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ATH



Build on the Science of Learning

The development of *Reveal Math*, a K-12 core mathematics program, draws from a range of academic research in learning science. In addition to academic research, several other critical inputs contributed to the development of the program, including extensive in-classroom testing, user testing, and direct feedback from hundreds of educators across the country.

Reveal Math is based on proven classroom practices and research from our expert advisor team, as well as current academic research brought forward by McGraw-Hill's Learning Scientists. This collective team played a critical role in the design of the program's instructional model. This document provides an overview of the key research areas that *Reveal Math* was built on and demonstrates the application of each within the program.

Key research areas:

Learning Targets

Learning targets are the foundational critical aspect of formative assessment. They provide a path for teachers to share with students the learning that is intended to happen and indicators that it is taking place. Learning targets help students understand and own the mathematical ideas in a lesson. Using the learning targets as touchstones throughout the lesson provides the opportunity for students to reflect on their learning trajectory process. This reflective process helps students see their growth while teachers are able to use the success criteria for formative assessment questioning and gain insight to the students' perceptions of their learning.

Teachers need to be able to define, create, and use learning targets effectively. This is a process. Students need to be able to use learning targets effectively. This is a process. Teachers need to be able to use learning targets effectively. This is a process. Teachers need to be able to use learning targets effectively. This is a process.

(Keeley & Tobey, 2011, p. 10)

Assessment is a process that is used to measure student learning. This is a process. Teachers need to be able to use learning targets effectively. This is a process.

Formative Assessments

The key to reaching all learners is to adjust instruction based on students' understanding. Using formative assessments lets teachers know when to provide additional guidance or additional challenges to keep students on track and engaged in learning. Based on student data, the teacher can create more refined and targeted differentiation.

The greatest enemy we have is not a better education, but a mediocre one.

(William, 2011)

Citation reference resources found on p.11

Where it appears in the program

Embedded formative assessment questioning and advice on what to watch for is provided to the teacher throughout every lesson. Formal check point opportunities found in *Reveal Math* are designed to provide teachers with actionable data for differentiation and skills gap identification. Actionable reports provide key information to quickly inform instruction and differentiation.

LESSON CHECKS AND EXIT TICKETS

Formative Lesson Checks and Exit Tickets are questions designed to be completed by students in a short amount of time. Teachers can use this information to decide how each student should proceed with independent practice, homework, and differentiation.

K-5 students are assessed in each lesson at a consolidated point of formative assessment. The easy-to-use results improve classroom management of daily, multi-modal differentiation.

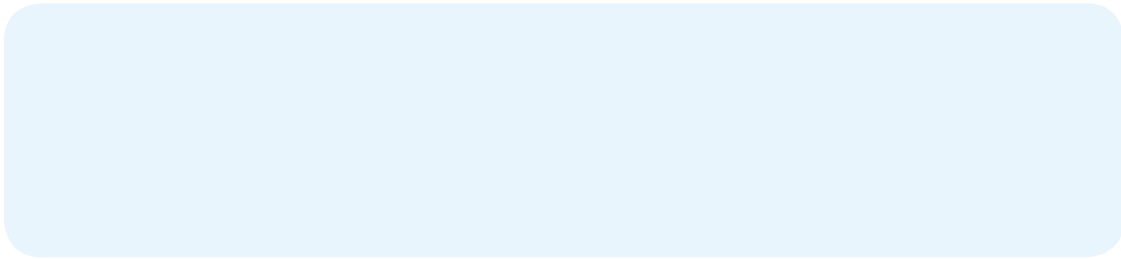
6-12 students have formative assessment checks after one or more examples. Results from the checks are displayed in easy-to-read reports that can be viewed in real-time to adjust instruction on the spot or at a later time, depending on the needs of the teacher.

MATH PROBES

Each module contains a math probe that poses a problem, set of problems, or task that elicits information about student misconceptions. Teachers can use a rubric to evaluate student responses and modify upcoming curriculum, as needed. The probe can also be used for student self-reflection at the end of the module.

K-5 EXPLORE AND DEVELOP

Problem solving is embedded in every lesson in *Reveal Math*. Students use problem contexts



Citation reference resources found on p.11

Mathematical Discourse

Mathematical discourse helps students expand their mathematical thinking and consider new strategies. Defending reasoning requires a deep understanding of processes and outcomes, and helps to solidify conceptual understanding. When students are asked to articulate their understanding and listen as others do the same, they deepen and expand their own comprehension of mathematics.

Teachers play a pivotal role in mathematical discourse. When teachers use focused questions, they are also modeling how to ask clarifying questions in a way that will serve students better in later phases of learning.

With a set of beads, a teacher and a student work together to create a pattern. The teacher asks, "What do you notice about the pattern?" The student responds, "I notice that the pattern is repeating every four beads." The teacher asks, "How do you know that?" The student explains, "I counted the beads and saw that the sequence of colors repeats every four beads." The teacher asks, "Can you describe the pattern in a different way?" The student says, "The pattern is a sequence of four beads that repeats." The teacher asks, "How can you use this pattern to solve a problem?" The student says, "I can use the pattern to predict the color of the next bead in the sequence." The teacher asks, "How can you use this pattern to solve a problem?" The student says, "I can use the pattern to predict the color of the next bead in the sequence."

