Effects of Super Solvers Fractions Intervention for At-Risk Third Graders

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1 July 2019

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This research was supported by Grant R324D130003 from the National Center on Special Education Research within the Institute on Education Sciences in the U.S. Department of Education to Vanderbilt University. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Center on Special Education Research, the Institute of Education Sciences, or the U.S. Department of Education.

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Many students have difficulty understanding and operating with fractions (Namkung, Fuchs, & Koziol, 2018). This is unfortunate because fractions competence is foundational for more advanced mathematics, such as algebra (Booth & Newton, 2012; National Mathematics Advisory Panel [NMAP], 2008), and essential to careers involving science, technology, engineering, and mathematics (NMAP, 2008). Difficulty with fractions is pervasive and persistent (NMAP, 2008) and especially prevalent among students who have experienced challenges with whole-number concepts and operations (Namkung et al., 2018).

The NMAP therefore assigned high priority to improving students' fraction performance, recommending an instructional emphasis on conceptual understanding of fractions as well as fraction calculations. As a series of five randomized controlled trials demonstrated (Fuchs et al., 2013, 2014, 2016a, 2016b; Malone, Fuchs, Sterba, Fuchs, & Foreman-Murray, in press), intervention that provides explicit instruction on fraction magnitude (FM) and strategy development improves the fraction performance of students who begin fourth grade with poor whole-number performance.

Although *fourth* grade may seem like an early grade to focus intervention on fractions, the Career- and College-Ready Standards, which have been adopted in the last decade across the U.S., establish a strong emphasis on fractions starting in *third* grade. They establish the expectation that third graders understand FM, as in identifying fraction equivalencies, using reasoning to compare fractions, and placing fractions on number lines. To encourage alignment with the general education curriculum and prevent students with histories of poor whole-number learning from falling behind classroom peers on this foundational skill, third-grade intervention therefore requires a strong focus on FM.

Two prior intervention studies addressed the development of fractions skill for third graders who are low-performing in math. Perkins and Cullinan (1984) assessed effects of a direct instruction intervention in a multiple-baseline study across three students. Effects were positive, but the nature of the intervention and study outcomes was limited. The intervention focused dominantly on part-whole understanding (representing fractions with circles, writing numerical fractions for circle representations, and adding fractions with like denominators). The study outcome, although focused on FM, was limited to identifying whether fractions greater than, equal to, or less than one.

Courey (2006) assessed the value of teaching visual representations of halves in the context of one-half word problems. In one condition, teachers conveyed the meaning of half (as *one of two equal parts*) and provided practice identifying relevant pieces of information about half. This component provided no additional value over a contrast condition involving the same fraction word-problem instruction but without the focus on language and key pieces of information conveying half. Students in both intervention conditions did outperform the control group only on procedural outcomes, but not on conceptual understanding. Also, as in Perkins and Cullinan (1984), the major emphasis was part-whole, not FM understanding.

The field's minimal focus on fractions intervention and FM understanding in at-risk third graders is likely due to the relatively recent emphasis on fractions at this grade level. It probably also stems from the field's overall lack of attention to general education curricular targets within intervention (Powell & Fuchs, 2015). This seems like a major omission from the mathematics intervention literature given that standards reform (Edgerton et al., in press) establishes the expectation that students with disabilities achieve college- and career-ready standards. For these reasons, the first purpose of the present study was to assess the efficacy of intervention that emphasizes FM improves fraction outcomes for third graders with histories of whole-number difficulty. This is an untested proposition. The intervention was *Super Solvers-3rd grade-revised*.

Our second purpose was to gain insight into whether embedded self-regulation instruction (SR) provides added value for improving performance on fractions, content that is essential for success in mathematics but challenging for this population. In the context of academic learning, SR is viewed in multiple ways. This includes a growth mindset reflecting the belief that intellectual and academic abilities can be developed (e.g., Lin-Siegler, Dweck, & Cohen, 2016; Yeager & Dweck, 2012), along with SR processes in which students set goals, self-monitor, and use strategies to engage motivationally, metacognitively, and behaviorally in academic learning (Cirino et al., 2017; Lezak et al., 2012; Zelazo, Blair, & Willoughby, 2016). We adopted this approach in the present study.

Studies provide some support for the effects of this type of SR on mathematics learning. Most research is correlational, showing a connection between mathematics performance and active goal setting and perseverance through challenging tasks (e.g., Schunk, 1996; Park et al., 2016). A smaller body of work, focused on the effects of building SR on mathematics outcomes, is conducted largely with preschool children and pre-academic tasks (e.g., Blair & Raver, 2014; Schmitt et al., 2015). In a series of more relevant experimental studies, Fuchs et al. (1997) isolated positive effects for task-focused goals within classroom peer-assisted learning strategies on low-performing students' mathematics concepts, applications, and operations at grades 2-4. Fuchs et al. (2003) found added value for SR instruction when integrated within word-problem instruction compared to word-problem instruction alone for low-performing students.

In the present study, we thus compared effects of two versions of the *Super Solvers* intervention for improving at-risk third graders' fraction performance against a business-as-usual control group. Our primary purpose was to estimate effects of the third-grade intervention program, known as *Super Solvers*, which focuses on FM and schema-based instruction to teach fraction word problems (WPs) using an instructional model previously validated with at-risk fourth graders (Fuchs et al., 2013, 2014, 2016a, 2016b; Malone, Fuchs, Sterba, Fuchs, & Foreman-Murray, in press), while simplifying the program's scope to address the third-grade curriculum. One of the two fraction conditions also included a SR component, in which students practiced goal setting and self-directed learning activities in conjunction with ongoing progress-monitoring data, as in the Fuchs et al. (1997, 2003) SR studies.

This present study expands on a pilot study assessing the promise of an earlier iteration of the same intervention program at third grade (Wang, Fuchs, Gilbert, Krowka, & Abramson, in press). In that pilot, the effects of two versions of the earlier *Super Solvers* iteration was assessed, also with one condition embedding SR instruction and the other not embedding SR instruction. Results suggested SR instruction's added value, but with a complicated pattern of effects.

On most fraction outcomes, the version of the intervention with SR performed more strongly than control, whereas the version without SR did not. However, on the WP outcome, results differed. In the condition without SR, students who began the study with stronger WP skill responded more adequately to intervention than did students with weaker pretest WP skill. By contrast, students in the condition with SR responded comparably well on the WP outcome, regardless of pretest WP skill. Further, neither intervention condition, with or without SR, outperformed the control group on the fraction number line outcome. That pilot study thus suggested promise for the earlier version of *Super Solvers*, but only when SR instruction is embedded within the third-grade intervention. At the same time, that pilot study suggested that the earlier iteration of *Super Solvers* needed to be strengthened.

