In the following report, Hanover Research discusses recommended practices for effective math instructional strategies, assessment, and intervention delivery.
TABLE OF CONTENTS

Executive Summary and Key Findings ................................................................. 3

INTRODUCTION ........................................................................................................ 3
KEY FINDINGS ........................................................................................................... 3

Section I: Strategies for Improving the Math Achievement of Struggling Students ........6

INSTRUCTIONAL STRATEGIES ........................................................................... 6
Explicit Direct Instruction ...................................................................................... 8
Visual Representations ......................................................................................... 11
Word Problems ..................................................................................................... 12
Building Fluency .................................................................................................. 14

Section II: Response to Intervention ................................................................. 16

RTI OVERVIEW ..................................................................................................... 16
ASSESSMENT ......................................................................................................... 17
Types of Assessment Used in RtI ......................................................................... 17
Characteristics of Effective Assessment Tools for Screening and Progress Monitoring .19

INTERVENTION IMPLEMENTATION AND DELIVERY .................................. 21
Implementation Considerations ............................................................................ 21
Models for Intervention Delivery ....................................................................... 22
Intervention Delivery by RtI Tier ........................................................................ 25

Appendix A .......................................................................................................... 28
EFFECTIVE INSTRUCTIONAL PROGRAMS FOR PURCHASE ............................ 28
EXECUTIVE SUMMARY AND KEY FINDINGS

INTRODUCTION

Research shows that early math interventions can help reduce future achievement deficits for struggling students.¹ To ensure later success in algebra and other foundational courses, students need to develop foundational math skills. However, a significant number fail to do so. A national survey of algebra teachers found, for instance, that many students entering algebra are deficient in the areas of whole number arithmetic, fractions, ratios, and proportions.² Therefore, many school districts use a Response to Intervention (RtI) model to identify struggling students and guide successful math interventions.

To support our partner district’s math intervention services, this report synthesizes research on effective math intervention strategies for elementary school students. The report includes the following two sections:

- **Section I: Strategies for Improving the Math Achievement of Struggling Students** discusses effective, research-based math instructional strategies for elementary school students.
- **Section II: Response to Intervention** examines the delivery of math interventions within the Response to Intervention model, including an overview of RtI, characteristics of effective assessments, and models for delivering the intervention strategies described in Section I.
- **Appendix** concludes with a brief review of comprehensive intervention programs for elementary mathematics reviewed by the What Works Clearinghouse (WWC) at the U.S. Department of Education.

KEY FINDINGS

- **Educators can positively impact the math achievement of struggling students by using explicit direct instruction, providing visual representations, teaching the underlying structure of word problems, and building fluency.** These intervention strategies are effective for all students when used in a whole class approach and for struggling students when delivered with increased intensity. Specifically, the following strategies benefit all and struggling students depending on the delivery method:
  - **Explicit instruction** involves step-by-step modeling, opportunities for practice, and extensive feedback;

---


Visual representations include the use of concrete manipulatives and two-dimensional drawings and diagrams that help students gain a conceptual understanding of math;

Word problem instruction teaches students about the underlying structure of word problems, how to identify common types of word problem structures, and how to solve them; and

Fluency building activities such as flashcards and instructional games increase students’ ability to automatically retrieve arithmetic facts.

### IES Recommended Math Intervention Strategies

<table>
<thead>
<tr>
<th>RECOMMENDATION</th>
<th>LEVEL OF EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tier 1</strong></td>
<td></td>
</tr>
<tr>
<td>Screen all students to identify those at risk for potential mathematics difficulties and provide interventions to students identified as at risk.</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>Tier 2 and Tier 3</strong></td>
<td></td>
</tr>
<tr>
<td>Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.</td>
<td>Strong</td>
</tr>
<tr>
<td>Interventions should include instruction on solving word problems that is based on common underlying structures.</td>
<td>Strong</td>
</tr>
<tr>
<td>Intervention materials should include opportunities for students to work with visual representations of mathematical ideas and interventionists should be proficient in the use of visual representations of mathematical ideas.</td>
<td>Moderate</td>
</tr>
<tr>
<td>Interventions at all grade levels should devote about 10 minutes in each session to building fluent retrieval of basic arithmetic facts.</td>
<td>Moderate</td>
</tr>
<tr>
<td>Instructional materials for students receiving interventions should focus intensely on in-depth treatment of whole numbers in kindergarten through grade 5 and on rational numbers in Grades 4 through 8. These materials should be selected by the committee.</td>
<td>Low</td>
</tr>
<tr>
<td>Monitor the progress of students receiving supplemental instruction and other students who are at risk.</td>
<td>Low</td>
</tr>
<tr>
<td>Include motivational strategies in Tier 2 and Tier 3 interventions.</td>
<td>Low</td>
</tr>
</tbody>
</table>

