New York State EDUCATION DEPARTMENT
Knowledge › Skill › Opportunity

Brief 7:

Understanding, Using, and Modifying Curriculum Materials

Supporting Evidence-Based P–12 Mathematics Teaching Practice

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Background

Curricular materials are key resources for teachers and are necessary, but not sufficient, for ensuring student learning. Skillful evidence-based instruction (see Briefs #1, #2, #4, and #6), appropriate assessment of learning (see Brief #5), and deep understanding of high-leverage mathematics content (see Brief #3) must be present alongside high-quality materials and be supported through professional learning and strong leadership (see Brief #8). Curriculum materials should be selected by a team to ensure alignment with research-based instructional practices and grade-level content standards. However, even when strong, research-based materials are selected, teachers must analyze, adapt, and implement their school's chosen materials in ways that meet the learning needs of students.

Analyzing Curricular Materials with a Critical Eye

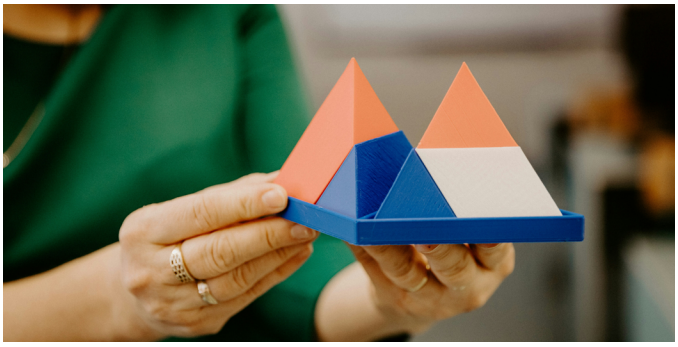
When analyzing their school's chosen materials, teachers examine them carefully, considering the content of the curriculum, how mathematics is represented, and the diversity of cultures and people shown in the curriculum. They consider the ways the materials align with learning standards and evidence-based practices, center culturally responsive-sustaining practices and social-emotional learning, and support the needs of all learners.

Learning standards and evidence-based practices

How is mathematics represented in the curriculum materials?

Engaging in mathematics proficiently requires conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and a productive disposition (National Research Council, 2001) (see Brief #1). Building this proficiency requires opportunities to engage in mathematics activities that make space to practice these skills. As teachers consider how mathematics is represented in materials, they look at the mathematical activities that students are asked to engage in and the types of skills regularly called for. Do those activities represent, in an age-appropriate way, the fullness of mathematical proficiencies and practices as outlined in the New York State Next Generation Mathematics Learning Standards? Or do they overemphasize a narrow band of mathematical activities (e.g., calculational procedures) that can lead to incomplete mathematical learning and/or the development of negative mathematical identities (Lockhart, 2009)? Are students only asked to engage with these proficiencies and processes in "application" lessons at the ends of units or are these woven throughout the materials? To build such proficiencies, students need regular and repeated opportunities to utilize these skills.

In addition to analyzing opportunities for students' mathematical engagement, teachers should consider how mathematical coherence is built over the course of the curriculum. Are mathematical topics treated in isolation from each other as a set of independent skills, or are students supported to build connections, see the "big picture" of the mathematics, and develop concepts across topics? Are too many topics "covered," leading to surface coverage or are fewer focal topics addressed deeply?



How are evidence-based practices represented in the curriculum materials?

Curriculum materials designed to support student learning are structured in ways that allow teachers to engage in high-leverage practices (see Brief #4). Materials should include opportunities for students to engage in rich, cognitively demanding mathematical tasks (Stein et al., 2000), making space for teachers to elicit students' mathematical thinking and press for reasoning and justification. Supports for teachers should include prompts and guidance for mathematics discussions, guidance for the use of representations and manipulatives, and structured opportunities for students to engage in collaborative group work. These supports should also include sufficient professional learning that helps teachers to understand and use the materials as well as guidance on differentiation. Depending on the specific content, explicit instruction and teacher modeling should sometimes come first, but in order to ensure that students develop conceptual understanding, it should often take place after strategically designed exploration activities to support students' sense-making.

Culturally responsive-sustaining practices and social-emotional learning

Who is represented in the curriculum materials and how are they shown?

Learning that mathematics is a human endeavor that has evolved over time and across contexts is vital for students' mathematical development. This involves looking to see that multiple cultures and identities, including the home cultures and identities of one's own students, are authentically represented in instructional materials. Although the use of names and cultural practices (e.g., food and holiday traditions) may be included in the text and tasks, this is insufficient and does not represent the wide range of cultural contributions to and uses of mathematics. Is the development of mathematics across time and place made visible? Does the curriculum provide opportunities to learn about others' experiences and mathematical contributions? Reading curriculum materials with a critical eye also involves examining whether people from a variety of cultures and ability statuses are represented as creators and doers of mathematics and whether harmful stereotypes are reproduced or reinforced (Nguyen & Ryan, 2008; Spencer et al., 1999).

