specifically, communicating strategies. She recognized that her students were not communicating their problem-solving methods and solutions well. Although her materials provided opportunities for communication throughout the year, the teacher recognized that she had not emphasized this skill and justification adequately. To meet this particular GLE and prepare her students for the state assessment, she focused the upcoming task on both oral and written communication skills. Repurposing involved shifting the primary goals of the lesson but not necessarily omitting the materials' stated goals.

The original purpose and goal were to use strategies to add, subtract, and multiply fractions and use pictorial representations (i.e., an area model) to show the computations (e.g., 1/2 of 1/2 is 1/4) (Lappan et al. 2002). In this scenario, a class was preparing for a pizza party by making a square pizza and storing it in the cafeteria freezer for a week. On the first night, a "pizza pirate" went to the freezer and ate one-half. On the second night, the pirate returned and ate one-half of what remained. Each night after, he continued to eat one-half of the remaining pizza.

Table 1 Structuring data in a table gave students a reference for communicating their thoughts.

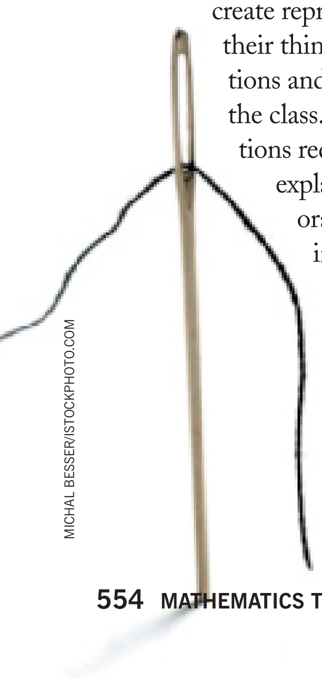
Day	Fraction Eaten
1	1/2
2	1/4
3	1/8
4	1/16
5	1/32
6	1/64
7	1/128

Table 2 The data in this table are a companion and provide a comparison to **table 1**.

Day	Fraction Eaten
1	1/2
2	3/4
3	7/8
4	15/16
5	31/32
6	63/64
7	127/128

Students had to determine what fraction of the pizza was available for the party after it had been in the freezer for seven nights. They were prompted to draw diagrams to show their thinking and to make a table or chart depicting the fraction of pizza (1) eaten each day, (2) eaten so far at the end of each day, and (3) remaining at the end of each day.

The teacher recognized that this task gave her students opportunities to apply multiple strategies and make sense of the math. However, communicating solution methods was not the primary purpose of the original task. To help students improve their communication skills, the teacher required that each group of three to four students create representations of their thinking and solutions and present them to the class. These presentations required students to explain their methods orally and in writing and provide another opportunity for them to justify their work. In addition, by listening and observing other groups' presentations, students had the opportunity to experience alternative ways of communicating and to understand, evaluate, and possibly challenge others' approaches.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Groups used different approaches, such as rectangular area models, circle graphs, and numeric tables. A second group shared a table that showed how much the "pizza pirate" ate each day (see **table 1**), explaining that the denominator doubled each day. After seeing this representation, a third group explained that its table of values showed how much pizza remained, not how much the pirate ate. At this point, the teacher asked whether it made sense that the two tables were the same. Although several students responded yes, they struggled to explain why.

One boy eventually explained that the two tables are the same because the pirate is eating half each time, so the amount eaten is the same as the amount remaining. While discussing this relationship, the students were using both their visual representations (e.g., area models) and their tables, making connections between them. The teacher then asked, "If the pirate took one-third of the pizza instead, would the tables be the same?" After some discussion, a student reasoned that they would not be the same: The "amount eaten" table would show one-third of the previous day's pizza and the "amount left" table would show two-thirds.

While making their presentations, students realized that their thinking and work were not clear to others, so they revised their written work. Classmates asked questions and compared groups' solution methods. For instance, a fourth group made a table that showed a running total of how much the pirate had eaten (see **table 2**). After seeing other presentations, this group arrived at the same answer of 1/128 after 7 days but found it in a different way. In explaining their group's work, students were communicating their thinking and solutions. By listening to other groups and seeing other approaches, students developed stronger understandings and connections among representations. After all groups had presented their methods, the teacher continued with the task as it had been intended.

4. ADJUST FOR READING LEVELS

Is the reading level required for the task aligned with your students' literacy skills?

While recognizing the value of mathematics tasks as presented in curriculum materials, teachers identified a need to change the written presentation (e.g., organization of information and vocabulary) based on their knowledge of particular students. We illustrate these literacy-focused alterations with the following examples.

A teacher working with students with special needs and language-learning needs found that modifying the tasks' format was necessary because the original print density and the language used made some tasks inaccessible to her students. To address the density of the text, the teacher rewrote tasks in a format that provided ample space for students to record their solutions and their thinking. The teacher also made accommodations to facilitate students' visual organization of information by providing templates for representations used in the problems. For example, when students were asked to record data in a table, the teacher provided students with a table template to help them focus on filling in the values and looking for patterns rather than on the skill of drawing the table.

The teacher made additional accommodations to help students understand the prompts presented in the tasks. For this problem, the prompt was the following:

> Based on your experimental data, predict the fraction of blocks in the bucket that are blue, that are yellow, and that are red. (Lappan et al. 1998, p. 6)

The teacher found that her students did not see three parts to the prompt. She rewrote the task using three separate statements, leaving recording space between each statement. This teacher also realized that students did not always understand words such as *explain, justify,* and *predict*. As she rewrote the questions, she included definitions for these words at the side of the page (for example, Predict: Tell me what you think will occur).

Others have found that in classrooms with ELLs, cognates offer another way to support their understanding of language. *Cognates* are words that look or sound similar across languages (see Enright 2009). For example, the following English words are followed by their Spanish cognate in parentheses: experimental (experimental), explain (explicar), justify (justificar), and predict (predecir). For students who speak Spanish as their home language, teachers can discuss these (and other) cognates for many mathematical words when presenting tasks to ELLs. These small changes can help students who have reading challenges.

CONCLUDING REMARKS

The four categories of questions are meant to help teachers plan, implement (and collect evidence of learning), analyze, and reflect on their practice. Our hope for teachers reading this article is threefold:

1. We acknowledge and honor teachers' efforts to tailor tasks according to their wisdom from practice, knowledge of their students, and external requirements for students' learning (e.g., states' GLEs). We have found that teachers who think deeply about the best ways to implement high-level tasks continually alter them to align with their students' (changing) needs.
2. We illustrate examples from actual classrooms of teachers effectively using these strategies for other teachers to consider, relative to their practices.
3. We provide a jumping-off point for a teacher or group of teachers to reflect on how they are currently tailoring tasks and whether these alterations are effective ways to help students understand mathematics.

Seemingly small alterations can enable your students to engage successfully in a problem-based curriculum.

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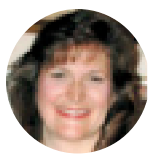

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