
eal
ATH

B il on he Science of Lea ning

The de elopment of *Reveal Math*, a K-12 core mathematics program, dra s from a range of academic research in learning science. In addition to academic research, se eral other critical inputs contributed to the de elopment of the program, including e tensi e in-classroom testing, user testing, and direct feedback from hundreds of educators across the countr .

Reveal Math is based on pro en classroom practices and research from our e pert ad isor team, as ell as current academic research brought for ard b McGra Hill s Learning Scientists. This collecti e team pla ed a critical role in the design of the program s instructional model. This document pro ides an o er ie of the ke research areas that *Reveal Math* as built on and demonstrates the application of each ithin the program.

Key research areas:

Lea ning Ta ge .

Learning targets are the foundational critical aspect of formati e assessment. The pro ide a a for teachers to share ith students the learning that is intended to happen and indicators that it is taking place. Learning targets help students understand and o n the mathematical ideas in a lesson. Using the learning targets as touchstones throughout the lesson pro ides the opportunit for students to re ect on their learning trajector process. This re ecti e process helps students see their gro th hile teachers are able to use the success criteria for formati e assessment questioning and gain insight to the students perceptions of their learning.

> Teac e eed be e a f de e _ e e de ate e e a d de a d f a d e e c a ce . S de eed be ac e ed e a e e ce a e a e ea e a e e a e a d ef feedbac e eac e .
>
> (Keeley & Tobey, 2011, p. 10)

A e e de a e e e f e d c e e c e f e a e a ca a f e e e .T c e

Fo ma i e A . e . men

The ke to reaching all learners is to adjust instruction based on students understanding. Using formati e assessments lets teachers kno hen to pro ide additional guidance or additional challenges to keep students on track and engaged in learning. Based on student data, the teacher can create more re ned and targeted di erentiation.

> T e / t e e e a be ee e c ee de ce a d / t e t c / , eb e e, ac / ea .
>
> (Wiliam, 2011)

Citation reference resources found on p.11

Where it appears in the program

Embedded formati e assessment questioning and ad ice on hat to atch for is pro ided to the teacher throughout e er lesson. Formal check point opportunities found in *Reveal Math* are designed to pro ide teachers ith actionable data for differentiation and skills gap identification. Actionable reports provide key information to quickly inform instruction and differentiation.

LESSON CHECKS AND EXIT TICKETS

Formati e Lesson Checks and E it Tickets are questions designed to be completed b students in a short amount of time. Teachers can use this information to decide ho each student should proceed ith independent practice, home ork, and differentiation.

K-5 students are assessed in each lesson at a consolidated point of formati e assessment. The eas -to-use results impro e classroom management of daily, multi-modal differentiation.

6-12 students ha e formati e assessment checks after one or more e amples. Results from the checks are displa ed in eas -to-read reports that can be ie ed 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 e aluate student responses and modif upcoming curriculum, as needed. The probe can also be used for student self-re ection at the end of the module.

K-5 EXPLORE AND DEVELOP

Problem sol ing is embedded in e er lesson in *Reveal Math*. Students use problem conte ts

Citation reference resources found on p.11

Ma hema ical Di co . e

Mathematical discourse helps students e pand their mathematical thinking and consider ne strategies. Defending reasoning requires a deep understanding of processes and outcomes, and helps to solidif conceptual understanding. When students are asked to articulate their understanding and listen as others do the same, the deepen and e pand their o n comprehension of mathematics.

Teachers pla a pi otal role in mathematical discourse. When teachers use focused questions, the are also modeling ho to ask clarif ing questions in a a that ill ser e students better in later phases of learning.

> W t a e t be e a t be a d e te ea a d te a e te de e a e f e t a d, d e e d c e t e e d f a e a ca tea a e a e t ea e a t f e ce ta dea f e d c e.
>
> (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 pro ide strong questioning e amples to help teachers focus discussions so students de elop e cient approaches to a problem.

K-5 TALK MATH ACTIVITIES

Follo ing small group ork in the E plore Acti ities, teachers facilitate student discourse here students e plain and clarif their reasoning. Teacher questions are carefull constructed to help students connect their ork to the mathematical ideas that de elop from their e ploration. This conceptual bridge e plicitl links conceptual understanding to de eloping procedural skills and uenc in the ne t section of a lesson.

6-8 TALK ABOUT IT! PROMPTS

The Talk About It! questions throughout the E plore, Learn, and E ample sections of each lesson o er opportunities for students to build meaning, to reason and e plain their thinking, and ultimatel to ork to ard building conceptual understanding of the math concepts co ered in that lesson.

COLLABORATE

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

Collabo a i e Lea ning

There are tremendous bene ts to be gained b student collaboration. Not onl do students learn from the thinking of others, but the also learn to appreciate di erse ie points. In e plaining their o n understanding, students gro as indi idual learners. Research suggests that collaborati e learning acti ities boost student engagement. The a in hich collaborati e learning acti ities promote student learning outcomes compliments the bene ts of meaningful discourse, producti e struggle, and rich tasks described earlier. Both hole-class and small-group collaboration pro ide opportunities for these rich e periences.

Mi conce ion , E o Anal i , and Pe ce ion

Research suggests that learning occurs optimall in mistake friendl en ironments, in hich taking risks and making errors are considered a natural part of the learning process rather than e idence of teacher or student failure. Promoting such an en ironment 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 bet een concepts and procedures. When the teacher recogni es misconceptions, the shed light on ho to best pro ide support so that learners mo e to a deeper and more accurate understanding of a concept. Less emphasis is on getting the right ans er. Rather, instruction focuses on using mistakes, misconceptions, and opportunities to learn. This t pe of mistake-friendl en ironment is closel related to the notions of producti e struggle and rich tasks, as it allo s students to engage ith content in a a that is learner-centered and learner-dri en. This t pe of en ironment helps students engage ith mathematics more deepl and ithout an iet about immediate correct ans ers impeding their learning processes.

Reference

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

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