PROJECT STAIR INSTRUCTIONAL GUIDE FOR MATHEMATICS

Supporting **T**eaching of **A**lgebra: **I**ndividual **R**eadiness

Project STAIR is a federally-funded research project that supports middle-school mathematics teachers in implementing data-based individualization (DBI). STAIR coaches work with teachers to help support students who experience difficulty with math to develop algebra readiness skills needed to be successful in high school and beyond. Project STAIR is supported by the Office of Special Education Programs (OSEP) under grant H326M170006. The project is housed at the University of Missouri, Southern Methodist University, and the University of Texas at Austin.

Authors of this guide:
Samantha E. Bos
Rachel Juergensen
Tiffini Pruitt-Britton
Sarah R. Powell

PROJECT STAIR TEAM MEMBERS:

Erica S. Lembke
Leanne Ketterlin-Geller
Sarah R. Powell
Tessa L. Arsenault
Samantha E. Bos
Taylor Cox
Stacy Hirt
Stephanie Hopkins
Jiyung Hwang
Rachel Juergensen
Erica N. Mason
Alain Mota
Yaacov Petscher
Tiffini Pruitt-Britton
Elizabeth Thomas

Project STAIR Instructional Guide for Mathematics

In this guide, we provide suggestions for implementing evidence-based mathematics (math) instruction.
We suggest you design an instructional platform and intensify the platform based on student needs.

WHAT IS EVIDENCE-BASED MATHEMATICS INSTRUCTION?

Evidence-based instruction is instruction based on the results of several high-quality research studies that find a practice to effectively improve students' math skills and understandings across a variety of settings.

In this guide, we provide an introduction to key evidence-based math practices. Additionally, we provide a brief description of the research-base that supports each practice, and we provide additional resources if you are interested in learning more.

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How to Use this Guide

Math Instructional Practices

We highlight 7 evidence-based math practices.

EXPLICIT INSTRUCTION

Explicit instruction includes proper modeling, practice, and support of math learning. Teachers should be purposeful in their explanations and interventions to ensure student participation and reflection.

MULTIPLE REPRESENTATIONS

The use of multiple representations, including concrete, pictorial, and abstract representations allows students to have multiple access points in understanding the math concepts. There is no hierarchy between the three forms of representation, and it is important that students at all grade levels have access to these multiple forms of learning.

MATH LANGUAGE

Math language includes the use of precise and concise formal math language. It is important that students hear, see, write, and practice speaking using the mathematically correct term, even at a young age. Teachers can explicitly teach math language and integrate it into their practice.

WORD-PROBLEM INSTRUCTION

Many students benefit from explicit word problem instruction, including attack strategies to break down the word problem as well as schema instruction. Learning the different schemas, or structures, of word problems helps student identify strategies to solve each problem.

MNEMONICS

Mnemonics includes devices or strategies to help students remember math concepts or the steps in a math procedure. Mnemonics can be a powerful tool to help students learn multi-step strategies or complex multi-component procedures.

GRAPHIC ORGANIZERS

Graphic organizers are visual, or graphic, displays of math vocabulary, concepts, procedures, or relationships between larger math topics. Graphic organizers are an effective tool to help students organize their thoughts and implement complex math procedures.

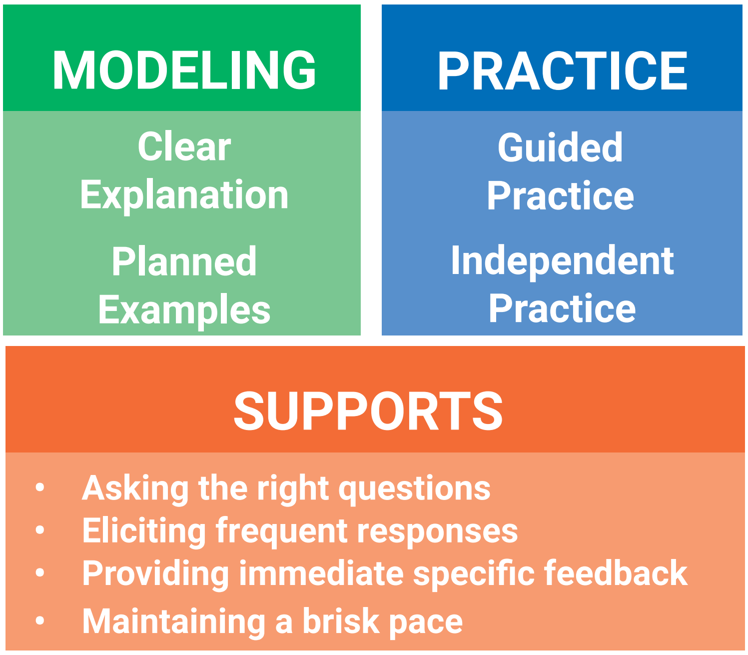
FLUENCY BUILDING ACTIVITIES

To help students master math facts and math essentials, it is important they are provided frequent, brief opportunities to develop their fluency. Students can play games, use manipulatives, or practice their facts in a variety structured ways.

Utilize Explicit Instruction

DEFINITION

Teachers should be explicit in the modeling and practicing of math. In the figure below, interventions should be divided between modeling and practice. Modeling includes a step-by-step explanation and clarity in the language used during explanations. Practice includes practice with the teacher (i.e., guided practice) as well as independent practice. During modeling and practice, teachers should use supports, such as asking a variety of question types, eliciting student responses and providing immediate corrective feedback while maintaining a brisk pace.



WHAT DOES THE RESEARCH SAY?

Explicit and systematic instruction is essential when providing math intervention (Fuchs et al., 2021). In reviews of math intervention, explicit instruction is often noted in almost all interventions (Jitendra et al., 2018; Stevens et al., 2018).

Researchers have used explicit instruction to teach a variety of math content, including operations (Milton et al., 2019; Parker et al., 2019), fractions (Bouck et al., 2017; Dyson et al., 2020), word-problem solving (Bottge et al., 2014; Jitendra & Star, 2012), algebra (Bouck et al., 2019; Bryant et al., 2020), and math writing (Hughes & Lee, 2020).

Utilize Explicit Instruction

EXAMPLE: MODELING

MODELING

Clear Explanation

Planned Examples

State the goal and its importance.

Model steps.

Use precise math language.

"To solve 26 plus 79, we first decide about the operation. Do we add, subtract, multiply or divide?"
"The plus sign tells us to add. So, we'll add 26 plus 79. We'll use the partial sums strategy. First, we add 20 plus 70. What's 20 plus 70?"
...
"Finally, we add the partial sums: 90 and 15. 90 plus 15 is 105."

MODELING

Clear Explanation

Planned Examples

Use examples.

Also use non-examples.

24 / 6 $\quad$ 28 ÷ 7 $\quad$ 35) 5

32 ÷ 8 $\quad$ 42 ÷ 7 $\quad$ 25 – 5

EXAMPLE: PRACTICE

PRACTICE

Guided Practice

Independent Practice

Teacher and student practice together.

"Let's work on this problem together. First..."

Student practices with teacher support.

"Now you'll practice a problem on your own. Don't forget to use your attack strategy."