The present study, therefore, is an *efficacy trial of the strengthened and final version of third-grade Super Solvers*. This randomized controlled trial had three arms: (a) the fractions program, strengthened to encourage depth rather than breadth of FM understanding and WP performance (FM+WP), (b) FM+WP with a strengthened SR component (FM+WP+SR), and (c) a business-as-usual control group (regular classroom fractions instruction, with some students receiving school-provided intervention). We hypothesized that a strengthened fraction intervention robustly supports the learning challenges of at-risk students, with improved performance across a range of proximal and distal fraction measures, thereby diminishing the need for embedded SR instruction.

Method

Participants

Participants were third-grade students at risk for mathematics learning disabilities from 29 classrooms across eight schools in a large, metropolitan school district. We conducted whole-class screening at the start of the school year to identify students who met either or both of two low-mathematics criteria, as in Wang et al. (in press): (a) performance below the 22nd percentile on a broad-based calculations measure (Wide Range Achievement Test–4 [WRAT-4]; Wilkinson & Robertson, 2006) or (b) WRAT-4 performance below the 31st percentile *and* a score less than three on the *Minuends to 18* subtest of the *Second-Grade Calculations Battery* (Fuchs, Hamlett, & Powell, 2003).

Of 406 screened students, 151 met one or both criteria. We excluded 45 students: 10 whose teachers identified them with very limited English proficiency (to avoid false positive identification of risk); three with autism diagnosis or an intensive individualized behavior plan and 19 scoring below the 9th percentile on both subtests of the 2-subtest Wechsler Abbreviated Scales of Intelligence (WASI; Wechsler, 2011) (because this study was about intervention designed to address the needs of learning disabilities); and 13 whose schedules precluded the study's intervention. Of the 106 remaining students, we randomly selected 90 to assign to study conditions, as per our power analysis.

Random assignment occurred at the individual level to a business-as-usual control condition (n = 30) or one of two intervention conditions: (a) the base intervention, focused on improving FM and WP performance (FM+WP; n = 30), and (b) the same FM+WP with embedded SR (FM+WP+SR; n = 30). Prior to the end of the study, six students (four in FM+WP, one in FM+WP +SR, and one in control) moved beyond the study's reach. Complete data were thus available for 26 FM+WP condition students, 29 FM+WP+SR condition students, and 29 control students. Students did not differ by condition on demographic or screening measures (see Table 1).

Measures

Screening. With WRAT-4-*Math Computation* (Wilkinson & Robertson, 2006), students complete calculation problems of increasing difficulty (median reliability at 5-12 years = .94). With *Second-Grade Calculations Battery-Minuends to 18* (Fuchs, Hamlett, & Powell, 2003), students have 1 min to complete 25 problems (α = .89). WASI (Wechsler, 2011), a 2-subtest measure of general cognitive ability, includes the *Vocabulary* and *Matrix Reasoning* subtests (reliability > .92). *Vocabulary* assesses expressive vocabulary, verbal knowledge, memory, learning ability, and crystallized and general intelligence. Students identify pictures and define words. *Matrix Reasoning* measures nonverbal fluid reasoning and general intelligence. Students complete matrices with missing pieces.

Fraction outcomes. Because multiplication is foundational for identifying equivalent fractions, we included it as a fraction outcome. With *Fraction Battery-revised Single-Digit Multiplication* (Malone & Fuchs, 2017), students have 5 min to answer 30 problems (factors 1-10) presented horizontally (α = .92).

Fraction Battery-revised Ordering (Malone & Fuchs, 2017) assesses magnitude understanding with 12 items. Each shows three fractions to be ordered from least to greatest. Two items have fractions with the same numerator; one has fractions with the same denominator; the remaining nine include ½ as one of the three fractions (e.g., 9/12, ½, and 3/8). The maximum score is 12 (α = .82). At pretest, instead of *Ordering*, we administered *Fraction Battery-revised Comparing* (Malone & Fuchs, 2017) to account for students' limited fraction magnitude skill at the start of third grade. *Comparing* indexes magnitude understanding with six items. Each shows two fractions, between which students place a greater than, less than, or equal sign. Two items have the same numerator; one has ½ and a fraction less than ½; one has ½ and a fraction equivalent to ½; one can be solved by rewriting one fraction with an equivalency to make the same denominator or numerator as the other fraction (e.g., 1/3 and 2/12); and one has a fraction equal to 1 and a fraction less than 1. The maximum score is 6 (α = .82).

Fraction Battery-revised Number Line (Malone & Fuchs, 2017) assesses magnitude understanding by having students place fractions on a 0-1 paper number line. The tester demonstrates how to mark a fraction on the number line with a tick mark using a sample item with non-numeric fractions (e.g., a/b, c/d). The student then completes six test items. For each item, a number line is presented with labeled endpoints on which students place two fractions.

Students earn 1 point for each fraction placed correctly above or below ½ and 1 point for placing the two fractions in correct order regardless of whether the fractions are on the correct side of ½. The maximum score is 14 ($\alpha = .86$).

Fraction Battery-revised Addition and Subtraction (Malone & Fuchs, 2017) includes 14 fraction addition and subtraction problems with like (seven items) and unlike denominators (seven items). To solve problems with unlike denominators, students rewrite ½ as an equivalent fraction. Four items that include ½ as a fraction are subtraction; four are addition. Students earn 1 point for each correct answer. The maximum score is 14 ($\alpha = .90$).

Fraction Battery-revised Word Problems (Malone & Fuchs, 2017) includes 18 acquisition and transfer problems. Six are compare WPs; 12 are change WPs. (The pretest included 10 items to limit fatigue given students' limited pretest fraction WP skill.) None of the problems was used during intervention. Change problems comprise two subtypes: change increase (six problems) and change decrease (six problems). With compare problems, students evaluate the magnitude of fraction quantities within a narrative (e.g., In art class, Maria used 5/12 of a bottle of blue paint and ¾ of a bottle of red paint. What paint color did she use more of?). Some problems include irrelevant numerical information or an additional fraction that requires students to order three fractions. With change problems, students solve for a missing start, change, or end amount within a cause-effect narrative (e.g., Kavonte had 5/6 of a bottle of water. He drank 2/6 of the bottle of water. How much water does he have now?). Some problems include irrelevant numerical information. Testers read items aloud while students follow along on paper. Students can ask for one rereading. For each problem, students earn 1 point for the correct numerical answer and 1 point for the correct label (e.g., of a gallon of blue paint).

Students can earn 0.5 point for partial labeling (e.g., blue paint). The maximum score on the 18-item test is 36 (α = .89).