Source: Institute of Education Sciences, U.S. Department of Education

Math intervention strategies can be intensified to assist struggling students by increasing the amount of instructional time or the amount of individualization. Educators can increase instructional time by increasing the frequency, length, and duration of intervention sessions and increase individualization by instructing students in small groups or through one-on-one tutoring. Within a Response to Intervention Framework, interventions using effective instructional strategies are delivered to small groups of students at Tier 2 and through one-on-one, highly individualized, and responsive tutoring in Tier 3.

---

3 Figure content quoted verbatim with modification from: Ibid.
Various instructional groupings and intervention settings have been shown to be effective at promoting math achievement, including increasing instructional time, reducing group size, and peer-assisted learning. Notably, all are the product of in some way intensifying the instruction a student receives. However, for interventions to be successful, teachers must continue to use evidence-based instructional strategies (shown here in Section I) and maintain student engagement during more intense sessions.

Experts recommend that schools universally screen all students at least two to three times per year, and then use that data for instructional decision-making. Multiple screenings help identify students who fall just above cut scores and allow for comparisons of students’ growth between screening sessions. Schools should regularly monitor students who fall right above the cut score for increased intervention services. When choosing an assessment, the district should evaluate the tool’s predictive validity, reliability, efficiency, and key mathematics content. Standardizing screening tools district-wide allows the district to compare and analyze results across schools. Tools developed by groups like the Center on Response to Intervention can help districts identify valid screening assessments.

Educators should monitor students’ progress frequently and adjust the intervention as necessary. Common progress monitoring intervals include weekly, biweekly, and monthly assessments. Student data from frequent progress monitoring allows educators to individualize the intervention’s content, adjust the intensity of the intervention according to students’ needs, and evaluate the effectiveness of the intervention.

Intervention programs reviewed by the What Works Clearinghouse with evidence of potentially positive effects on students’ math outcomes include Odyssey Math, Everyday Mathematics, Accelerated Math, DreamBox Learning, and Saxon Math. Educators should ensure that the intervention program meets students’ needs regarding content and delivery.
SECTION I: STRATEGIES FOR IMPROVING THE MATH ACHIEVEMENT OF STRUGGLING STUDENTS

The following section discusses effective, research-based math instructional strategies for elementary school students. Notably, the body of literature does not differentiate greatly between the use of these strategies with all students and with students struggling with math; rather the strategies serve as best practices for instruction that can be delivered with different levels of intensity according to students’ needs.

INSTRUCTIONAL STRATEGIES

High-quality math instruction is essential to the math success of all student, as students who struggle with math in elementary school do not develop the necessary skills to succeed in critical later math courses, such as algebra. Therefore, it is essential that students receive effective instruction and intervention to “mitigate and prevent mathematics difficulties.”

Successful instructional practice can be gleaned from successful schools. A U.S. Department of Education summary of Blue Ribbon schools who have dramatically improved their students’ math performance revealed common practices in curriculum content and standards, teaching strategies, student support, and assessment. Figure 1.1 below describes the successful practices common to these schools. Notably, while the schools follow different math programs, they all emphasize an aligned curriculum, dedicated time for math instruction and assessment, formative assessment and progress monitoring, and immediate intervention for struggling students.

