

Intervention Name: Pirate Math

Common Core State Standards Domain Areas: (check all that apply)

Counting and Cardinality (K)	Operations and Algebraic Thinking (K-5)	Numbers and Operations in Base Ten (K-5)	Numbers and Operations – Fractions (3-5)	Measurement and Data (K-5)	Geometry (K-HS)	Ratios and Proportional Relationships (6-7)	The Number System (6-8)	Expressions and Equations (6-8)	Statistics and Probability (6-HS)	Functions (8-HS)	Number and Quantity (HS)	Algebra (HS)	Modeling (HS)
	X	X	X	X									

Setting: (check all that apply)

Whole-class	Small-group	Individual
X		X

Focus Area: (check all that apply)

Acquisition	Fluency	Generalization
X	X	X

Function of Intervention:

Pirate Math is a program designed to improve the word-problem skill of elementary-aged students. Currently, there is a *Pirate Math* program for use in second-grade classrooms and a third-grade program for use as an individual tutoring intervention. During *Pirate Math*, students learn to

- Focus on and identify the conceptual framework of three types of word problems (i.e., Total, Difference, and Change word problems);
- Identify and ignore irrelevant information;
- Translate a word problem’s narrative to a mathematical equation, substituting “X” for the missing information;
- Solve for the missing variable (“X”) as expressed in the mathematical equation; and
- Self-evaluate the reasonableness of solved equations.

Brief Description:

Within each (Total, Difference, Change) word-problem unit:

Students learn to identify word problems by their underlying conceptual framework and to represent the problem structure with a mathematical equation prior to solving the equation. Students also learn to transfer problem-solving skills to problems with irrelevant information and to problems with relevant information found in graphs, charts, or figures, like word problems found on high-stakes tests.

Pirate Math integrates a pirate theme into the program. Students learn to “find X,” just like pirates do on a treasure map, and they are reinforced and motivated by treasure coins.

Students initially rely on training posters to remember each word-problem type’s corresponding equation and solution strategies. With mastery of the strategies, use of training posters is faded.

Examples of Word-Problem Types:

1. Total Problem Example:

Kayla has 9 pencils. David has 6 pencils. How many pencils do Kayla and David have in all?

Total Problem Equation:

$$P1 + P2 = T$$

(Part 1) + (Part 2) = (Total)

Solution:

$$9 + 6 = X$$

X = 15 pencils

2. Difference Problem Example:

Kayla has 9 pencils. David has 6 pencils. How many fewer pencils does Kayla have than David?

Difference Problem Equation:

$$B - s = D$$

(Bigger amount) – (smaller amount) = (Difference)

Solution:

$$9 - 6 = X$$

X = 3 pencils

3. Change (Increase/Decrease) Problem Example:

(Change-Increase) Kayla had 9 pencils. Then, David gave her 6 more pencils. How many pencils does Kayla have now?

(Change-Decrease) Kayla had 9 pencils. Then, she gave 6 of her pencils to David. How many pencils does Kayla have now?

Change Problem Equation:

$$St \ +/- \ C = E$$

(Starting amount) +/- (Change) = (Ending amount)

Solution:

$$9 +/- 6 = X$$

X = 15 pencils; X = 3 pencils

Procedures:

- **Duration (differs by grade level and program):**
 - Second-Grade Whole-Class Instruction is conducted 2 times per week for 17 school weeks. Each session lasts approximately 45 minutes.
 - Third-Grade Individual Tutoring is conducted 3 times per week for 16 school weeks. Each session lasts approximately 25-30 minutes.
- **Teacher training:** Teachers must be familiar with the instructional scripts for each of the three problem types. For the individual sessions, it is recommended that teachers use individual students' Attendance Logs to record each aspect of the sessions.
- **Instructional practices (differ by grade level and program):**
 - Second-Grade Whole-Class Instruction contains the same 4 activities each session: Teacher Lesson, Teacher-Led Problem, Partner Work, and Pirate Problems (i.e., individual review). Each activity should be completed for each session.
 - Third-Grade Individual Tutoring contains the same 5 activities each session: Math Fact Flash Cards, Word Problem Warm-Up, Instructional Lesson, Sorting Cards, and Pirate Problems (i.e., review). Each activity should be completed for each session.
- **Monitoring system:** Progress monitoring assessment is recommended every 1 to 2 weeks in addition to ongoing informal assessments and observations. Students should be able to independently verbalize and demonstrate on paper an understanding of problem-solving strategies prior to fading use of training posters.

Critical Components (i.e., that must be implemented for intervention to be successful):

Teacher scripts are intended to be studied and followed as a framework for terminology and instruction, but not read verbatim. All components of the tutoring program should be implemented with fidelity during each tutoring session. Tutoring should begin with the first lesson and proceed sequentially.

Critical Assumptions (i.e., with respect to prerequisite skills):

This program, supplemental to the core curriculum, is designed to provide additional instruction with addition and subtraction word problems. Thus, although the first few lessons of *Pirate Math* review basic counting and number line strategies, it is critical that students have prior exposure to and knowledge of basic numerical competencies such as number recognition, one-on-one correspondence, and conceptual understanding of addition and subtraction. Additionally, schema-based instruction encourages students to develop a schema (i.e., a category that encompasses similar characteristics) for each of the 3 problem types taught with *Pirate Math* tutoring. Because the majority of this

schema-based tutoring program's content is delivered orally, students must be able to understand and express themselves with the English language proficiently.

Materials:

Teachers must purchase the *Pirate Math* manual and supplemental materials (\$75 2nd-grade program; \$40 for 3rd-grade program) by emailing lynn.a.davies@vanderbilt.edu.

- *Pirate Math* manual (includes all lesson scripts and templates for additional training materials)
- *Pirate Math* supplemental materials (includes student worksheets and necessary flash card templates)

Not included with *Pirate Math*:

- Treasure coins; treasure chest; stopwatch; pencil/colored pencil/crayons; highlighter; timer.

Selected Relevant References:

- Fuchs, L. S., Powell, S. R., Seethaler, P. M., Cirino, P. T., Fletcher, J. M., Fuchs, D., & Hamlett, C. L. (2010). The effects of strategic counting instruction, with and without deliberate practice, on number combination skill among students with mathematics difficulties. *Learning and Individual Differences, 20*, 89-100. doi:10.1016/j.lindif.2009.09.003
- Fuchs, L. S., Powell, S. R., Seethaler, P. M., Cirino, P. T., Fletcher, J. M., Fuchs, D.,...Zumeta, R. O. (2009). Remediating number combination and word problem deficits among students with mathematics difficulties: A randomized control trial. *Journal of Educational Psychology, 101*, 561-576. doi:10.1037/a0014701
- Fuchs, L. S., Seethaler, P. M., Powell, S. R., Fuchs, D., Hamlett, C. L., & Fletcher, J. M. (2008). Effects of preventative tutoring on the mathematical problem solving of third-grade students with math and reading difficulties. *Exceptional Children, 74*, 155-173.