Utilize Explicit Instruction

EXAMPLE: SUPPORTS

SUPPORTS		
Asking the right questions	Ask low-level and high-level questions.	"What is 7 times 9?" "How would you solve this problem?"
Eliciting frequent responses	Vary responses, such as: classwide, individual, partner, write on paper, write on whiteboard, thumbs up, etc.	"Turn and discuss the formula for perimeter with your partner." "Write 2 + 6 on your whiteboard."
Providing immediate specific feedback	Provide affirmative and correct feedback.	"Let's look at that again. Tell me how you added in the hundreds column."
Maintaining a brisk pace	Be planned and organized.	"Grab your bag of manipulatives as you enter the classroom."

ADDITIONAL RESOURCES

National Center on Intensive Intervention Course on Explicit Instruction

Vanderbilt IRIS Center Module on Explicit Instruction

Explicit Instruction Homepage

Utilize Explicit Instruction

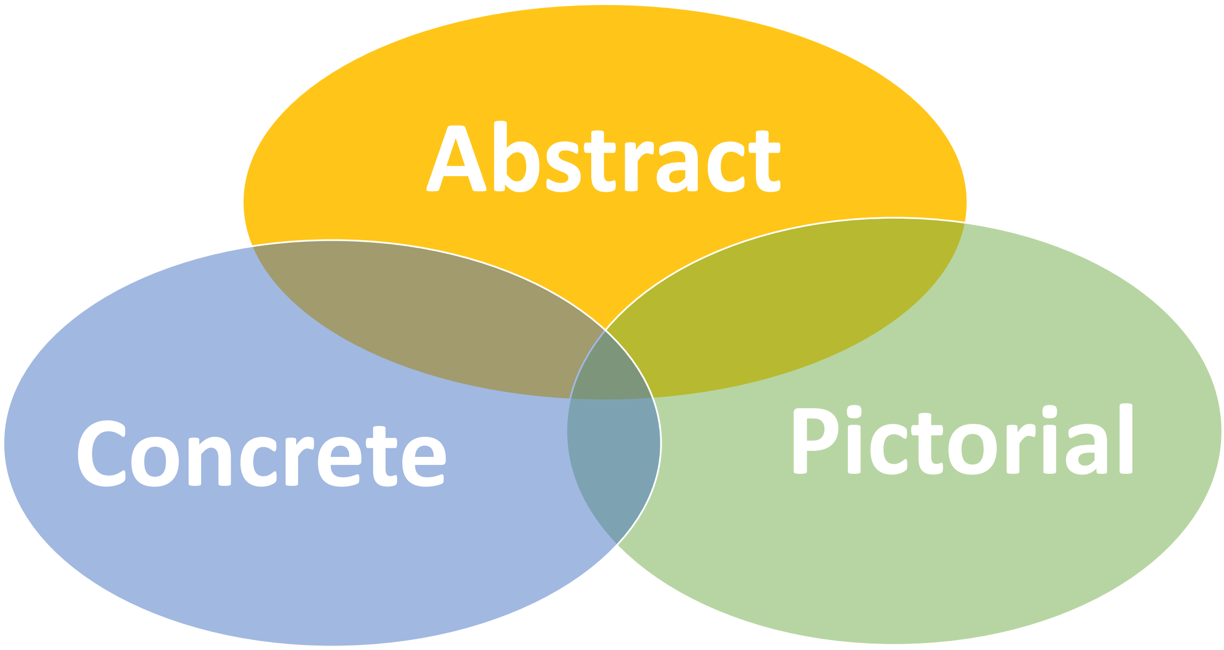
PROCEDURES

Clear Explanation with Precise Language	When modeling, start with a clear explanation about why the math is important. For example, say, "Today, we are learning about division. This is important because sometimes you have to share objects or things with your friends." This will help students start to make the connection between math and real life. Precise language includes the formal language of math. For example, say "numerator" instead of "top number" or "product" instead of "answer."
Model Steps	While modeling, model the steps to solve a problem. Involve your students in the process by asking questions and giving them opportunities to respond. Modeling should feel like a dialogue between you and your students.
Planned Examples and Non-Examples	Plan the examples you choose for your interventions. For example, when modeling a division problem, think about the different ways to show division and how you want to represent the problems. Include non-examples to help students understand when to apply the strategy you have modeled.
Guided Practice	You and the students practice problems together. Provide scaffolding so students can start to see how they can solve these problems on their own.
Independent Practice	Students practice independently while you provide feedback. Ensure that students are able to complete problems on their own before they begin independent practice.
Supports: Questions	During both modeling and practice, ask a mix of low-level questions (to check for understanding) and high-level questions (to learn what students understand about different concepts and procedures).
Supports: Responses	During both modeling and practice, provide opportunities for students to respond. Typically students should respond at least every 30 to 60 seconds during modeling and guided practice.
Supports: Feedback	During both modeling and practice, provide affirmative feedback. Make the affirmative feedback specific to math. Provide corrective feedback when necessary.
Supports: Brisk Pace	During both modeling and practice, maintain a brisk pace by being prepared, organized, and ready to teach in order to maximize time spent learning.

Multiple Representations

DEFINITION

Teachers should use multiple representations to help students understand different math concepts and procedures. Multiple representations include concrete representations. These are hands-on tools students can use to show math in different ways. Multiple representations also includes pictorial representations. These might be pictures, graphs, or organizers printed or drawn on a two-dimensional surface. Pictorial representations could also include virtual manipulatives accessed via technology. Finally, multiple representations includes abstract representations of math presented with numerals, symbols, and words.

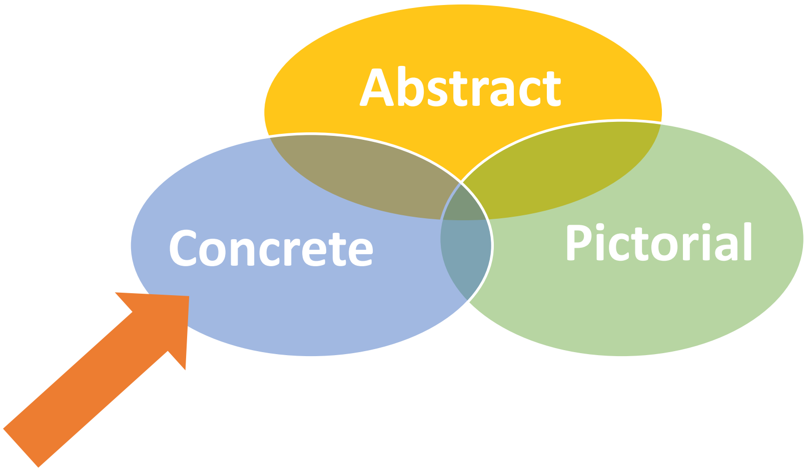


WHAT DOES THE RESEARCH SAY?