Figure 1.1: Strategies for Improving Math Performance

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
<th>SUCCESSFUL PRACTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curriculum Content and Standards</td>
<td>The math curriculum is coherent, focused, demanding, and reflects the logical and sequential nature of math. Students move from mastering basic computational skills and number concepts to more complex ideas and mathematical reasoning, including problem-solving. All teaching is aligned with district and state standards in mathematics.</td>
<td>▪ Curriculum is aligned with state frameworks;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Coherent, focused, demanding program;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Connections to the real world;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Year-to-year continuity;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Building on prior skills and knowledge;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Use of manipulatives for concept development.</td>
</tr>
</tbody>
</table>

4 Ibid.
### Table: Teaching Strategies

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
<th>SUCCESSFUL PRACTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Strategies</td>
<td>High-quality teachers provide individual instruction through differentiated instruction, flexible grouping, and immediate intervention.</td>
<td>▪ Ongoing assessment; ▪ Differentiated instruction; ▪ Flexible grouping; ▪ Teacher collaboration; ▪ Year-to-year continuity; and ▪ Ongoing professional development.</td>
</tr>
</tbody>
</table>

### Table: Student Support

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
<th>SUCCESSFUL PRACTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Support</td>
<td>Students’ math instruction is supported through data-driven decision making and collaboration between teachers and between teachers and parents.</td>
<td>▪ Early intervention; ▪ Frequent parent-teacher conferences; ▪ Home strategies; ▪ Extended day programs; ▪ Tutoring; and ▪ Summer workshops.</td>
</tr>
</tbody>
</table>

### Table: Assessment

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
<th>SUCCESSFUL PRACTICES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td>Formative, continuous assessment guides mathematics instruction, informs instructional planning for individual student needs, and suggests where a given teacher might improve a lesson.</td>
<td>▪ Diagnostic screening; ▪ Individual instruction based on assessment data; ▪ Teaching guided by assessment data; ▪ Performance assessment; and ▪ Ongoing assessment.</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Education

Research further indicates that educators can use a variety of instructional strategies to positively impact the math achievement of struggling and low-income students. For example, the Institute of Education Science’s (IES) What Works Clearinghouse (WWC) produced a practice guide for implementing math strategies within the RtI framework highlighted above. Based on the input of a diverse panel of experts and researchers in addition to an analysis of experimental and quasi-experimental studies meeting WWC’s strict criteria, the guide offers eight recommendations for instructional interventions in math.

The recommendations, which reflect “the best evidence on effective practices in mathematics interventions,” are presented along with their corresponding level of evidence in Figure 1.2 on the following page. The definitions for WWC’s levels of evidence are provided in the Appendix.

---

6 Figure content quoted verbatim with modification from: Ibid., pp. 1–11.
The following pages synthesize the strategies from the IES report and recommendations, a similar report produced in 2016 by the American Institutes for Research’s National Center on Intensive Intervention (NCII), and additional literature on increasing the math achievement of struggling students.

**Explicit Direct Instruction**

Research consistently finds that *explicit and systematic instruction* is highly effective for students struggling with math, and “provide[s] in-depth coverage of the most critical content areas of mathematics and reflect[s] current research on effective mathematics instruction.”

According to the National Mathematics Advisory Panel’s (NMAP) 2008 final report, explicit instruction aids in solving word problems, computation, and transferring known skills to novel situations – particularly for students with learning disabilities and low-achieving students.

---

8 Figure content quoted verbatim with modification from: Ibid.
Explicit, systematic math instruction requires clearly teaching the steps involved in solving or understanding a problem or using a strategy. Instruction can be direct and explicit regardless of the topic, and can take many forms. The NMAP defines explicit instruction as including the following requirements:12

- Teachers provide clear models for solving a problem type using an array of examples;
- Students receive extensive practice in use of newly learned strategies and skills;
- Students are provided with opportunities to think aloud (i.e., talk through the decisions they make and the steps they take); and
- Students are provided with extensive feedback.

Following the NMAP’s findings, a guide published by the IES finds strong evidence for the effectiveness of explicit and systematic mathematics instruction and includes the practice as a key recommendation for teaching students struggling with math.

The figure at right notes recommendations from the IES regarding systematic math instruction, focusing on instructional materials, class structure, and review.13

Explicit instruction requires the instructor to clearly model how to apply a skill or solve a problem, offer step-by-step instruction, and provide students with time to practice.14 When modeling the steps to solve a problem, the IES recommends that teachers “think aloud” and share their thinking processes. Explaining the reasoning behind each step helps students to understand the underlying mathematics. To provide instruction that is also systematic, instructors “should gradually build proficiency by introducing concepts in a logical order and by providing students with numerous applications of each concept.”15 Additionally, each lesson should include cumulative review, which helps students practice previously taught concepts, remember what they learned, and make connections between math concepts. For example, when practicing fractions, students

COMPONENTS OF EXPLICIT SYSTEMATIC INSTRUCTION

- Ensure that instructional materials are systematic and explicit. In particular, they should included numerous clear models of easy and difficult problems, with accompanying teacher think-alouds.
- Provide students with opportunities to solve problems in a group and communicate problem-solving strategies.
- Ensure that instructional materials include cumulative review in each session.