To index broad fraction understanding, we administered 13 released items from 1990-2009 National Assessment of Educational Progress (NAEP): a subset of easy, medium, or hard fraction items from the fourth-grade assessment and a subset of easy items from the eighth-grade assessment. Items tap part-whole understanding and magnitude understanding. Testers read each problem aloud, rereading up to one time upon student request. Response formats are selecting answers from four choices, writing answers, shading a portion of a fraction, and marking a number line. The maximum score is 13 (α = .63).

Programmatic Changes in the Fractions Intervention

In the FM+WP and the FM+WP+SR conditions, students received *Super Solvers–Third Grade-revised*; Fuchs, Malone, Wang, Schumacher, Krowka, & Fuchs, 2017). This revision improves on the Wang et al. (in press) pilot version, in terms of the fractions instructional procedures and the SR component, as next described.

Revisions to the FM+WP instructional procedures. In the present study, FM+WP instruction was redesigned by incorporating more opportunities for interleaved (mixed) practice across compare, order, and number line problems and slower pacing, with few fewer problem subtypes to encourage mastery and emphasize depth rather than breadth of understanding.

We also made the following four changes (also see Table 2). First, for multiplication, we placed stronger emphasis on skip-counting strategies and allocated more time to building fluency. Second, for comparing, ordering, and placing fractions on a number line, we consolidated strategies to improve FM understanding and facilitate strategy use. That is, in the earlier iteration (Wang et al., in press), we introduced strategies for three forms of FM comparison separately, with each activity having its own strategy card to support students thinking through the problem-solving process. In the revised program, these problem-solving strategies were consolidated, as represented on an integrated “Compare Card,” to emphasize conceptual and strategic similarities in the problem-solving processes across the FM activities.

Third, we added four lessons highlighting the similarities and differences in the thought processes among the three forms of FM comparison. For example, whereas compare problems require assessment of relative FM (e.g., placing the less than, equal to, or greater than sign between two fractions), number line placement requires more exact estimation of FM (e.g., placing multiple fractions on the correct side of ½ in the correct order).

Fourth, we included excluded splitting WPs (describing a unit or units being cut, divided, or split into equal parts) from the earlier iteration to allocate greater time to master the complexities involved in change WP subtypes and to add pre-algebraic instructional time on addition and subtraction solution strategies to find missing start, change, or end amounts. Also, to reduce working memory demands, we substituted letters representing missing amounts (S for start, C for change, E for end) for the generic x.

Programmatic changes to the SR component. We made three changes to the SR component. First, the SR update relies on a comic series called *Brain Boost Adventures*, which features school-age children who struggle with challenging math content in a school fractions intervention program and face other school and life hurdles. At the start of each lesson, tutors present and lead discussion about an episode addressing key SR concepts such as self-sufficiency (using help cards and other tools only when necessary), partner support (asking for and providing help), goal-setting, taking responsibility for planning one’s own learning activities, and tracking one’s own progress. Second, the revised SR component added strategies for students to check their work, evaluate sources of errors, and check for misunderstanding of concepts or strategies, while encouraging students to use mistakes to adjust plans and select practice items to reach personal goals.

Third, in the revision, personal goals were featured in *Brain Boost Adventures*, in conjunction with a newly added, bi-weekly *Super Challenge*, a fractions curriculum-based measurement (CBM) progress-monitoring tool. After each biweekly CBM, SR students graphed the score just earned, set upcoming goals to beat their highest score, and developed strategies to meet goals. To encourage students who failed to meet goals, comic episodes feature main characters thinking about working hard to learn from mistakes, evaluating progress, adjusting plans, and revising goals after earning lower-than-hoped-for scores. Although CBMs were conducted in both conditions (FM+WP and FM+WP+SR), only SR students evaluated progress and adjusted plans to reach self-set goals. In FM+WP, tutors scored assessments without feedback or guided student reflection on progress.

Fractions Intervention

Super Solvers–3rd grade-revised (Fuchs et al., 2019) includes three 35-min sessions per week for 13 weeks delivered to pairs of students. *Super Solvers* relies on the following systematic, explicit instructional principles. Tutors introduce new topics with worked examples, then gradually fade worked examples as students practice applying strategies during guided and independent practice. During modeling, tutors explain and think aloud each step using simple, direct language. Students learn efficient solution strategies to support understanding and mastery of concepts, and have many opportunities to answer questions, practice problems, and receive immediate feedback. Systematic, cumulative review is interwoven throughout all lessons.

The two major *Super Solvers* intervention emphases are FM and WPs. Instruction on FM focuses on four activities: comparing, ordering, placing fractions on number lines, and equivalencies. Instruction on WPs relies on schema-based instruction (Fuchs et al., 2016; Wang et al., in press) to focus on comparing fraction WPs and change fraction WPs.

Lesson activities. In each lesson, *Super Solvers-3rd grade-revised* includes five activities presented in the following order: *Multi-Minute* (1-2 min), *Problem Quest* (7-12 min), *Fraction Action* (10-18 min), *Fraction Flash* (2-3 min), and *Power Practice* (5-7 min), which sum to 35 min of instructional time per session. *Multi-Minute*, *Fraction Action*, and *Power Practice* begin in Week 1. *Fraction Flash* begins in Week 2; *Problem Quest* begins in Week 4. The FM+WP+SR condition differs from the FM+WP condition, in that SR students receive the additional *Brain Boost* activity (3-7 min) at the start of each lesson. Instructional time is held constant across both conditions by providing FM+WP base condition students with an extra WP beginning Lesson 22. In earlier lessons, base students have more time for independent practice.

During ***Multi-Minute*** (Weeks 1-3), students practice whole-number multiplication. They learn strategies for solving basic facts (1s, 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, and 10s), beginning with rules for multiplying by 1 and by 10, then to skip count by 10s. Next, they apply skip counting to solve times 2 and 5 problems. They then learn a commonly taught “trick” for solving times 9 problems. (They number their fingers one through 10, from left to right; fold down the finger they are multiplying nine by; count the number of fingers to the left of the folded finger. This number is assigned the 10s spot in the answer. They finally count the number of fingers to the right of the folded finger; this number is assigned the 1s spot in the answer.) For remaining facts, students practice skip-counting sequences with the assistance of a skip-counting mat.

In Weeks 4-6, students practice one skip-counting sequence (e.g., skip-counting by 4) per lesson. They recite each sequence twice; once with and once without the mat (to encourage fact memorization). In Week 7, *Multi-Minute Flash*, a fluency-building activity, begins and lasts through Lesson 39. Tutors present basic multiplication facts on cards. Students alternate with partners to provide as many correct responses as possible in 1 min. When an error occurs, a the correct response is immediately required using skip-counting before the next card is revealed. The timer continues to run to discourage careless responding. Pairs try to beat their previous session's score.