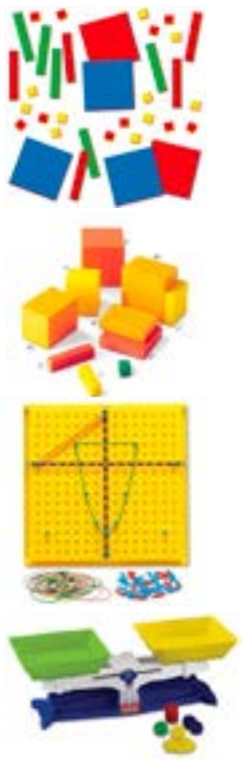
When students use multiple representations, their math performance increases (Bouck & Park, 2018). This is true for hands-on tools (Namkung & Bricko, 2021), virtual manipulatives (Bouck et al., 2018), and graphic organizers. Multiple representations have been used to increase student understanding of operations (Bennett & Rule, 2005), fractions (Bouck et al., 2020), word-problem solving (Xin et al., 2020), geometry (Strickland & Maccini, 2012), and algebra (Scheuermann et al., 2009).

Multiple Representations

EXAMPLE: CONCRETE REPRESENTATIONS

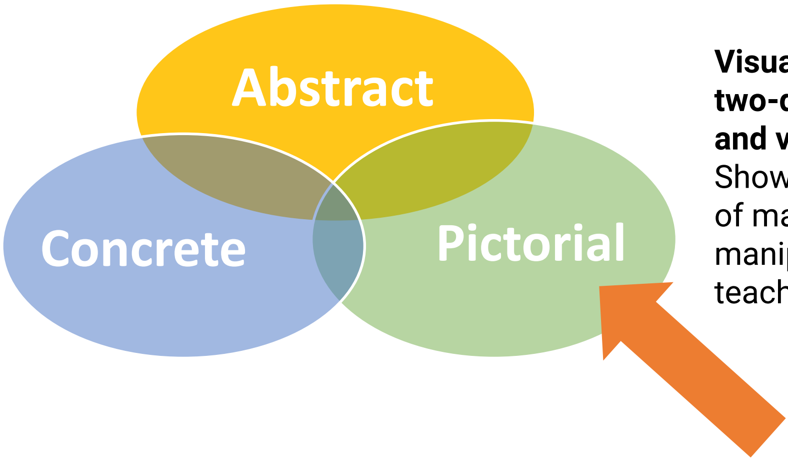


Concrete representations include three-dimensional objects or virtual manipulatives.
Shown below are examples of manipulatives, but many manipulatives can be used to teach a variety of math topics.

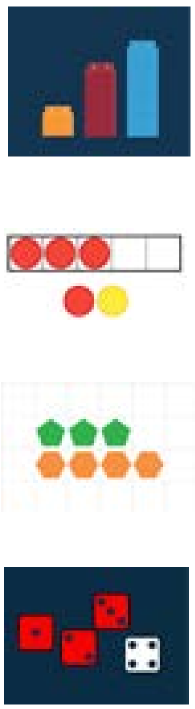
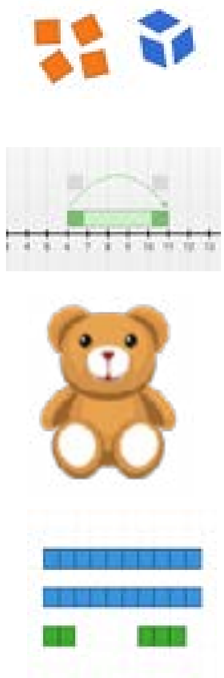
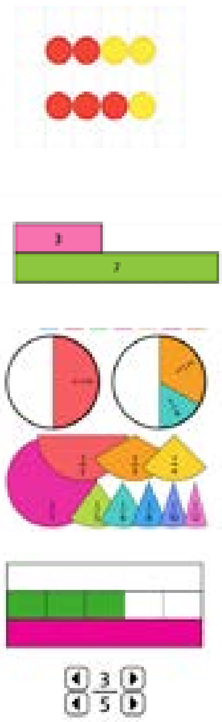
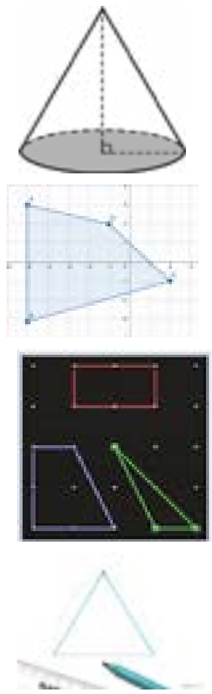
Operations	Whole Numbers	Fractions	Algebra	Geometry
				

Multiple Representations

EXAMPLE: VISUAL REPRESENTATIONS

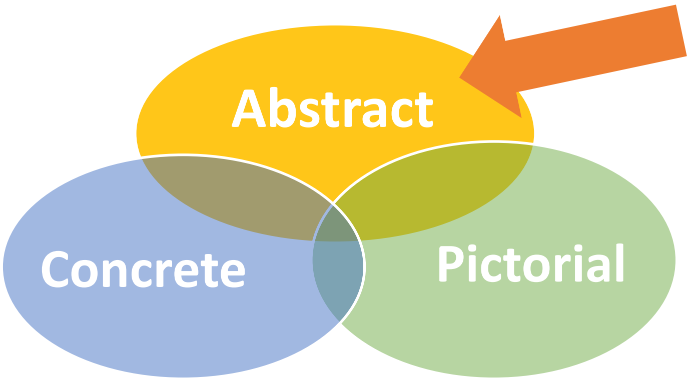


Visual representations include two-dimensional objects and virtual manipulatives. Shown below are examples of manipulatives, but many manipulatives can be used to teach multiple math topics.

Operations	Whole Numbers	Fractions	Algebra	Geometry
				

Multiple Representations

EXAMPLE: ABSTRACT REPRESENTATIONS



Abstract representations include symbols and numerals. It is beneficial to always have the abstract representation present when working with additional representations as well.

$$34 = 3 \text{ tens and } 4 \text{ ones}$$

$$2 + 8 = 10$$

$$x - 6 = 8$$

$$\begin{array}{r} 4{,}179 \\ +\quad 569 \\ \hline \end{array}$$

ADDITIONAL RESOURCES

National Council of Teachers of Mathematics: Multiple Representations

Vanderbilt IRIS Center Module on Visual Representations

Virtual Manipulatives LIbrary

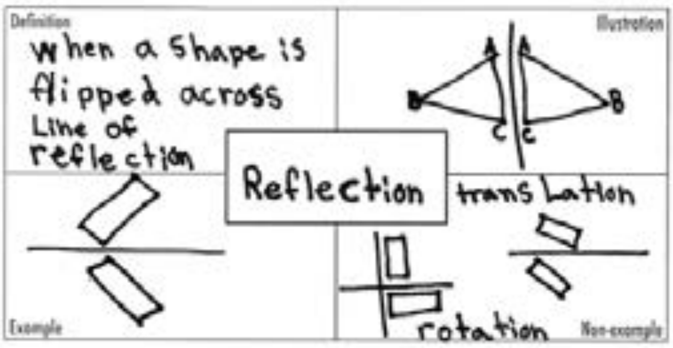
Math Language

DEFINITION

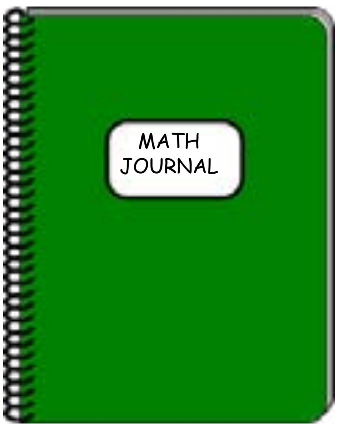
Teachers should be sure to use precise and concise math language. Math terms should be explicitly taught. Precise math language includes the formal math terms that accurately portray a math concept or procedure. For example, teachers should say **numerator**, not *top number*. When teachers use concise math language, they use short but accurate and student-friendly definitions when they introduce and discuss math concepts.