---


could also practice other their multiplication and division skills. These steps, as well as further essential components of explicit and systematic instruction, are presented in Figure 1.3 below.

**Figure 1.3: Components of Explicit and Systematic Instruction**

<table>
<thead>
<tr>
<th>Advance Organizer</th>
<th>• Providing students with an advance organizer allows them to know the specific objective of the lesson and its relevance to everyday life.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing Background Knowledge</td>
<td>• Instructors determine whether students have mastered the prerequisite skills for successful problem solving in the new concept area. Instructors can also determine whether students are able to generalize previously learned concepts to the new concept.</td>
</tr>
<tr>
<td>Modeling</td>
<td>• Instructors “think aloud” as they model the process of working through a computation problem; read, set up, and solve a word problem; use a strategy; or demonstrate a concept. Instructors should be clear and direct in their presentation; and precise and mindful in using general and mathematical vocabulary and in selecting numbers or examples for use during instruction.</td>
</tr>
<tr>
<td>Guided Practice</td>
<td>• Instructors engage all students by asking questions to guide learning and understanding as students actively participate in solving problems. Instructors prompt and scaffold student learning as necessary. Positive and corrective feedback is provided during this phase, and instruction is adjusted to match student needs.</td>
</tr>
<tr>
<td>Independent Practice</td>
<td>• After achieving a high level of mastery, students move to the independent practice phase where they autonomously demonstrate their new knowledge and skills. During independent practice, the instructor closely monitors students and provides immediate feedback as necessary. If students demonstrate difficulty at this stage, instructors evaluate and adjust their instruction to re-teach concepts as needed.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>• Instructors use distributed practice to assess student maintenance at regularly scheduled intervals. Distributed practice is focused practice on a specific skill, strategy, or concept. The frequency of these practice assessments is determined by the difficulty level of the skill and according to individual student needs. Maintenance may also include cumulative practice.</td>
</tr>
</tbody>
</table>

Source: National Center on Intensive Intervention

---

16 Ibid.

Multiple meta-analyses of studies conducted in the past twenty years indicate that explicit direct instruction is effective for the general student body, students struggling to learn math, and students with demonstrated math difficulties. For example, a 2009 meta-analysis by Gersten et al. in *Review of Education Research* analyzed 11 studies of math interventions for low-achieving students and found that explicit instruction had an overall significant mean effect size of 1.22 on student math achievement. 18 Additionally, in a meta-analysis in *Remedial and Special Education*, researchers analyzed 58 studies of math interventions for elementary students with special needs, focusing on interventions dealing with preparatory math, basic skills, and problem-solving strategies. Interventions that provided direct instruction had a mean effect size of 1.13. 19

**Visual Representations**

Math instruction that uses concrete manipulatives and visual representations can help students who struggle with math, with a mean effect size of 0.47 as measured through a 2008 meta-analysis. 20 Students often struggle to grasp the abstract, conceptual nature of math, and thus providing students with concrete or visual examples facilitates connections and a deeper understanding. 21 The Center on Instruction (COI) recommends teaching students to visually represent information when solving a math problem, arguing that the systematic use of visuals positively affects the math outcomes of struggling students and students with disabilities by clarifying and simplifying problems. 22 The most common types of visual aides are drawings, number lines, diagrams, and graphs, while concrete manipulatives can include tiles, counting bears, money, and blocks. 23

The NCII notes that systematically progressing from concrete and visual representations of math problems to abstract and symbolic representations allows students to better understand math conceptually. 24 Figure 1.4 on the following page describes the three stages of representing math concretely with physical manipulatives, visually with drawings, diagrams, or graphs, and abstractly with numbers and symbols. Notably, teaching math through these stages can be effective for students struggling with more complex math skills as well as foundational skills.