Fraction Action addresses FM understanding. In Weeks 1-8, students extend existing part-whole and equal-sharing understanding with more sophisticated concepts about FM and learn strategies for evaluating FM. Activities include comparing, ordering, and placing fractions on number lines, and finding equivalencies. Fraction tiles, fraction circles, and number lines are used to introduce and review concepts throughout the program.

This instruction is supported via strategies depicted on the Compare Card, which is faded as quickly as possible. Students first learn how to compare fractions by thinking about fractions with same denominators or same numerators. They learn that denominators indicate how many equal parts the unit is divided into and therefore represent the size of each equal part, whereas numerators indicate how many parts in the fraction. Thus, for fractions with the same denominators, students identify the bigger fraction by determining which fraction has more parts; for same numerator problems, by thinking about which fraction has bigger parts.

Then, instruction focuses on helping students compare fractions with different denominators or different numerators. Tutors teach strategies for identifying fractions equal to 1 whole (when the numerator and the denominator are the same) and fractions equal to ½ (double the numerator should equal the denominator or, the numerator is half the denominator). Then benchmarking instruction begins, with the assistance of additional strategic steps on the Compare Card. Students identify and label each fraction as less than or equal to 1 (L1 or =1) and, if needed, label fractions as less than ½, greater than ½, or equal to ½ (L1/2, G1/2, or =1/2). They practice comparing: (a) one fraction =½ and the other =1; (b) one fraction =½ and the other L½ or G½; (c) one fraction =1 and the other L1; (d) both fractions =1; (e) one fraction L½ and the other >½; and (f) both fractions L½ or >½. In Week 8, tutors introduce items with two fractions L1 or G1/2, which require finding an equivalent fraction.

After instruction on compare FM problems, tutors introduce how to place fractions on a 0-1 number line, following the same strategies presented on the Compare Card to place fractions on the number line. First, students identify if the fraction is L1 or =1. Next, using ½ as the benchmark, they determine if the fraction is L½, G½, or =½. Then, they place the fraction on the correct side of ½ using a tic mark and writing the fraction below their mark. Number line problems include placing two fractions on the 0-1 number line. In the case of two fractions L½ or G½, students follow Compare Card strategies to place them on the correct side of 1/2 and then order the fractions.

Next, tutors introduce ordering problems from least to greatest, again with the support of the Compare Card strategies. Tutors lead discussions about similarities and differences in comparing, ordering, and placing fractions on a number line, while presenting examples with compare, ordering, and number line problems including the same fractions (e.g., ½, 2/8, ¼). These discussions deepen understanding of the Compare Card strategies and why the same strategies apply across comparing, ordering, and number line placement.

Fraction Flash focuses on FM fluency building. Stimuli are presented on cards. Students alternate with partners to provide as many correct responses as possible in 2 min. When an error occurs, a correct response is immediately required with an explanation for that correct response before the next card is revealed. The timer continues to run to discourage careless responding. Pairs try to beat their previous session's score.

On Weeks 2-3, 5, 7, 9, and 11-13, students compare fractions, stating which is bigger (the mix of fractions gradually increases in difficulty across weeks). On Weeks 4 and 6, students identify if the fraction is =½, =1, or neither. In Weeks 8 and 10, flashcards present a 0-1 number line and a fraction, and students point to ½, identify if the fraction is L½, G½, or =½ and then point to which side of ½ the fraction goes.

Problem Quest, which addresses WP instruction, begins in Week 4. Relying on schema-based instruction (Fuchs et al., 2016), students learn to categorize WPs as belonging to problem types based on the underlying mathematical structure of the WP. They also learn to use a mnemonic, RUN to identify the problem type: Read the problem, Underline the question, and Name the problem type; and apply strategies to identify irrelevant numbers in WPs.

Tutors introduce each WP type (compare WPs and change WPS) with an intact story (no unknown quantity to solve for; no question), while explaining and demonstrating the story's mathematical event with fraction tiles. Next, tutors present the same mathematical story in the form of a WP, with a question and an unknown. Then, students learn a systematic strategy for building the WP model and solving this WP type. To execute the strategy, students initially use a help card, which is faded as quickly as possible.

Compare WPs are taught first. Ordering WPs (with three fractions to order) are taught as a subtype of compare WP in Lesson 20. For compare WPs, students (a) circle the compare word and the fractions to compare; (b) circle and connect these fractions; (c) cross out irrelevant amounts; (d) set up work; (e) compare or order the fractions; and (f) answer the question and check label. Tutors introduce compare WPs with irrelevant information in Lesson 21. This presentation of compare WP variations encourages students to pay close attention to distinguish an ordering WP versus a WP with irrelevant numerals in the cover story.

In Week 5, tutors introduce change WPs. First, students learn how to recognize and solve increase and decrease WPs using whole numbers with the end amount missing (to facilitate understanding without the complication of fractions). Then, they learn how to solve fraction increase and decrease WPs with the end amount missing (e.g., Dyshawn had 2/6 of a liter of water in his water bottle. Then, his friend poured another 3/6 of a liter of water into his bottle. How much water does he have now?). Students learn to write label; write the equation, S + C = E or S – C = E; circle amounts and label S, C, E; cross out irrelevant amounts; write amounts in the equation; solve for missing number; and answer question and check their label. Starting in Week 8, students solve change word WPs with irrelevant information.

In the other two Week 8 lessons, tutors review and encourage careful attention to distinguish between the two WP types. They present a list of WPs and prompt students to identify the WP type, think hard about what the question is asking, and explain their thinking. In Week 9, tutors introduce change WPs with the change amount missing; first with whole numbers, then fractions (e.g., Sarah ran 3/9 of a mile at the gym. After lifting weights, she ran some more. Now she has run 7/9 of a mile. How many miles did Sarah run after lifting weights?). In Week 10, problems are introduced with the start amount missing using whole numbers, then fractions (e.g., Willie has some water in a bottle. Then, he fills his bottle with another 2/10 of a liter at the water fountain. Now, he has 7/10 of a liter of water. How much water did Willie start with?). Change problem subtypes, with and without irrelevant information, are spiraled and reviewed throughout the lessons.

Power Practice is the final activity in each lesson. Students independently complete problems, with systematic cumulative review of previously taught compare, ordering, and number line problems. Starting in Week 4, practice also includes one WP.