WHAT DOES THE RESEARCH SAY?

Research suggests that teachers and students should have multiple opportunities to access and use precise and concise math language (Powell et al., 2019). Teachers who use informal language or casual terms such as *box* instead of **cube** are setting students up for later failure and confusion when they are assessed using the formal language or move to another classroom in which a different term is used. Instead, it is important that teachers use the mathematically correct and exact term for the concepts they are teaching. Teachers should explicitly teach math terms just as they would teach math concepts to students.

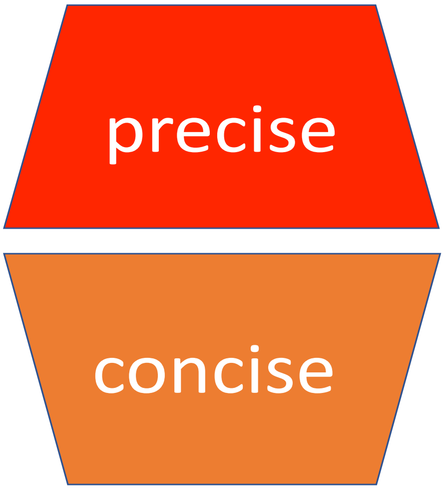


In addition to explicitly teaching math terms, teachers can also use Frayer models, math journals, word walls with student-friendly definitions and images, and vocabulary practice sheets (depicted here starting at the top and moving counter-clockwise).



Math Language

EXAMPLE: PRECISE & CONCISE LANGUAGE

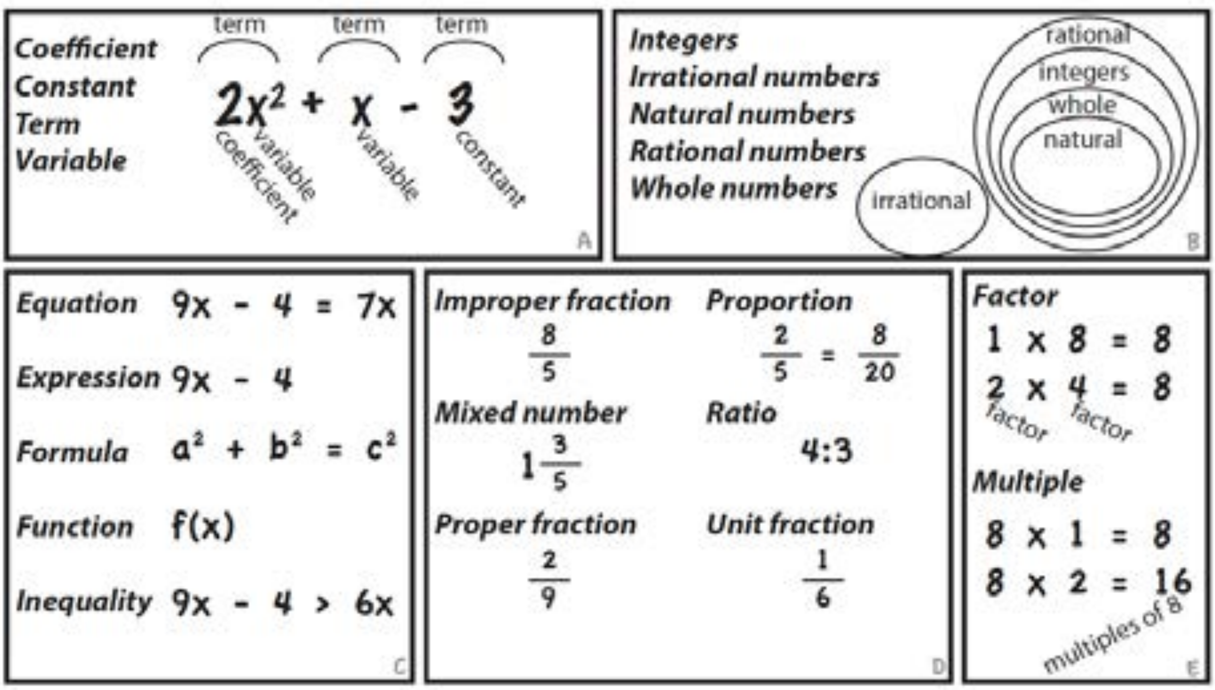


"The **denominator** is the number of equal parts that make the whole."

"A **difference** problem is two amounts compared for the difference."

"To show the fraction, look at the **denominator**. A **denominator** of 5 means I need to break the whole into 5 equal parts."

"To use **partial sums**, add the hundreds, then add the tens, then add the ones. Finally, add all the **partial sums**."



Powell, Stevens, & Hughes (2019)

Word-Problem Instruction

DEFINITION

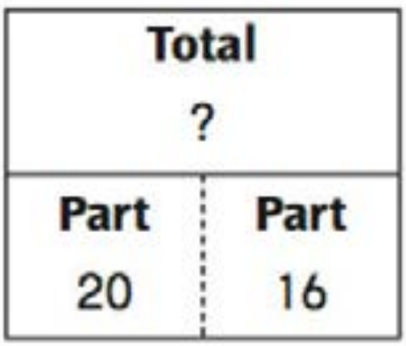
Many students require explicit instruction in solving word problems. It is important that teachers do not focus on teaching key words (Karp et al., 2019), but instead teach students how to use an attack strategy for working through word problems (Powell & Fuchs, 2018). High-quality attack strategies require the students to read the problem, create a plan for solving the problem, solve the problem, and check the answer. Attack strategies should be flexible to address any word problem.

WHAT DOES THE RESEARCH SAY?

In addition to teaching students to use attack strategies, it is also important to introduce schemas (Jitendra et al., 2015). A schema refers to the structure of the word problem. There are three primary additive schemas: Total, Difference, and Change problems. There are also three multiplicative schemas: Equal Groups, Comparison, and Ratio/Proportion problems.