---

Figure 1.4: Math Representation Stages

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>Students use three-dimensional manipulatives to solve problems and to gain a better conceptual understanding of a concept.</td>
<td><img src="image" alt="Concrete example" /></td>
</tr>
<tr>
<td>Visual</td>
<td>Students use two-dimensional pictures, drawings, or diagrams to solve problems. These pictures, drawings, or diagrams may be given to the students, or they may draw them when presented with a problem. These representations should be used to connect and solve the same concepts previously taught using concrete objects.</td>
<td><img src="image" alt="Visual example" /></td>
</tr>
<tr>
<td>Abstract/Symbolic</td>
<td>Students solve problems with numbers and symbols rather than concrete objects or visual representations. Students are often expected to memorize facts and algorithms as well as to build fluency.</td>
<td>$4 + 5 = 9$</td>
</tr>
</tbody>
</table>

Source: National Center on Intensive Intervention

However, the IES cautions against an overemphasis on manipulatives, noting the importance of “fading them away systematically to reach the abstract level.” Using manipulatives becomes counterproductive when students over-rely on the manipulatives and do not learn math at the abstract level. To avoid an overreliance on manipulatives, the instructor or interventionist should use manipulatives during the initial instruction of a new strategy and then scaffold instruction so students reach the abstract stage.

Furthermore, while visuals can be helpful, they should be used alongside explicit instruction. Also, empirical studies find that visual aids are more effective when used by both the teacher and the student, and that the most effective visuals address a specific problem type. The IES recommends using visual representations “extensively and consistently” and suggests interventionists “explicitly link visual representations with the standard symbolic representations used in mathematics.”

**Word Problems**

Students should learn to categorize the structures of word problem types and strategies for solving different problem types. The IES, which rates the evidence supporting word problem instruction as “strong” based on empirical review, recommends explicitly teaching students about the underlying structures of word problems with similar mathematical

---

25 Figure content quoted verbatim with modification from: Ibid.
29 Ibid., pp. 26–29.
structures. Teachers should also help students to identify the relevant elements of the problem, such as numbers and vocabulary, and distinguish them from superficial elements of the problem, such as the problem’s format (e.g., a story or advertisement). Once students are familiar with the underlying structure of word problem types and can identify relevant features, students can apply their knowledge of how to solve underlying structures of familiar problems to new, unfamiliar problems.

Students struggling with word problems can benefit from mnemonic devices. The Council for Learning Disabilities (CLD) provides four strategies for students with math difficulties: “R.I.D.E.,” “F.A.S.T D.R.A.W.” “T.I.N.S.,” and “S.T.A.R.” Figure 1.5 below describes the four strategies and their meanings.

Figure 1.5: Mnemonic Strategies for Solving Word Problems

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• R – Remember the problem correctly.</td>
<td>• F – Find what you’re solving for.</td>
<td>• T – Thought. Think about what you need to do to solve this problem and circle key words.</td>
<td>• S – Search the word problem.</td>
</tr>
<tr>
<td>• I – Identify the relevant information.</td>
<td>• A – Ask yourself, “What are the parts of the problem?”</td>
<td>• I – Information. Circle and write the information to solve this problem; draw a picture; cross out unneeded information.</td>
<td>• T - Translate the words into an equation in picture form.</td>
</tr>
<tr>
<td>• D – Determine the operations and unit for expressing the answer.</td>
<td>• S – Set up the numbers.</td>
<td>• N – Number sentence. Write a number sentence to represent the problem.</td>
<td>• A - Answer the problem.</td>
</tr>
<tr>
<td>• E – Enter the correct numbers, calculate and check the answer.</td>
<td>• T – Tie down the sign.</td>
<td>• S – Solution Sentence. Write a solution sentence that explains your answer.</td>
<td>• R – Review the problem.</td>
</tr>
</tbody>
</table>

The CLD recommends that visually displaying one or more of these strategies in the classroom and demonstrating how to perform each step can help students struggling with word problems. The first strategy, RIDE, can be especially helpful for students who struggle with abstract reasoning, attention, memory, and visual-spatial skills.