Behavior management. Both intervention conditions include a motivational system focused on on-task behavior: Listen (listen when others speak; mouths closed; eyes on the speaker); (b) Try your best (think about each question before answering; if you know the answer, show me or tell me; if you don't know the answer, ask for help); and (c) Be respectful (treat others how you would like to be treated; keep hands to yourself; sit when working; walk in hall).

With a group contingency reward, tutors set a timer to beep at three unpredictable intervals in each session. If both students are on task at the beep, students earn a "dollar" for their *Super Solvers* "bank account." Students also earn dollars for on-task behavior during transitions between classrooms and during intervention. During *Power Practice*, tutors score each student's work, then reveal which problems provide an accuracy bonus, and award dollars accordingly. At each lesson's end, students have the opportunity to purchase a prize from the Super Store or to save money for a more highly valued purchase.

As noted, students in both intervention conditions complete the **fractions CBM, *Super Challenge***, every 2 weeks, starting Week 3. Each *Super Challenge* includes 20 problems representing the problem types taught in *Fraction Action*. Tutors score each CBM, providing immediate feedback and goal-directed discussion only in the SR condition. (To control instructional time across, an extra WP in the FM+WP condition was completed in Lesson 22-39 while FM+WP+ SR students engage in SR activities.)

In the SR condition, students received the same FM+WP intervention along with the embedded **SR component, *Brain Boost***, which occurs at the start of each lesson. SR time averages 4-9 min per lesson (lessons with *Super Challenge* were longest). During Weeks 1-3, discussion focuses on the meaning of “brain power,” its malleability, how to train one’s brain like an athlete, how mistakes can help the brain grow, and tracking progress. In Week 4, discussion extends to learning from mistakes, how to avoid careless mistakes, and applying this thinking in their first, upcoming *Super Challenge* CBM. Week 5 encourages students to use fractions in everyday lives, to persist in learning fractions, and to think about why their CBM scores increase, decrease, or remain the same. The Week 6 topic is SMART (specific, measurable, achievable, realistic, and time-bound) goals. In Weeks 7-13, students discuss working hard through challenges, prioritizing goals, adjusting plans to reach goals, and identifying strengths and weaknesses via CBM scores. In Lesson 10, students review their last CBM (taken in Lesson 9) to identify mistakes and think about, “Why did I get this type of problem wrong?” and “What can I do to get it right?” Tutors assist students in identifying the cause of their mistakes (e.g., forgetting a strategy vs. making a careless mistake).

Tutor Training and Fidelity of Implementation

Ten tutors were research grant employees; three were licensed teachers. All had a bachelor’s degree, and two also had a master’s. Each tutor was responsible for 2-4 groups, distributed across the FM+WP and FM+WP+SR conditions. To avoid contamination across conditions, we color coded materials, conducted periodic live observations, and monitored fidelity of implementation (FOI) audio recordings. Tutors also attended weekly meetings to receive training for upcoming sessions, engage in problem solving, and receive feedback.

To quantify FOI, we digitally audio recorded all sessions. Of 1,131 intervention sessions, 20% were randomly sampled to ensure comparable representation of conditions, tutors, and lessons. Research assistants (RAs) listened to recordings while completing a checklist of essential points addressed in each lesson. For the FM+WP component, the mean percentage of points addressed was 92.05 (SD = 8.53) in the FM+WP; 91.83 (SD = 6.15) in the FM+WP+ SR condition. For the SR component, the mean percentage of points addressed was 96.58 (SD = 10.28). Two RAs independently re-coded 20% of sessions. Agreement exceeded 95% - 98%. A within-tutor paired t-test indicated no significant difference in FOI between FM+WP component between the two conditions (p = 0.74).

Mathematics Instructional Time: Intervention versus Control

Near the end of the study, the 23 classroom teachers completed a survey on their instructional time and practices. They reported that math instruction occurred in 80-90-min math block five days per week. The study's intervention typically occurred during part of classroom math instruction or the school's intervention period. Thirteen (24% of) intervention students also received supplemental math intervention from their school (mean 131.67 min [SD = 83.87] per week). Eight (28% of) control students received the school's supplemental math intervention (mean 140.00 min [SD = 78.16] per week). Students across the three study conditions received comparable amounts of mathematics instruction (including minutes of classroom and supplemental instruction provided by the study or school).

Fractions Instruction: Intervention versus Classroom

Teachers also provided information about the schools' fraction instruction as part of the survey. Of 23 teachers, 19 reported that fraction instruction was based largely on state standards. Four reported using a combination of state standards and the district's mathematics program (enVisionMATH; Scott Foresman-Addison Wesley, 2011). See Table 3 for teacher survey responses about the control group's fraction instruction, as contrasted to researcher-provided fraction intervention.

There were four major distinctions between the control group versus the two intervention conditions. First, the control group focused mainly on part-whole understanding, whereas the intervention conditions emphasized FM. Second, for helping students understand relative FM, teachers relied primarily on number lines and drawing pictures, whereas the intervention conditions, while focusing heavily on number lines, also emphasized comparing fractions to benchmark fractions and considering the meaning of the numerator and denominator, without attention to drawing pictures. Third, the control group did not restrict the range of fractions, whereas the interventions conditions limited the pool of denominators to 1, 2, 3, 4, 5, 6, 8, 9, 10, and 12. Fourth, control group WP instruction focused more on operational procedures and drawing pictures, while the intervention conditions focused more on identifying WPs as belonging to WP types to represent the structure of WPs.

Procedure

Whole-class screening (WRAT-4-*Math Computation* and *Minuends to 18*) was conducted in one 45-min whole-class session in late-August to early-September. *NAEP* items were administered in the same session. WASI *Vocabulary* and WASI *Matrix Reasoning* were administered individually in one 60-min session in mid-September to early-October, and *Multiplication*, *Comparing Fractions*, *Fraction Addition and Subtraction*, *Fraction Number Line*, and *Fraction Word Problems-Pretest* were administered in the same time frame in two small-group 45-min sessions. From late October to early February, Intervention occurred for 13 weeks, three times per week for 35 min per session. In late February-early March, we readministered *NAEP* and *Ordering Fractions* (Part 1; half of the items) in a whole-class session and *Multiplication*, *Ordering Fractions* (Part 2; remaining items), *Fraction Number Line*, *Fraction Addition and Subtraction*, and *Fraction Word Problems* in two small-group sessions. Teachers completed instructional surveys in March.

Testers were graduate RAs who received training and passed fidelity checks on testing procedures prior to administering tests. Two independent RAs scored and entered data for each test. All scoring discrepancies were discussed and resolved. All testing sessions were audiotaped; 20% of tapes were randomly selected, stratifying by tester, for accuracy checks by an independent scorer. Agreement on test administration accuracy was 98%. Testers were blind to conditions when administering and scoring tests.