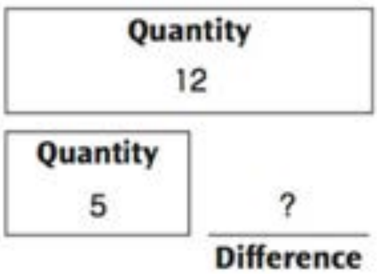
Total

Parts put together into a total



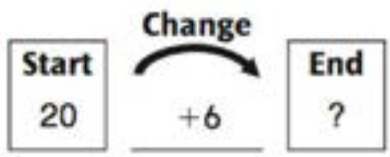
Difference

Greater and lesser amounts compared for a difference



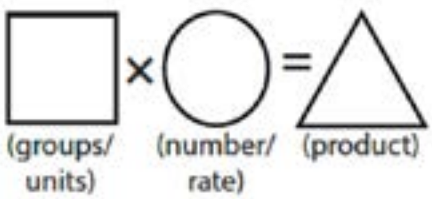
Change

An amount that increases or decreases



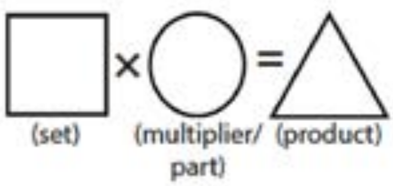
Equal Groups

Groups multiplied by an equal number in each group



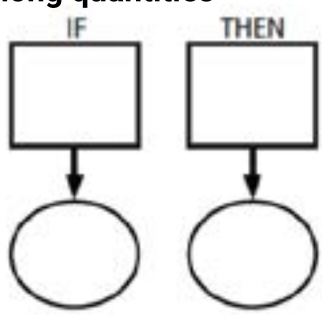
Comparison

Set compared a number of times



Ratios/Proportions

Description of relationships among quantities



Word-Problem Instruction

EXAMPLE: SCHEMAS

Total	Max baked 40 cookies and 75 brownies. How many baked goods did Max bake?
Difference	The Brazos River is 840 miles. The Red River is 1,360 miles. How much longer is the Red River?
Change	There were 23 passengers on the bus. Then, 13 more passengers boarded the bus. How many passengers are on the bus now?
Equal Groups	Mark has 2 boxes of crayons. There are 24 crayons in each box. How many crayons does Mark have?
Comparison	Jill picked 6 apples. Meg picked 2 times as many apples as Jill. How many apples did Meg pick?
Ratios/Proportions	There are 176 slices of bread in 8 loaves. If there are the same number of slices in each loaf, how many slides of bread are in 5 loaves?

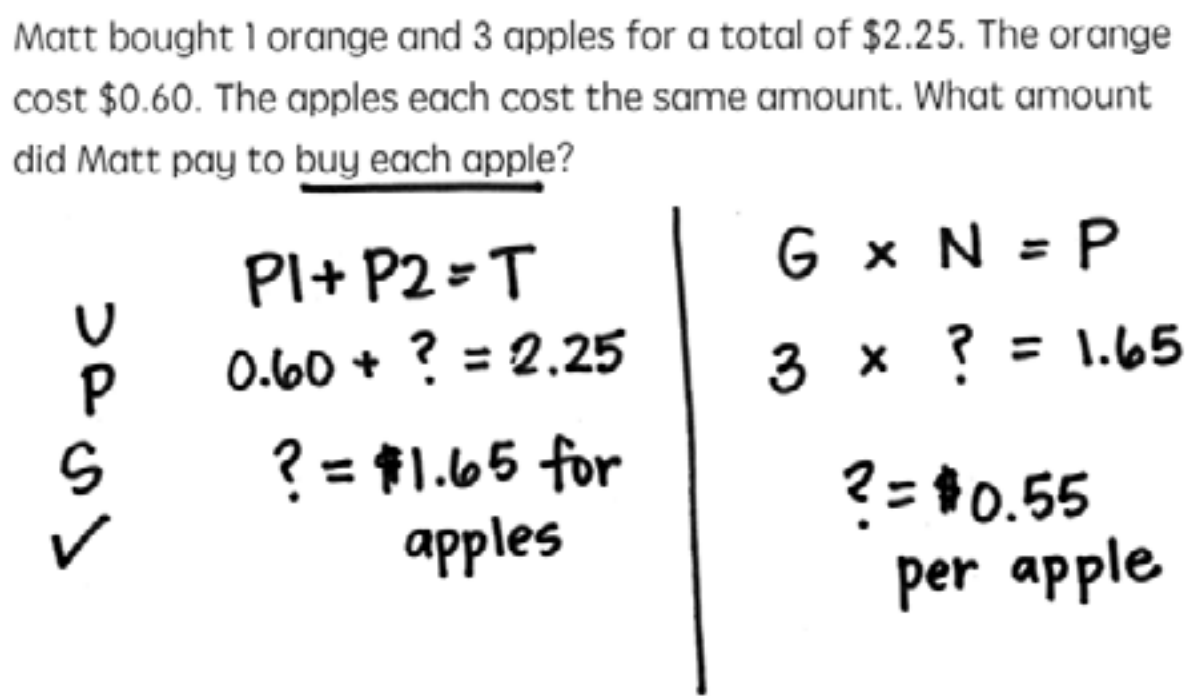
Mnemonics

DEFINITION

Mnemonics are a device or strategy designed to help students remember a strategy, concept, or series of steps. Many mnemonics include a series of letters in which each letter represents a step or component of an intervention (e.g., SOLVE: *Study the problem, Organize the facts, Line up a plan, Verify your plan with action, Examine your results*). Mnemonics can be a helpful tool for students with limited working memory or as students are first learning the steps in a complex intervention.

WHAT DOES THE RESEARCH SAY?

Mnemonic devices or mnemonic strategies are evidence-based components that have been shown to aid students in mastering math concepts (Cuenca-Carlino et al., 2016; Freeman-Green et al., 2015). Mnemonics can used to help students remember the components in a multi-step process, including advanced algebraic procedures. Mnemonics are also often found as part of word problem instruction. Mnemonics can used to remember an attack strategy or a cognitive or meta-cognitive strategy .



EXAMPLES: MNEMONICS

RIDE

Read the problem.
Identify the relevant information.
Determine the operation and unit for the answer.
Enter the correct numbers and calculate, then check the answer.

UPS CHECK

Understand: Read the problem.
Plan: Choose a strategy.
Solve: Show all your work.
Check: Explain & justify your answer.

SOLVE

Study the problem.
Organize the facts.
Line up the plan.
Verify the plan with computation.
Examine the answer.

RIDGES

Read the problem.
I know statement.
Draw a picture.
Goal statement.
Equation development.
Solve the equation.

ADDITIONAL RESOURCES

[IRIS Center Modules]

[LD Online Resources]

RICE

Read and Record the problem.
Illustrate your thinking.
Compute.
Explain your thinking.