---

31 Figure content quoted verbatim with modification from: Ibid., pp. 2–4.
32 Ibid., p. 2.
**BUILDING FLUENCY**

Students who struggle with math benefit from increasing their fluency in fact retrieval and procedural knowledge. The IES emphasizes that a “weak ability to retrieve arithmetic facts is likely to impede understanding of concepts students encounter with rational numbers, since teachers and texts often assume automatic retrieval of facts.”  

Fluency in retrieving arithmetic facts allows students to work on more complicated, multi-step math problems. Fluency can also increase students’ confidence and motivation to complete challenging mathematics tasks.

Students can build fluency through strategies and practice that emphasize automatic retrieval of arithmetic facts. The IES recommends spending 10 minutes per session for building automatic retrieval of arithmetic facts, while the NCII recommends combining timed activities with additional opportunities for practice. The IES states that “the goal is quick retrieval of facts using the digits 0 to 9 without any access to pencil and paper or manipulatives... Presenting facts in number families (such as $7 \times 8 = 56$, $8 \times 7 = 56$, $56/7 = 8$, and $56/8 = 7$) shows promise for improving student fluency.” Students in Grades K-2 should practice counting, while students in Grades 2-8 should practice using their knowledge of properties (e.g., commutative, associative, and distributive) to retrieve facts and solve problems in their heads.

Common methods for building automatic retrieval include the use of timed activities, technology and computer software, flash cards, and instructional games.

**Figure 1.6: Instructional Games for Building Fluency**

- **Bingo**: The instructor draws a card and reads the number, basic facts, fraction, or other item. Students mark the number or solution on their bingo cards. The first student who completes a row or column wins only if he or she can read all the numbers or answer all the problems in the row or column.

- **Concentration/Memory**: Students play the game as they would with cards; however, before students can pick up a match, they must read the numbers or solve the problem.

- **Dominoes**: Students play the game as they would regular dominoes by matching numbers with objects, math facts, fraction names with pictures of fractions, and so forth. Students must be able to answer the problem before they place their dominoes.

---

34 Ibid.
38 [1] Ibid.
- **Board games**: Using commercially produced board games can assist students in counting, estimation, and understanding real-world applications of money. Board games also tend to be linear and link to understanding of measurement and fractions in later grades.

- **I have _____; who has _______?** This game can be used to practice a variety of mathematical skills. The sentence structure “I have _____; who has _____?” is written on each card. The cards are evenly distributed among students. One card has the word Start written on it. Examples are as follows: “I have 5; who has 6 more?” “I have 11; who has 2 less?” “I have 9; who has its double?” “I have 18; who has 7 less?” The game continues until all cards have been used. This game can be used to practice knowledge of basic facts or more advanced skills such as adding and subtracting fractions with unlike denominators.

Source: National Center on Intensive Intervention\(^{39}\)

---

\(^{39}\) Figure content quoted verbatim with modification from: “Principles for Designing Intervention in Mathematics,” Op. cit., p. 15.
SECTION II: RESPONSE TO INTERVENTION

This section examines the delivery of math interventions within the Response to Intervention (RtI) model, including an overview of RtI, characteristics of effective assessments, and models for delivering the intervention strategies described in Section I.

RTI OVERVIEW

Response to Intervention (RtI) is a schoolwide, multi-level prevention system that uses assessment and intervention to increase student achievement.\(^{41}\) RtI has four main components, as described in Figure 2.1 at right.

The foundation of RtI involves data-based decision making; teachers and school staff regularly screen students and monitor their progress in order to provide instruction and intervention that meets students’ needs.\(^{42}\) Universal screening, which briefly assesses all students in a grade, identifies students that are at risk for low achievement.\(^{43}\)

Progress monitoring assesses students’ academic performance and the effectiveness of instruction and intervention.\(^{44}\) RtI follows a multi-level prevention system consisting of three tiers of intervention:

- Tier 1 includes high-quality instruction for all students.
- Tier 2 involves evidence-based intervention for students not making progress with regular instruction.

---


\(^{41}\) Ibid.