Data Analysis

Table 4 shows pretest and posttest means by intervention condition. Tests of baseline equivalence identified no significant differences among conditions on any pretest fraction measure, with the exception of Multiplication ($p < 0.05$). We also conducted preliminary tests to assess whether pretest performance moderated intervention effects on any corresponding fraction outcomes. There were no significant interactions.

Other preliminary analyses evaluated the nested structure of the data: a cross-classified, partially nested design in which nesting occurred at the school and classroom levels for all three study conditions and at the intervention-group level for the two intervention conditions. We began by estimating the proportion of variance in each fraction outcome measure due to schools, classrooms, and intervention dyads. We regressed observations on school dummy codes and modeled the student data as nested in a cross-classification of classrooms and dyad. To estimate variance due to group, classroom, and dyad, intraclass correlations (ICCs; see Table 5) were obtained by fitting a pair of models to each outcome for observations nested in school and for observations nested in a cross-classification of classroom and intervention dyad, controlling for schools. ICCs were large enough to justify retaining school, classroom, and intervention dyad in further analyses.

We used the Roberts and Roberts (2005) method (described in Bauer, Sterba, & Hallfors, 2009) to model nesting for intervention conditions, but not for the control condition. ICC analyses were modified accordingly; we obtained ICC results separately for each condition, but sharing a common level 1 residual variance. Next, we used Bayes estimation to conduct regression models to test two contrasts of interest: intervention (combined) versus control, and base intervention versus SR. Analyses used the ICC code as a basis, with pretest scores as covariates. Accordingly, the final model equation was

$$y_{ijk} = \gamma_{00} + \sum_{j=1}^{7} \gamma_{oj}\, d_j + u_{0j} + (\gamma_{10} + u_{1j} + u_{1k})c_{1i} + (\gamma_{20} + u_{2j} + u_{2k})c_{2i} + \gamma_{40} y_{0ijk} + e_{ijk}$$

where *y* is a generic outcome, y_0 is pretest, *c* is dummy code for condition (00 = Control; 10 =Base; 01 = SR), *d* is dummy code for school, *i* denotes individual student, *j* denotes classroom, and *k* denotes dyad. For SR versus the base condition, the difference was $\gamma_{20} - \gamma_{10}$. For average intervention (combined) versus control, the difference was $[(2\gamma_{00} + \gamma_{10} + \gamma_{20})/2] - \gamma_{00}$.

Results

Results of the Bayes estimation are shown in Table 6, with credible intervals (CrI), rather than *p*-values; CrIs excluding zero indicating a significant effect (with Bayesian estimation, a 95% CrI has a 95% probability of containing the parameter; this is preferred to a frequentist confidence interval). In line with study hypotheses, the intervention (combined) conditions produced higher scores than the control condition on NAEP, Multiplication, Word Problems, Ordering, Fraction Addition and Subtraction, and Number Line, and there were no significant differences between the two intervention conditions. Effect sizes (ESs; Hedges *g*), calculated from adjusted posttest means, are provided in Table 7.

Discussion

The study's first purpose was to assess the efficacy of *Super Solvers-3rd grade-revised*, a small-group intervention designed to improve at-risk third graders' fraction magnitude (FM) understanding and word-problem (WP) performance. The second purpose was to gain insight into whether embedded self-regulation instruction (SR) provides added value for improving performance on these skills. Wang et al.'s pilot study (in press) had indicated promise for an earlier iteration of the program, while suggesting that an embedded SR may be required. Ths is, significant effects favored intervention that embedded SR over control on all outcomes except fraction number line, whereas the earlier iteration of the FM+WP program without the SR component did not produce stronger outcomes than control except for WP outcome, an effect that was stronger for SR students who entered the study with strong WP skill.

The present study differs from the Wang et al. pilot (in press) by relying on updated and strengthened FM, WP, and SR intervention components, now constituting the *Super Solvers-3rd grade-revised* intervention program. This enhanced FM+WP intervention now includes incorporates slower pacing and more opportunities for interleaved practice across compare, order, and number line FM problem types, with few fewer taught problem subtypes to encourage mastery and emphasize depth over breadth of understanding. It also consolidates conceptual and procedural strategies across compare, order, and number line FM problem types. For WP, it emphasizes depth over breadth by eliminating one WP type. Across the FM and WP instructional design, additional improvements were also made (see Table 2). The revised SR component now incorporates CBM progress monitoring to concretize goal setting and self-directed learning even as SR processes are depicted via at-risk third-grade comic characters to help students activate these processes in their own learning.

With these enhancements, the present study extends Wang et al. (in press) by assessing the efficacy of the now fully developed *Super Solvers*-3rd grade-revised intervention, even as it provides a more robust and stringent test of the proposition that SR instruction offers added value over well conceptualized explicit and strategic intervention without SR instruction. Our hypothesis was that the effects of strengthened FM+WP intervention are sufficiently strong to preclude the need for embedded SR instruction.

Results supported this idea. We found that when FM+WP intervention is designed to promote depth of skill development, thorough cumulative review and interleaved practice, and conceptually-grounded, efficient strategies for understanding and executing FM judgments and building fraction WP problems to support accurate solutions, it substantially and significantly improves the fraction learning of at-risk third-grade students over the business-as-usual control group. We also found that this is the case regardless of whether or not SR instruction is embedded within this intervention.

Across the *Super Solvers* conditions, effects were not only significant but also strong across both intervention conditions over control on all six fraction outcomes. This includes the proximal (Multiplication ES = 1.13; Ordering ES = 1.03; WPs ES = 0.88; Addition and Subtraction ES = 1.00; Number Line = 1.03) and the far-transfer (NAEP ES = 1.29) measures. Specifically for the FM+WP condition, without the SR component was included, ESs were 1.00 on Multiplication, 1.23 on Ordering, 0.92 on WPs, 1.06 on Addition and Subtraction, 1.03 on Number line, and 1.01 on NAEP. At the same time, there were no significant differences between the two intervention conditions, and the SR component's added value over FM+WP without SR was inconsequential (-0.17 to 0.10 across measures). Thus, the absence of statistical significance between the two *Super Solvers* conditions cannot be attributed *not* to insufficient statistical power.

We thus offer three major conclusions. First, fractions intervention that incorporates explicit instruction on FM and WPs substantially improves third graders' multiplication skill, fraction magnitude understanding (ordering fractions and placing them on number lines), fraction addition and subtraction, fraction word problems, and performance on a widely accepted measure of fractions performance (released NAEP items).