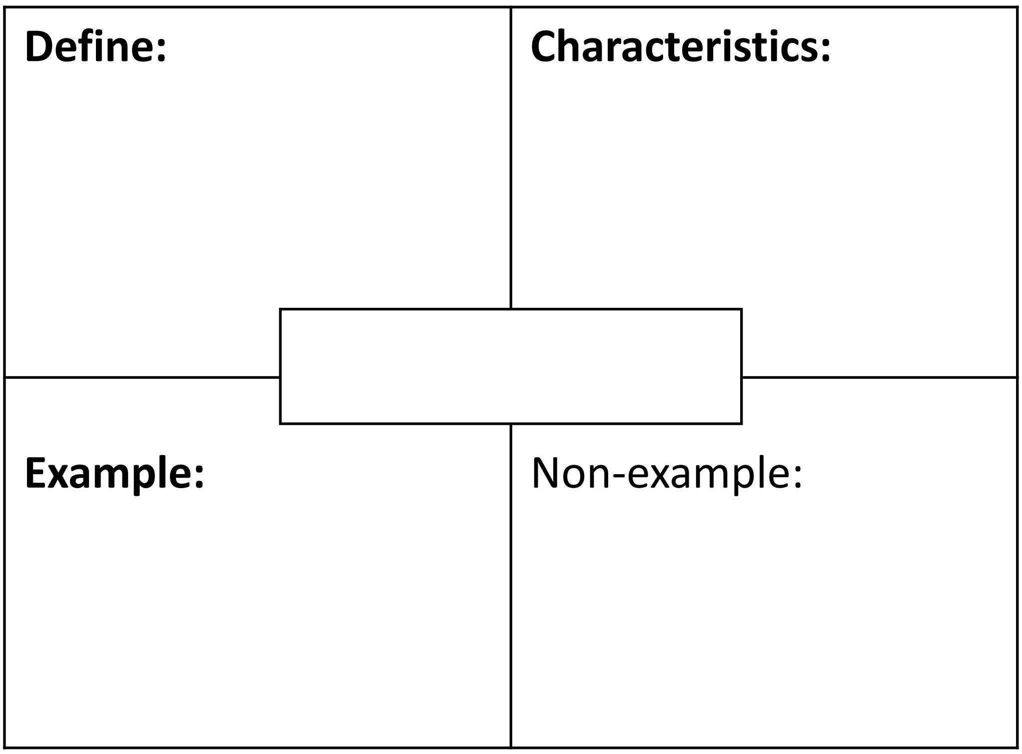
Graphic Organizers

DEFINITION

Graphic organizers are visual or graphic representations of procedures or relationships within a math concept. Similar to mnemonics, graphic organizers can be a useful tool in helping students to remember specific procedures. Alternatively, graphic organizers can be used to help students better understand the relationship between math concepts or learn math vocabulary. Depending on the purpose of the graphic organizer, students can either be presented with a prepared graphic organizer or students may benefit from drawing their own graphic organizers.

WHAT DOES THE RESEARCH SAY?

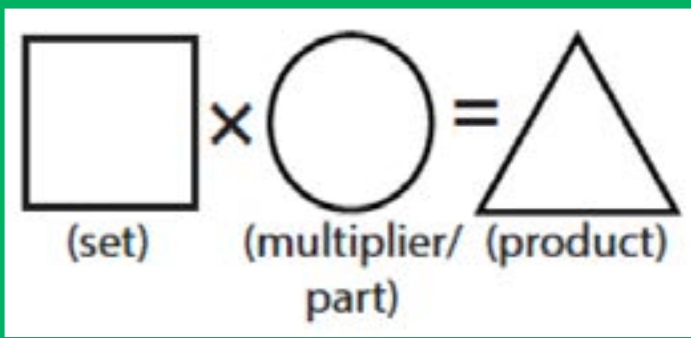
Graphic organizers have been shown to be an effective tool to help students learn new material, practice multi-step procedures, and make connections between math concepts for a deeper conceptual understanding (Shin & Bryant, 2017; van Garderen, 2007). Graphic organizers are often used as part of multi-component interventions, and can be tied with mnemonics and explicit instruction to help students master math concepts.



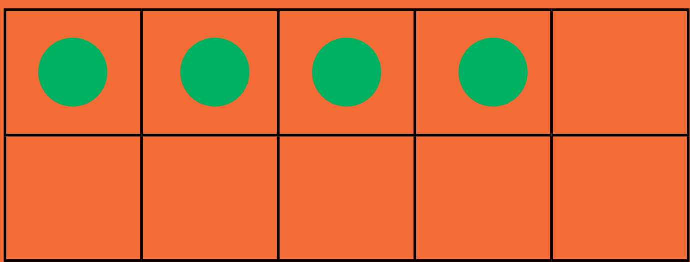
Graphic Organizers

EXAMPLES: GRAPHIC ORGANIZERS

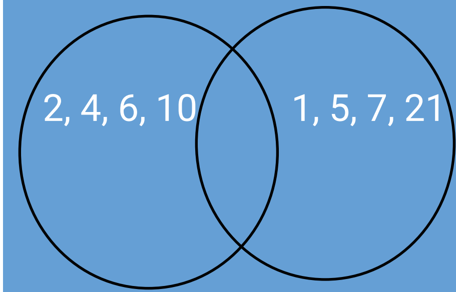
COMPARISON SCHEMA

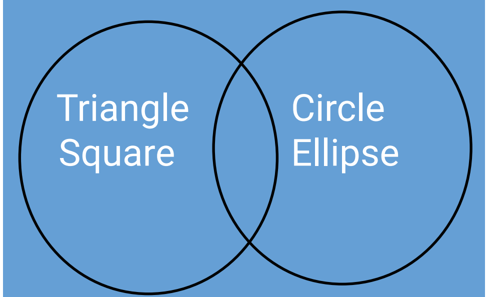


TEN FRAME



MATH LANGUAGE OR MATH CONCEPT VENN DIAGRAM





ADDITIONAL RESOURCES

[National Center on Intensive Intervention Resources](#)

[The Access Center Graphic Organizers](#)

[Understood Graphic Organizers](#)

Fluency Building Activities

DEFINITION

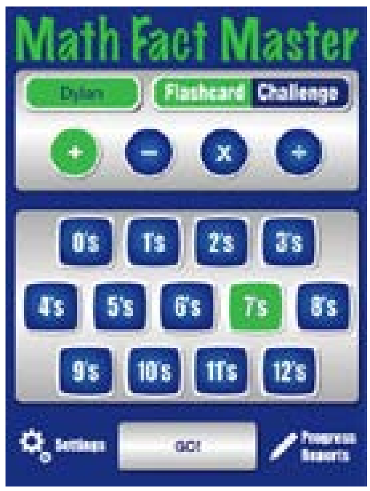
Fluency building activities provide opportunities for students to master math facts and other necessary math knowledge. When students are fluent in math facts, they can spend more energy solving problems or tackling complex problems. In addition to math facts, as students mature, it is recommended that they become fluent in determining equivalent and benchmark fractions, determining common denominators, and adding, subtracting, multiplying, or dividing positive and negative integer patterns.

WHAT DOES THE RESEARCH SAY?

It is recommended that all teachers include brief fluency building activities everyday in math class (Burns et al., 2010). Fluency practice is important for students with limited working memory or students who experience difficulty with math. When students are fluent in essential math facts and math understandings, it frees up cognitive processing power which can then be devoted to more complex math. Students who struggle with math often benefit from explicit instruction in learning math facts and strategies.