(Smith & Stein, 2011, p. 73)

Citation reference resources found on p.11

Where it appears in the program

STRONG QUESTIONING TECHNIQUES FOR THE TEACHER

The teacher materials provide strong questioning examples to help teachers focus discussions so students develop efficient approaches to a problem.

K-5 TALK MATH ACTIVITIES

Following small group work in the Explore Activities, teachers facilitate student discourse where students explain and clarify their reasoning. Teacher questions are carefully constructed to help students connect their work to the mathematical ideas that develop from their exploration. This conceptual bridge explicitly links conceptual understanding to developing procedural skills and fluency in the next section of a lesson.

6-8 TALK ABOUT IT! PROMPTS

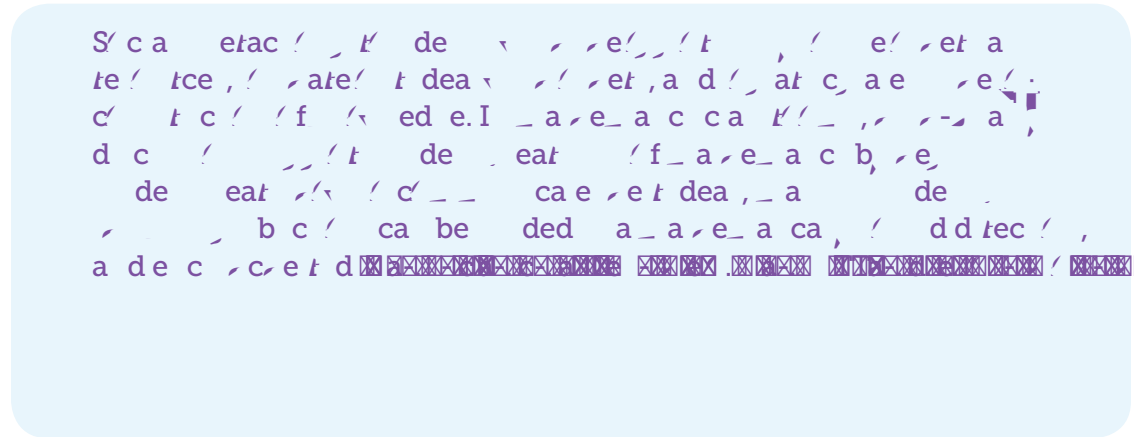
The Talk About It! questions throughout the Explore, Learn, and Example sections of each lesson offer opportunities for students to build meaning, to reason and explain their thinking, and ultimately work toward building conceptual understanding of the math concepts covered in that lesson.

COLLABORATE

Students are encouraged to work together at various points in each lesson, listening to others and discussing their approach to the mathematics.

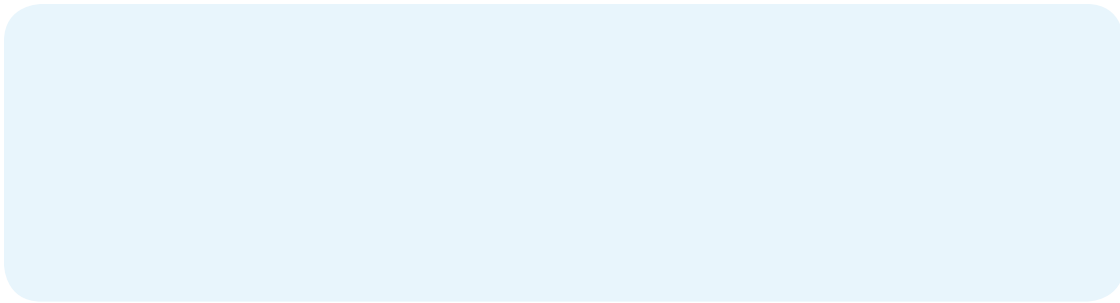
Collaborative Learning

There are tremendous benefits to be gained by student collaboration. Not only do students learn from the thinking of others, but they also learn to appreciate diverse viewpoints. In explaining their own understanding, students grow as individual learners. Research suggests that collaborative learning activities boost student engagement. The gains in which collaborative learning activities promote student learning outcomes complements the benefits of meaningful discourse, productive struggle, and rich tasks described earlier. Both whole-class and small-group collaboration provide opportunities for these rich experiences.



Misconception, Error Analysis, and Perception

Research suggests that learning occurs optimally in mistake-friendly environments, in which taking risks and making errors are considered a natural part of the learning process rather than evidence of teacher or student failure. Promoting such an environment requires a shift in thinking for both the teacher and the student so that errors are considered opportunities for meaningful classroom discourse centered around the learners' thinking about the connection between concepts and procedures. When the teacher recognizes misconceptions, they shed light on how to best provide support so that learners move to a deeper and more accurate understanding of a concept. Less emphasis is on getting the right answer. Rather, instruction focuses on using mistakes, misconceptions, and opportunities to learn. This type of mistake-friendly environment is closely related to the notions of productive struggle and rich tasks, as it allows students to engage with content in a way that is learner-centered and learner-driven. This type of environment helps students engage with mathematics more deeply and without an anxiety about immediate correct answers impeding their learning processes.



Reference

- ▲ . (2014). . *Educational Leadership*, 72(2).
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