

# Supporting Research



*Ready*<sup>®</sup> *Classroom Mathematics* is built on research from a variety of federal initiatives, national mathematics organizations, and experts in mathematics.

## Ready Classroom Mathematics Uses . . .

## Examples

## Research Says . . .

### Instructional Routines

An instructional routine supports students in achieving mathematical proficiency and rigor within a collaborative structure to develop greater understanding of how to reason mathematically.

*Ready Classroom Mathematics* lessons follow a Try-Discuss-Connect instructional routine in which students make sense of a problem, discuss and connect strategies and models, reflect on their learning, and apply that learning to new problems in **Try It**, **Discuss It**, **Model It**, **Connect It**, and **Apply It**.

*"... [I]nstructional routines are situated in the learning opportunity itself, providing students with a predictable frame for engaging with the content. . . . They allow for a greater focus on learning. . . . [and] help teachers and students build crucial thinking habits."*

—Kelemanik, Lucenta, & Creighton, 2016

### Mathematical Practices

Mathematical Practices identify habits of mind and everyday ways of approaching math that are hallmarks of successful math students.

Mathematical Practices are an integral part of *Ready Classroom Mathematics* instruction.

- The **Mathematical Practices** section of the Student Handbook in the Student Worktext serves as reference for students.
- Mathematical Practices are built into the instruction and problems throughout each session.
- **Deepen Understanding** features in the Teacher's Guide provide rigorous discourse questions for specific Practices.

*"... Mathematical Practice[s] describe eight habits of mind teachers must incorporate into classroom instruction to help students develop depth of understanding of critical mathematical concepts. . . . If students are engaged in using the eight Practices, they are learning rigorous, meaningful mathematics."*

—Gojak and Miles, 2016

### Collaborative Learning

Collaborative learning (partner or small group) encourages students to present and defend their ideas, make sense of and critique the ideas of others, and refine and amend their approaches.

*Ready Classroom Mathematics* lessons provide multiple opportunities for collaborative learning. **Discuss It** prompts students to explain their thinking and justify their strategies to each other.

*"Research tells us that when students work collaboratively, which also gives them opportunities to see and understand mathematics connections, equitable outcomes result."*

—Boaler, 2016

### Mathematical Discourse

Mathematical discourse in instruction uses questioning, listening, reading, writing, interpreting information, and reflection to communicate mathematical knowledge.

*Ready Classroom Mathematics* lessons include predictable opportunities for sharing of ideas and understandings.

- **Discuss It** prompts students to explain and justify their strategies.
- **Ask-Listen for** questioning in the Teacher's Guide provides discussion prompts and expectations for possible student responses.
- **Deepen Understanding** features in the Teacher's Guide provide math discourse for specific Practices.

*"Mathematical discourse serves as a forum in which to exchange and record mathematics ideas, document evidence of learning, and monitor growth in knowledge development. Teachers gain insights not only about what students know but also about the approaches they use, how—and how well—they understand the ideas, and the ways they present their knowledge."*

—Kersaint, 2016

## Ready Classroom Mathematics Uses . . .

## Examples

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### Connection to Prior Knowledge

Connection to prior learning encourages students to draw on their experiences and knowledge and leads to coherence of mathematical understanding.

*Ready Classroom Mathematics* lessons routinely provide opportunities for students to connect to prior knowledge.

- Each **Explore** session introduces a new concept by having students make sense of a problem based on applying prior knowledge.
- **Start** slides establish a clear entry point by activating and/or connecting to prior learning related to the content of the session.

*“Mathematical knowledge and understanding cannot be transferred directly from teacher to student. Students must be provided with opportunities to construct their own knowledge and understanding that reflect, refine, and extend their prior knowledge, skills, and experiences.”*

—Ellis, Yeh, and Hurdato, 2017

### Productive Struggle

Productive struggle occurs when students are allowed critical processing time to reason about and make sense of mathematical situations on their own.

*Ready Classroom Mathematics* lessons are structured so that students work independently to persevere in making sense of a problem and starting their own solution strategies.

*“Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.”*

—NCTM, 2014

### Select and Sequence

Selecting and sequencing is an instructional practice where teachers identify students and specific approaches to focus on during whole class discussion and make a purposeful decision about the order of student presentations.

The *Ready Classroom Mathematics* Teacher’s Guide includes a **Select and Sequence Solutions** section that provides an order of possible student approaches ranging from concrete to representational to abstract that teachers can use to make decisions about the structure of whole class discussions.

*“Through planning, teachers can anticipate likely student contributions, prepare responses that they might make to them, and make decisions about how to structure students’ presentations to further their mathematical agenda for the lesson.”*

—Smith and Stein, 2011

### Making Connections

Making connections occurs when students compare approaches, strategies, tools, and representations, and then generalize their understanding.

The *Ready Classroom Mathematics* Try-Discuss-Connect instructional routine actively engages students in making connections.

- In **Discuss It** whole class discourse focuses on comparing and connecting student representations and approaches identified by the teacher during selecting and sequencing.
- **Model It** representations are compared and connected to student understandings.
- In **Connect It**, students record their learning, articulate their approaches, and demonstrate understanding of mathematical learning goals.

*“Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedure, and as tools for problem solving.”*

—NCTM, 2014

## CRA Model

The Concrete-Representational-Abstract (CRA) Model is a three-part instructional model that enhances students' mathematical learning.

The CRA Model is built into all *Ready Classroom Mathematics* lessons.