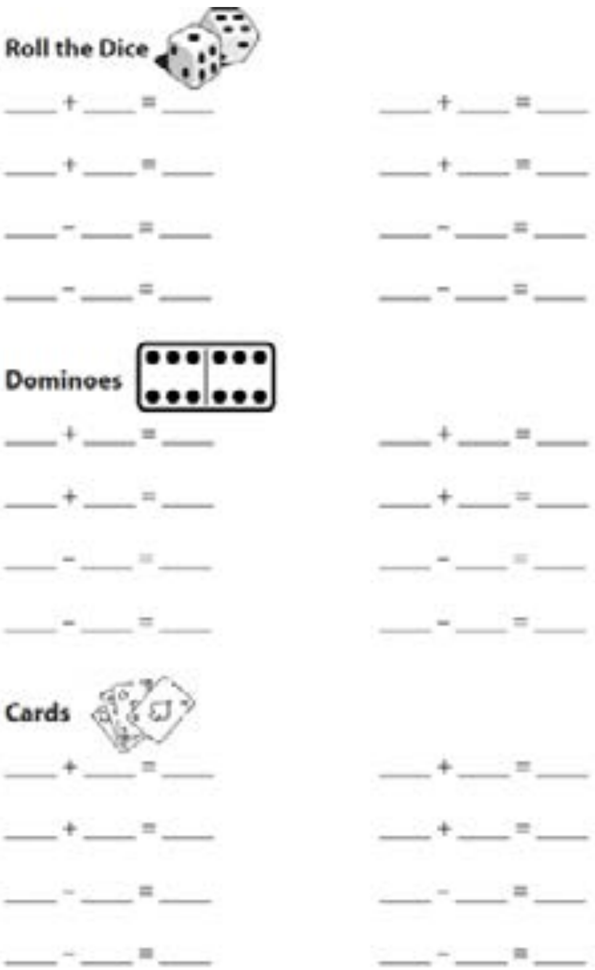
BRIEF
(1-2 min)

DAILY
(everyday)



Fluency Building Activities

EXAMPLES: FLUENCY BUILDING ACTIVITIES



File Folder

6 + 3 =	9
1 + 7 =	8
6 + 4 =	10
7 + 3 =	10
2 + 7 =	9
5 + 6 =	11
4 + 7 =	11
7 + 8 =	15
6 + 7 =	13
7 + 9 =	16
7 + 6 =	13
8 + 7 =	15
7 + 0 =	7
9 + 6 =	15
6 + 0 =	6
6 + 8 =	14

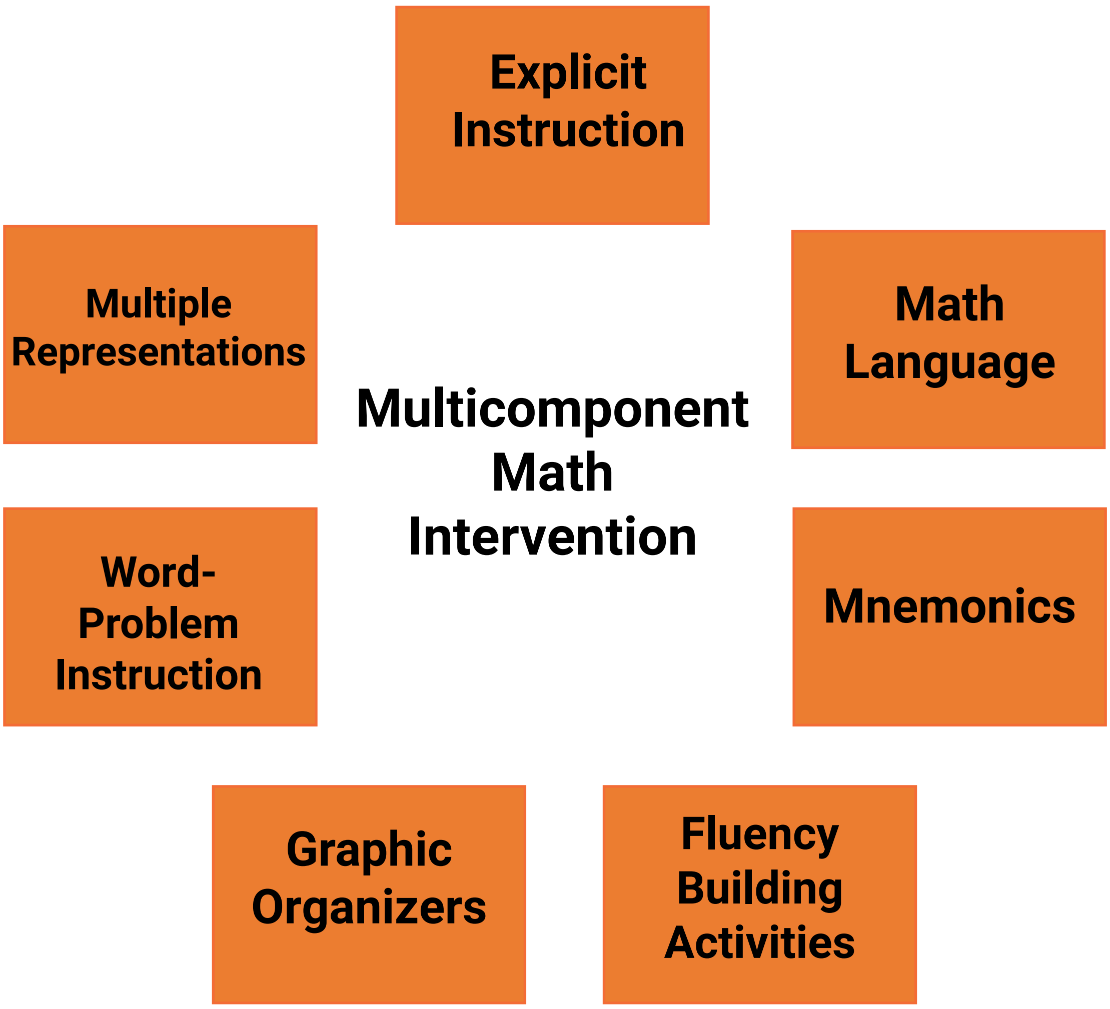
ADDITIONAL RESOURCES

[Combining Explicit Instruction and Mastery Practice to Build Fact Fluency Article]

Multicomponent Interventions

KEY CONSIDERATIONS

Many math interventions include many, if not all, of the components discussed in this guide. Therefore, this makes it difficult to determine which component(s) are responsible for student learning. Instead, researchers can only evaluate the impact of the overall intervention. Therefore, when designing an intervention, it is important to consider which components align with the goals of the intervention. For example, if designing a word problem solving intervention, mnemonics, graphic organizers and attack strategies all support student learning and align well with each other.



References

Bennett, P. & Rule, A. C. (2005). Hands-on long division with Skittles for students with learning disabilities. *Teaching Exceptional Children Plus, 1*(5), Article 2. https://files.eric.ed.gov/fulltext/EJ966522.pdf

Bottge, B. A., Ma, X., Gassaway, L., Toland, M. D., Butler, M., & Cho, S. (2014). Effects of blended instructional models on math performance. *Exceptional Children, 80*(4), 423-437. https://doi.org/10.1177/0014402914527240

Bouck, E. C., Bassette, L., Shurr, J., Park, J., Kerr, J., & Whorley, A. (2017). Teaching equivalent fractions to secondary students with disabilities via the virtual-representational-abstract instructional sequence. Journal of Special Education Technology, 32(4), 220-231. https://doi.org/ 10.1177/0162643417727291

Bouck, E. C., & Park, J. (2018). A systematic review of the literature on mathematics manipulatives to support students with disabilities. *Education and Treatment of Children, 41*(1), 65-106. https://doi.org/10.1353/etc.2018.0003

Bouck, E. C., Park, J., Satsangi, R., Cwiakala, K., & Levy, K. (2019). Using the virtual-abstract instructional sequence to support acquisition of algebra. *Journal of Special Education Technology, 34*(4), 253-268. https://doi.org/10.1177/0162643419833022

Bouck, E. C., Shurr, J., Bassette, L., Park, J., & Whorley, A. (2018). Adding it up: Comparing concrete and app-based manipulatives to support students with disabilities with adding fractions. *Journal of Special Education Technology, 33*(3), 194-206. https://doi.org/10.1177/0162643418759341

Bryant, D. P., Bryant, B. R., Dougherty, B., Roberts, G., Pfannenstiel, K. H., & Lee, J. (2020). Mathematics performance on integers of students with mathematics difficulties. *Journal of Mathematical Behavior, 58*, 100776. https://doi.org/10.1016/j.jmathb.2020.100776

Burns, M. K., Codding, R. S., Boice, C. H., & Lukito, G. (2010). Meta-analysis of acquisition and fluency math itnerventions with instructional and frustration level skills: Evidence for a skill-by-treatment interaction. *School Psychology Review, 39*(1), 69-83.