Tier 3 involves individualized, intense intervention for students who do not respond to Tier 2 interventions.45

ASSESSMENT

Assessing students’ math abilities is both a formal and informal process, and involves universal screening and continuous progress monitoring. Research points to the importance of studying a student’s growth longitudinally, as opposed to just a single point in time.46

TYPES OF ASSESSMENT USED IN RTI

Universal Screening

Universal screening, an essential component of the RtI framework, assesses all students to identify those at risk for math difficulties and in need of additional intervention. The RtI Action Network, a program of the National Center for Learning Disabilities (NCLD), writes that universal screening “is the mechanism for targeting students who struggle to learn when provided a scientific, evidence-based general education.”47 Universal screening measures are typically brief, easily administered, and focus on key skills that are predictive of later math outcomes.48

Experts recommend that schools screen all students two to three times per year to ensure the identification of all struggling students.49 The Center on Response to Intervention (CRTI) and RtI Action Network recommend screening students in the fall, winter, and spring.50 In a report regarding RtI math interventions for elementary and middle school students, the National Association of Elementary School Principals (NAESP), which recommends screening at the beginning and the middle of the schools year, asserts that twice-a-year screening “ensure[s] that those at risk are identified and receive intervention services in a timely fashion.”51 Similarly, the 2009 IES guide emphasizes that multiple screenings address concerns about students who fall just above or below cut scores on screening measures. In

---


48 Ibid.


addition, subsequent screenings allow for growth comparisons; a second or third screening “serves to identify any students who may have been at risk and grown substantially in their mathematics achievement—or those who were on track at the beginning of the year but have not shown sufficient growth.”

Districts should standardize screening tools and procedures used to enable objective comparisons between schools. Using the same screening tools allows the district to analyze results at the district level and implement instructional decisions and interventions for the entire district.

The IES also recommends using screening data in combination with state testing results for students in Grades 4-8. Districts can also use the previous year’s state testing results as a benchmark for initial screening, which “would allow districts and schools to combine a broader measure that covers more content with a screening measure that is narrower but more focused.”

**PROGRESS MONITORING**

Progress monitoring is critical to ensuring the effectiveness of math interventions, and experts recommend assessing students’ progress regularly and continuously. Progress monitoring assessment tools are typically brief, and common intervals include weekly, biweekly, or monthly assessment. Progress monitoring is crucial for students receiving Tier 2 and 3 interventions. However, schools should also monitor the progress of borderline Tier 1 students who scored just above the cutoff score and do not receive additional instruction so that they can be moved to Tier 2 if necessary.

Teachers and school staff use progress monitoring assessments to measure student progress, assess improvement and responsiveness to intervention strategies, and evaluate the effectiveness of the intervention. Progress monitoring also helps teachers and interventionists to create and adjust individualized education programs (IEP’s). For struggling students, teachers should continuously gather information and data to plan and adjust instruction, content, and pacing. Educators should adjust the intervention according to progress monitoring data. If students are not responding to the intervention, teachers can

---

53 Ibid., p. 15.
54 Ibid.
increase the intensity or implement instructional changes. Students who continuously meet benchmarks may qualify to be moved back to Tier 1.

Progress monitoring tools must accurately represent students’ academic development and must be useful for instructional planning and assessing student learning. Further, progress monitoring tools can assess general outcome measures and curriculum embedded measures. General outcomes measures offer a broad view of students’ math proficiency, while curriculum embedded measurement assesses student growth and instructional effectiveness.

**Characteristics of Effective Assessment Tools for Screening and Progress Monitoring**

There are several methods for screening and continuously monitoring elementary school students’ math abilities, which vary in effectiveness and administrative time and ease. When choosing a screening tool, the district should evaluate the tool’s predictive validity and content selection. Researchers with the COI emphasize the importance of ensuring that a student’s performance on the screening assessment predicts their future math performance in subsequent grades, as “assessments that show evidence of predictive validity can inform instructional decision-making.” Similarly, the IES recommends that a team comprised of individuals with measurement expertise, such as evaluation and research staff, and individuals with math expertise, select the screening and other assessment tools based on the following criteria:

- **Predictive Validity**: An index of how well a score on a screening measure earlier in the year predicts a student’s later mathematics achievement. The IES panel recommends that districts employ measures with predictive validity coefficients of at least 0.60 within a school year;
- **Reliability**: An index of the consistency and precision of a measure. The IES panel recommends that districts use measures with reliability coefficients of .80 or higher; and
- **Efficiency**: How quickly the universal screening measure can be administered, scored, and analyzed for all the students. The IES panel recommends that measures take no more than 20 minutes to administer.