How does the curriculum support a welcoming and affirming environment?

A welcoming and affirming environment is core to culturally responsive-sustaining education. Curriculum materials can contribute to the creation of such an environment when they focus on thinking, reasoning, and sense-making in appropriate balance with fluency and accuracy. They encourage a strong classroom environment by making space for mathematical discourse, discussion, and collaborative work.

Supporting the needs of all learners

What supports are integrated into materials for multilingual learners and students with disabilities?

Strong curriculum materials integrate supports for students into lessons as a natural part of instruction rather than treating these supports as "add-ons." Research-based mathematics supports for multilingual learners such as visual representations of mathematical ideas and the Stanford Graduate School of Education's mathematical language routines (Zwiers et al., 2017) should be a regular part of lessons, integrated into plans rather than sitting as an external resource. The Institute of Education Sciences *What Works Clearinghouse Practice Guides* can be a resource for determining appropriate supports for multilingual learners. Tasks with multiple entry points, strategies, or approaches should be present in a majority of lessons, allowing access for students with disabilities as well as challenge for students.

Adapting Curricular Materials with Care

A high-quality curriculum supports students' development of both conceptual and procedural knowledge and attends consistently to the use of mathematical practices. To contribute to students' learning across all of these domains, instructional materials must be used with skill. In particular, teachers must understand how to adapt materials without changing students' learning opportunities, while also ensuring that materials contain sufficient scaffolds and framing to support cultural relevance and equitable practice. Following are principles to guide and pitfalls to avoid when adapting curricular materials.

Principles	Example
Account for your students' prior knowledge and skills as you prepare to use and adapt particular lessons/ materials.	Administer a brief formative assessment of the prerequisite skills and knowledge that students need for an upcoming unit. This will help you know what supports your students might need to be successful, and what kinds of adaptations you might need to make.
Consider with care whether explicit instruction guidance is mathematically accurate and not just getting students to get right answers, and modify as needed.	Attend to the examples used and the language used to make the ideas clear and conceptually and mathematically accurate. Revise or change explanations that distort or mislead.
Consider where additional explicitness might be needed or where it might constrain students' sensemaking.	Look closely at the learning goal. Ensure that the instruction is aligned with what students are to learn.
Ensure that you keep and/or create additional opportunities for students to engage in mathematical practices.	Expand opportunities for students to explain their mathematical thinking (e.g., turn-and-talks). Use a variety of instructional routines that engage students in mathematical practices (Kelamanik et al., 2016).
Make changes that motivate students to engage in the curriculum.	Use a variety of contexts that students find interesting, including imaginative ones. Pose novel tasks/questions that challenge and intrigue students' attention.
Maintain the instructional/learning goal when making revisions and differentiating.	When differentiating during independent practice, small group, or partner activities, adjust tasks in ways that keep the mathematical focus.
Pitfalls	**Example**
Taking away opportunities for students to engage in mathematical practices	Removing opportunities for students to share their mathematical explanations
Reducing or omitting opportunities for students to develop conceptual knowledge	Proceduralizing a complex, open-ended task by modeling a solution strategy before students have an opportunity to work on the task
Changing the mathematics to make it easier	Omitting key parts of a task because students may struggle with it rather than providing appropriate learning supports
Using math tasks that contain contexts that reproduce or reinforce gendered and/or racialized stereotypes about students' home cultures and who can do mathematics	Using tasks where girls are using mathematics only for stereotypically female tasks such as baking and playing with dolls
Using math tasks that contain contexts that reproduce/ reinforce reductive views of what it means to do mathematics	Using math tasks that contain "pseudocontexts" (Boaler, 2015) that represent math as about questions no one would ever ask (e.g., a problem about a dog pen that is much too small for a dog) Using contrived scenarios that are not how mathematics is actually done and used in the world—unless the purpose is clearly playful
Eliminating opportunities for student or teacher-led synthesis of ideas	Removing direct instruction during the consolidation/ synthesis portion of the lesson

Key Take-Aways

1. Reading curriculum materials with a critical stance means attending not only to whether a variety of cultures are represented but also to how they are represented. Pay attention to whether curriculum materials reduce cultures to "food and flags" or reinforce harmful stereotypes. Attend to whether materials represent the range of ways that cultures have made and used mathematics, the contexts in which mathematics is done, and the people who do mathematics.

2. Adapting curriculum materials with care means that any adaptations maintain the core mathematical ideas, structures, practices, and cognitive demand while supporting children to develop positive mathematical identities.

Reflect & Analyze:

1. How are both the discipline of mathematics and students' home cultures represented in one unit (or even just one lesson) in your curriculum? Are they represented in a way that will aid in the development of authentic, positive mathematical identities?

2. Have you seen any of the pitfalls in your curriculum? Did you respond to them? If so, how? If not, in what ways could you respond to address them?

Key References

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