Cuenca-Carlino, Y., Freeman-Green, S., Stephenson, G. W., & Hauth, C. (2016). Self-regulated strategy development instruction for teaching multi-step equations to middle school students struggling in math. *Journal of Special Education, 50*(2), 75-85. https://doi.org/10.1177/0022466915622021

Dyson, N. I., Jordan, N. C., Rodrigues, J., Barbieri, C., & Rinne, L. (2020). A fraction sense intervention for sixth graders with or at risk for mathematics difficulties. *Remedial and Special Education, 41*(4), 244-254. https://doi.org/10.1177/0741932518807139

Freeman-Green, S. M., O'Brien, C., Wood, C. L., & Hitt, S. B. (2015). Effects of the SOLVE strategy on the mathematical problem-solving skills of secondary students with learning disabilities. *Learning Disabilities Research and Practice, 30*(2), 76-90. https://doi.org/10.1111/ldrp.12054

Fuchs, L. S., Newman-Gonchar, R., Schumacher, R., Dougherty, B., Bucka, N., Karp, K. S.., Woodward, J., Clarke, B., Jordan, N. C., Gersten, R., Jayanthi, M., Keating, B., and Morgan, S. (2021). *Assisting Students Struggling with Mathematics: Intervention in the Elementary Grades* (WWC 2021006). National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. https://ies.ed.gov/ncee/wwc/PracticeGuide/26

Hughes, E. M., & Lee, J.-Y. (2020) Effects of a mathematical writing intervention on middle school students' performance, *Reading & Writing Quarterly, 36*(2), 176-192. https://doi.org/10.1080/10573569.2019.1677537

Jitendra, A. K., Lein, A. E., Im, S., Alghamdi, A. A., Hefte, S. B., & Mouanoutoua, J. (2018). Mathematical interventions for secondary students with learning disabilities and mathematics difficulties: A meta-analysis. *Exceptional Children, 84*(2), 177-196. https://doi.org/10.1177/0014402917737467

Jitendra, A. K., Petersen-Brown, S., Lein, A. E., Zaslofsky, A. F., Kunkel, A. K., Jung, P.-G., & Egan, A. M. (2015). Teaching mathematical word problem solving: The quality of evidence for strategy instruction priming the problem structure. *Journal of Learning Disabilities, 48*(1), 51-72. https://doi.org/10.1177/0022219413487408

Jitendra, A. K., & Star, J. R. (2012). An exploratory study contrasting high- and low-achieving students' percent word problem solving. *Learning and Individual Differences, 22*, 151-158. https://doi.org/10.1016/j.lindif.2011.11.003

Karp, K. S., Bush, S. B., & Dougherty, B. J. (2019). Avoiding the ineffective keyword strategy. *Teaching Children Mathematics, 25*(7), 428-435.

References

Milton, J. H., Flores, M. M., Moore, A. J., Taylor, J. J., & Burton, M. E. (2019). Using the concrete-representational-abstract sequence to teach conceptual understanding of basic multiplication and division. *Learning Disability Quarterly, 42*(1), 32-45. https://doi.org/10.1177/0731948718790089

Namkung, J. M., & Bricko, N. (2021). The effects of algebraic equation solving intervention for students with mathematics learning difficulties. *Journal of Learning Disabilities, 54*(2), 111-123. https://doi.org/10.1177/002221420930814

Parker, D. C., Nelson, P. M., Zaslofsky, A. F., Kanive, R., Foegen, A., Kaiser, P., & Heisted, D. (2019). Evaluation of a math intervention program implemented with community support. *Journal of Research on Educational Effectiveness, 12*(3), 391-412. https://doi.org/10.1080/19345747.2019.1571653

Powell, S. R., & Fuchs, L. S. (2018). Effective word-problem instruction: Using schemas to facilitate mathematical reasoning. *Teaching Exceptional Children, 51*(1), 31–42. https://doi.org/10.1177/0040059918777250

Powell, S. R., Mason, E. N., Bos, S. E., Hirt, S., Ketterlin-Geller, L. R., & Lembke, E. S. (in press). A systematic review of mathematics interventions for middle-school students experiencing mathematics difficulty. *Learning Disabilities Research and Practice.*

Powell, S. R., Stevens, E. A., & Hughes, E. M. (2019). Math language in middle school: Be more specific. *Teaching Exceptional Children, 51*(4), 286–295. https://doi.org/10.1177/0040059918808762

Scheuermann, A. M., Deshler, D. D., & Schumaker, J. B. (2009). The effects of the explicit inquiry routine on the performance of students with learning disabilities on one-variable equations. *Learning Disability Quarterly, 32*(2), 103-120. https://doi.org/10.2307/27740360

Shin, M., & Bryant, D. P. (2017). Improving the fraction word problem solving of students with mathematics learning disabilities: Interactive computer application. *Remedial and Special Education, 38*(2), 76-86. https://doi.org/10.1177/0741932516669052

Stevens, E. A., Rodgers, M. A., & Powell, S. R. (2018). Mathematics interventions for upper elementary and secondary students: A meta-analysis of research. *Remedial and Special Education, 39*(6), 327-340. http://doi.org/10.1177/0741932517731887

Strickland, T. K., & Maccini, P. (2012). The effects of the concrete-representational-abstract integration strategy on the ability of students with learning disabilities to multiply linear expressions within area problems. *Remedial and Special Education, 34*(3), 142-153. https://doi.org/10.1177/0741932512441712

van Garderen, D. (2007). Teaching students with LD to use diagrams to solve mathematical word problems. *Journal of Learning Disabilities, 40*(6), 540-553. https://doi.org/10.1177/00222194070400060501

Watt, S. J., & Therrien, W. J. (2016). Examining a preteaching framework to improve fraction computation outcomes among struggling learners. *Preventing School Failure, 60*(4), 311-319. https://doi.org/10.1080/1045988X.2016.1147011

Xin, Y. P., Park, J. Y., Tzur, R., & Si, L. (2020). The impact of a conceptual model-based mathematics computer tutor on multiplicative reasoning and problem-solving of students with learning disabilities. *Journal of Mathematical Behavior, 58*, 100762. https://doi.org/10.1016/j.jmathb.2020.100762

Readiness
Individual
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Teaching of
Supporting

This project is supported by the U.S. Department of Education, Office of Special Education Programs (OSEP). Opinions expressed herein are those of the authors.

Funding provided by the Office of Special Education Programs, Award H326M170006 to the University of Missouri