Second and more specifically, *Super Solvers (3rd grade)* is a small-group intervention with evidence of efficacy. It can be used productively in standard protocol fashion to improve the multiplication, fraction understanding, and fraction calculation performance at third grade within supplemental Tier 2 intervention or as a platform to initiate data-based individualized Tier 3 instruction.

Third, self-regulation instruction does not provide added value for enhancing student outcomes over a well-designed explicit instructional program, with conceptual and strategic depth, focused on third-grade fractions. We note that this conclusion is limited to the intervention program investigated in the present study. We also note that practitioners may choose to incorporate the SR component, depending on the teachers' understanding of individual student needs, without any detrimental effects. That is, results were essentially the same with or without the SR component. In future research focused on intervention for at-risk learners in other content areas and other graders, the role of SR within explicit instruction programs should continue to be explored, while assessing whether SR's added value depends on the quality and overall strength of the based intervention.

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Table 1

Student Demographics and Screening Data by Study Condition

	FM+WP Condition (*n* = 26)		FM+WP+SR Condition (*n* = 29)		Control Condition (*n* = 29)	
Variable	*n*	%	*n*	%	*n*	%
Males	11	42.3	14	48.3	16	55.2
Race/Ethnicity						
African American	16	61.5	18	62.1	13	44.8
White	2	7.7	2	6.9	3	10.3
Hispanic	5	19.2	8	27.6	12	41.4
Other[1]	3	11.5	1	3.4	1	3.4
Subsidized Lunch	15	57.7	16	55.2	15	51.7
School-Identified Disability						
Learning disability	1	3.8	2	6.9	1	3.4
Learning disability and behavior disorder	--	--	--	--	--	--
Speech/language delay	--	--	--	--	3	10.3
Other	--	--	--	--	2	6.9
English-Language Learner	5	19.2	7	24.1	9	31.0
Screening Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*
Minuends to 18 (Subtraction)	2.96	5.11	1.93	2.10	1.00	1.16
WRAT-4	21.81	1.44	21.45	1.23	21.38	1.15
WASI Matrix Reasoning	8.31	2.41	8.72	3.95	8.38	2.56
WASI Vocabulary	20.23	3.98	19.76	4.58	19.31	4.63

Note. FM+WP is the *Super Challenge* Third-Grade Intervention without the self-regulation component; FM+WP+SR is *Super Challenge* Third-Grade Intervention with the self-regulation component self-regulation. *Minuends to 18* is *Second-Grade Calculations Battery-Minuends to 18* (Fuchs, Hamlett, & Powell, 2003). WRAT-4 is the Wide Range Achievement Test: *Math Computation* (Wilkinson & Robertson, 2006). WASI *Matrix Reasoning* and WASI *Vocabulary* are from Wechsler Abbreviated Scales of Intelligence (Wechsler, 2011).

[1]Other category does not include Asian; there were no Asian participants in the study.

Table 2

Programmatic Changes in Super Solvers 3^{rd} grade-revised

	Topic	Pilot Study Intervention Content	Content changes in *Super Solvers* 3^{rd} grade-revised
FM+WP	Multiplication	• Limited opportunities for speeded practice • Fluency activity alternated weekly between multiplication and fraction magnitude content	• Stronger emphasis on skip-counting • More opportunities for speeded practice (fluency with multiplication is separated from FM fluency activity)
	Fraction Comparing, Ordering, and Number Line	• Strategies for comparing, ordering, and placing fractions on number line are taught separately • Practice problems are not interleaved	• Strategies consolidated as an integrated problem-solving process • Practice problems heavily interleaved throughout program
	Fraction Magnitude Fluency	• Limited instructional time spent on fraction magnitude fluency	• Additional instructional activity, *Fraction Flash*, added to increase fluency
	Word Problems	• Included compare, change, and splitting WPs	• Includes only compare and change WPs
SR	Goal-Setting, Perseverance, and Mindset	• SR based on tutor-led discussions	• SR based on tutor-led discussions and centered on comic series, *Brain Boost Adventures* • Instruction includes learning from mistakes, evaluating sources of errors, and checking for misunderstanding of concepts.
	Progress Monitoring		• Monitoring and evaluating progress framed in *Brain Boost Adventures*, as students follow characters' growth on progress-monitoring measures.
	Instructional Time	• FM+WP students performed additional fraction magnitude problems to hold instructional between conditions time constant	• FM+WP students solve an extra WP in Lessons 22-39 to hold instructional time constant

Note. FM+WP is the *Super Solvers* Third-Grade Intervention; SR is the self-regulation component of *Super Solvers* Third-Grade Intervention.

Table 3

Fraction Instruction: Classroom versus Intervention

Domain	Dimension	Method	Classroom (%)	Intervention (%)
Fractions	Fraction Interpretation	Part-Whole	90.43	25.00
		Measurement	9.57	75.00
	Fraction Representation	Fraction Tiles	18.26	20.00
		Fraction Circles	11.30	10.00
		Pictures with Shaded Regions	31.74	10.00
		Blocks	28.70	0.00
		Number Lines	9.57	60.00
		Other	0.43	0.00
	Fraction Magnitude	Number Lines	26.96	20.00
		Drawing Pictures	24.35	0.00
		Referencing Manipulatives	10.43	10.00
		Benchmark Fractions	12.61	25.00
		Understanding Numerator and Denominator	15.22	25.00
		Finding Common Denominator	4.78	20.00
		Cross-Multiplying	5.65	0.00
		Other	0.00	0.00
Multiplication		Manipulatives	10.43	0.00
		Graph Paper	5.22	0.00
		Drawing	19.13	0.00
		Skip Counting	18.70	50.00
		Decomposition	11.74	0.00
		Memorization	12.17	15.00
		Trick	6.52	20.00
		Fact Families	15.22	10.00
		Other	0.87	0.00
Algebra	Equations[1]	Standard Equation (e.g., 3 + __ = 5)	91.0	--
		Double Operation (e.g., 3 + __ = 4 + 4)	78.0	--
		Double Operation (e.g., 3 + 2 = __ - 4)	39.0	--
		Standard Equation (e.g., __ - 2 = 5)	74.0	--
Word Problems		Identifying Problem Type	13.18	70.00
		Operational Procedures	44.83	20.00
		Writing an Equation	18.64	10.00
		Keywords	15.91	0.00
		Drawing Pictures	33.18	0.00
		Making a Table	2.73	0.00

Note. [1]For Equations and Function Tables, values indicate the percentage of the 23 teachers who reported teaching that skill.