- In **Try It**, students analyze problems in a very focused way to help them begin to develop concrete solutions. Students may use concrete, representational, or abstract strategies to solve the problem, based on their understanding of the problem or mathematical concept.
- In **Discuss It**, as teachers sequence student strategies, they have students share concrete approaches before discussing other mathematical representations and more abstract strategies.
- In **Connect It**, students connect concrete and representational approaches to more abstract understanding as they formalize their learning.
- **Hands-On Activities** at point of use and at the end of each lesson in the Teacher's Guide support students needing additional work on a concept or skill.

*"Using and connecting representations leads students to deeper understanding. Different representations, including concrete models, pictures, words, and numbers, should be introduced, discussed, and connected to support students in explaining their thinking and reasoning."*

—Clements and Sarama, 2014

## Conceptual Understanding

Conceptual understanding is meaningful knowledge of mathematical concepts and relations and understanding of why math processes and rules work.

All *Ready Classroom Mathematics* lessons lay a foundation for conceptual understanding of the mathematical principles underlying strategies and skills being addressed.

- **Understand** lessons put a special emphasis on these principles.
- **Deepen Understanding** features in the Teacher's Guide provide further support for conceptual understanding.

*"To prepare students for Algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, and problem-solving skills."*

—National Mathematics Advisory Panel, 2008

## Reasoning and Problem Solving

Reasoning about mathematical ideas and approaches to problem solving contributes to the development of foundational conceptual understanding and procedural fluency.

Problem solving and reasoning about mathematics are at the heart of *Ready Classroom Mathematics*.

- **Try It, Discuss It, Model It, and Connect It** engage students in active problem solving and support reasoning through productive struggle, peer discussion, and whole class discourse.
- **Apply It** problems are an opportunity for students to independently apply flexible use of strategies to solve new problems and reflect on their learning.

*"Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies."*

—NCTM, 2014

## Procedural Fluency and Skills

Procedural fluency and skills are the ways students use their knowledge to accurately, flexibly, and efficiently apply mathematical procedures and operations.

*Ready Classroom Mathematics* directly addresses the development of procedural skills connected to conceptual understanding.

- **Additional Practice** encourages students to demonstrate flexible use of strategies, explain their thinking about procedures, and apply procedures appropriately and efficiently.
- **Start** slides in the Teacher's Guide provide fluency practice that connects previously learned skills to new content.
- **Building Fluency** and **Fluency Practice** activities in the Teacher's Guide and **Fluency & Skills Practice** are ongoing opportunities for students to accurately, flexibly, and efficiently practice mathematical procedures and operations.

*"Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems."*

—NCTM, 2014

## Formative Assessment

Formative assessment is a strategy that involves frequent, in-classroom progress checks of students' understanding and mastery of math concepts and skills.

*Ready Classroom Mathematics* lessons are structured so that teachers can monitor understanding throughout.

- **Common Misconceptions** and **Error Alerts** in the Teacher's Guide are ongoing formative assessment opportunities, with support for correcting misconceptions and errors.
- Refine sessions include a **Check for Understanding** in the Teacher's Guide to help assess students' progress toward mastery of skills, identify specific misconceptions, and provide support on the spot.

*"Teachers' regular use of formative assessment improves their students' learning, especially if teachers have additional guidance on using the assessment to design and to individualize instruction."*

—National Mathematics Advisory Panel, 2008

## Support for All: Differentiated Instruction

Differentiated instruction is an approach to teaching that gives students multiple ways to access and make sense of mathematical ideas.

*Ready Classroom Mathematics* lessons provide a full range of support for differentiating instruction.

- **Hands-On Activities, Visual Models, Deepen Understanding,** and **Challenge Activities** in the Teacher's Guide provide differentiation options for use during lessons.
- Recommendations in the Teacher's Guide for **Tools for Instruction, Center Activities,** and **Enrichment Activities** provide differentiation options for use after lessons.

*"Differentiation is a teacher's proactive response to learner needs shaped by mindset and guided by general principles of differentiation: an environment that encourages and supports learning, quality curriculum, [and] assessment that informs teaching. . . ."*

—Tomlinson & Moon, 2013

## Support for All: Culturally Responsive

Being culturally and linguistically responsive (CLR) entails the validation, affirmation, building, and bridging of students' cultural and linguistic behaviors through instructional practices.

Support for a culturally responsive classroom is woven into every lesson in *Ready Classroom Mathematics*.

- Lessons follow the Universal Design for Learning (UDL), ensuring that all students can access the mathematics by providing multiple ways of representing information for engagement, action, and expression.
- **Connect to Community and Cultural Responsiveness** at the beginning of each lesson in the Teacher's Guide provides ideas for promoting cultural responsiveness throughout the sessions.
- In each unit, **Connect Language Development to Mathematics** gives strategies on establishing a classroom environment supporting mathematical discourse for all learners.

*"CLR is the validation and affirmation of the home (indigenous) culture and home language for the purpose of building and bridging the student to success in the culture of academia and mainstream society."*

—Hollie, 2011

## Support for All: ELL

*Ready Classroom Mathematics* helps teachers scaffold language so that students can access and express understanding of rigorous grade-level mathematics.

*Ready Classroom Mathematics* lessons use many approaches to support English Language Learners (ELL).

- The Student Worktext has pictorial and visual representations combined with direct, simple text to clearly present concepts.
- **ELL Differentiated Instruction** in every session provides scaffolds for the different levels of language proficiency and language domains so teachers can address students' language needs.
- Additional ELL and language support in the Teacher's Guide includes **Language Objectives** and a **Develop Language** feature in every session and vocabulary development for both mathematical terms and academic language.

*"The framework [is] . . . a new vision for mathematics instruction that explicitly attends to the needs of ELLs, addressing the interdependence of language and mathematics."*

—Council of the Great City Schools, 2016