Table 4

Pre and Posttest Means and Standard Deviations

	FM+WP (*n* = 26)			FM+WP+SR (*n* = 29)			Control (*n*= 29)		
	Pretest	Posttest		Pretest	Posttest		Pretest	Posttest	
Measure	*M* (*SD*)	*M* (*SD*)	M_{adj}	*M* (*SD*)	*M* (*SD*)	M_{adj}	*M* (*SD*)	*M* (*SD*)	M_{adj}
NL	3.27 (2.82)	8.77 (3.56)	8.78	3.83 (2.71)	9.17 (3.63)	9.06	2.83 (2.69)	5.14 (3.43)	5.24
WPs	1.94 (1.31)	10.48 (5.78)	10.16	1.78 (1.13)	10.40 (6.49)	10.35	1.53 (1.10)	4.76 (5.14)	5.10
Mult	8.81 (6.44)	19.42 (5.69)	18.11	6.69 (4.19)	18.86 (5.55)	18.66	3.69 (3.33)	10.76 (6.42)	12.11
Ordering[1]	0.38 (1.13)	5.27 (3.01)	5.26	0.21 (0.82)	5.38 (3.20)	5.39	0.24 (0.79)	2.24 (1.70)	2.25
Add/Sub	0.04 (0.20)	5.31 (3.89)	5.35	0.00 (0.00)	4.66 (3.21)	4.74	0.17 (0.76)	1.72 (3.10)	1.60
NAEP	2.11 (1.33)	6.07 (1.89)	6.10	2.66 (1.21)	6.03 (2.64)	6.01	2.33 (1.63)	3.98 (2.21)	3.99

Note. FM+WP is the *Super Solvers* 3rd Grade-revised without the self-regulation component; FM+WP+SR is *Super Solvers 3rd* Grade-revised with the self-regulation component self-regulation. Number Lines, Word Problems, Multiplication, Ordering, and Fraction Addition and Subtraction are from the *Fraction Battery-revised* (Malone & Fuchs, 2017). NAEP is *NAEP-Revised*, 17 released fraction items from the National Assessment of Educational Progress. NL= Number Lines. WPs = Word Problems. Mult = Multiplication. Add/Sub = Fraction Addition and Subtraction. M_{adj} = Adjusted mean, i.e., posttest with pretest as a covariate. Number Lines, Word Problems, Multiplication, Ordering, and Fraction Addition and Subtraction are from the *Fraction Battery-revised* (Malone & Fuchs, 2017). NAEP is *NAEP-revised*, 17 released fraction items from the National Assessment of Educational Progress.

[1]For Ordering, pretest is comparing fractions with the *Fraction Battery-revised Comparing* (Malone & Fuchs, 2017).

Table 5

ICCs for School, Classroom, and Tutoring Dyads

		ICC (School)	ICC2 (Classroom)	ICC2 (dyad)
NAEP	Base	0.480	0.067	0.102
	FM+WP+SR	0.291	0.155	0.341
	Control	0.494	0.145	
Multiplication	FM+WP	0.288	0.132	0.255
	FM+WP+SR	0.309	0.104	0.240
	Control	0.360	0.233	
Word Problems	FM+WP	0.456	0.087	0.113
	FM+WP+SR	0.354	0.168	0.212
	Control	0.475	0.166	
Ordering	FM+WP	0.157	0.195	0.187
	FM+WP+SR	0.131	0.206	0.278
	Control	0.235	0.077	
Fraction Addition and Subtraction	FM+WP	0.194	0.126	0.264
	FM+WP+SR	0.174	0.138	0.316
	Control	0.283	0.114	
Number Line	FM+WP	0.206	0.135	0.258
	FM+WP+SR	0.222	0.111	0.234
	Control	0.299	0.117	

Note. ICC is intraclass correlation. FM+WP is the *Super Solvers* 3rd Grade-revised without the self-regulation component; FM+WP+SR is *Super Solvers* 3rd Grade-revised with the self-regulation component self-regulation. Number Lines, Word Problems, Multiplication, Ordering, and Fraction Addition and Subtraction are from the *Fraction Battery-revised* (Malone & Fuchs, 2017). NAEP is *NAEP-revised*, 17 released fraction items from the National Assessment of Educational Progress.

Table 6

Results of Bayesian Estimates with Credible Intervals

	Contrast[1]	Mean Difference	95% Credible Interval Lower Limit	95% Credible Interval Upper Limit	Significant	Condition with higher value
NAEP						
	SR v FM+WP	0.173	-1.570	2.215		
	Intervention v Control	2.208	1.281	3.207	*	Intervention
Multiplication						
	SR v FM+WP	0.355	-3.990	5.524		
	Intervention v Control	5.901	3.033	8.251	*	Intervention
Word Problems	SR v FM+WP	0.633	-3.125	5.334		
	Intervention v Control	5.163	2.724	7.493	*	Intervention
Ordering						
	SR v FM+WP	0.316	-2.167	3.187		
	Intervention v Control	3.182	1.684	4.841	*	Intervention
Fraction Addition and Subtraction	SR v FM+WP	-0.592	-3.401	2.936		
	Intervention v Control	3.357	1.572	5.026	*	Intervention
Number Line						
	SR v FM+WP	0.390	-2.656	4.311		
	Intervention v Control	3.426	1.312	5.104	*	Intervention

Note. SR is self-regulation. Number Lines, Word Problems, Multiplication, Ordering, and Fraction Addition and Subtraction are from the *Fraction Battery-revised* (Malone & Fuchs, 2017). NAEP is *NAEP-revised*, 17 released fraction items from the National Assessment of Educational Progress.

[1]For contrasts, *intervention* refers to combined intervention conditions across FM+WP (*Super Solvers* 3rd Grade-revised without the self-regulation component and FM+WP+SR (*Super Solvers* 3rd Grade-revised with the self-regulation component self-regulation).

Table 7

Effect Sizes

Measure	INT vs. C	FM+WP vs. C	SR vs. C	SR vs. FM+WP
Number Line	1.03	1.00	1.07	0.08
Word Problems	0.88	0.92	0.88	0.03
Multiplication	1.06	0.97	1.08	0.10
Ordering[1]	1.13	1.23	1.21	0.04
Fraction Add/Sub	1.00	1.06	0.99	-0.17
NAEP	1.29	1.01	0.82	-0.04

Note. INT is combined intervention conditions across FM+WP (*Super Solvers* 3rd Grade-revised without the self-regulation component) and FM+WP+SR (*Super Solvers* 3rd Grade-revised with the self-regulation component). Effect size is reported as Hedges *g*. Number Lines, Word Problems, Multiplication, Ordering, and Fraction Addition and Subtraction are from the *Fraction Battery-revised* (Malone & Fuchs, 2017). NAEP is *NAEP-revised*, 17 released fraction items from the National Assessment of Educational Progress.