---

63 [1] Ibid.
66 Ibid.
Assessment instruments can either be single-proficiency or multiple-proficiency measures. Single proficiency screening measures assess “discrete aspects of numerical aptitude” and only assess individual early math skills. Districts can administer single proficiency measures quickly and easily, as they are more focused, can be administered in a few minutes, and can be administered to large groups of students for use across an entire school or district. Alternately, multiple proficiency screening measures assess several components of numerical proficiency and provide a composite total score rather than separate scores for separate skills. The IES notes that while the most predictive single measure approaches assess a student’s knowledge of magnitude comparison and strategic counting, some research indicates that multiple proficiency measures are better able to predict students’ future math performance.

**CONTENT**

In addition to sound psychometric characteristics, effective math screening and progress monitoring assessments are based on critical math content and aligned with the grade-level math curriculum and standards. Screening tools should include assessments of both how a student performs relative to other students in a class or grade (relative judgments) and how a student performs relative to grade-level standards (absolute judgments). Screening tools that include only one judgment type may lead to errors in student referral and intervention decisions.

The content for assessment tools should reflect the objectives for a student’s grade level and assess numerical proficiency in accordance with a student’s grade level. The IES recommends that screening tools in the lower elementary grades focus on students’ understanding of whole numbers, while screening tools in the upper elementary grades should focus on students’ understanding of rational numbers, as well as computational proficiency. Numerical proficiency (also known as number sense) is essential for all students, and includes skills such as recognizing numbers, counting, and comparing quantities. Figure 2.2 presents the components of numerical proficiency. Notably, the IES finds that magnitude comparison and strategic counting are two of the most predictive screening measures.

---

**Figure 2.2: Components of Numerical Proficiency**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>DESCRIPTION</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude Comparison</td>
<td>The ability to identify and compare bigger and smaller numbers or amounts. Almost all screening tools use some measure of magnitude comparison.</td>
<td>Showing a picture of a worm and five birds to a student and asking if each bird can have a worm requires the student to make a “gross magnitude judgment.”</td>
</tr>
<tr>
<td>Strategic Counting</td>
<td>Includes: Knowledge of basic counting principles: understanding that changing the order of counting does not affect the quantity but additional and subtraction do; and Counting skills such as correctly using manipulatives (like fingers or objects) to count to a certain number.</td>
<td>When given a group of 5 objects and a group of 3 objects, students can “count on” from 5 (i.e., count 6, 7, 8) to determine the total quantity.</td>
</tr>
<tr>
<td>Retrieval of Basic Arithmetic Facts</td>
<td>The ability to retrieve basic addition and subtraction number combinations without using manipulatives (e.g. counting on one’s fingers). Problems with this ability are common among students with math difficulties or math-related learning disabilities and indicate a problem with semantic memory (i.e. the ability to store and retrieve abstract information).</td>
<td>Mental retrieval of addition/subtraction combinations without using tools.</td>
</tr>
<tr>
<td>Word Problems</td>
<td>Math problems that refer to objects and provide context, rather than number combinations.</td>
<td>Using a story to present an addition problem instead of a numerical equation.</td>
</tr>
<tr>
<td>Numeral Recognition</td>
<td>The ability to understand the naming system used for numbers and math functions. This ability “serves as a gateway skill to formal mathematics.</td>
<td>Recognizing the name “nine” applies to the symbol “9.”</td>
</tr>
</tbody>
</table>

Source: Center on Instruction

**INTERVENTION IMPLEMENTATION AND DELIVERY**

The math intervention strategies described in Section I should be implemented to varying degrees depending on a student’s needs and tier level – with differences in intensity, frequency, and duration. Regardless of the delivery method, effective intervention should follow the instructional practices detailed in Section I, with students assigned to different tiers of intervention intensity depending on their needs.

**IMPLEMENTATION CONSIDERATIONS**

When implementing RtI for math, districts and schools can use an implementation checklist to ensure that math interventions are being implemented effectively and with fidelity. One such checklist (Figure 2.3) describes the essential elements of effective math intervention.

---

75 Figure contents quoted verbatim with modification from: Gersten, Clarke, et al., Op. cit., pp. 5–8.
within the RtI framework, the date by which each element should be completed, who is responsible for implementing each element, what activities will support implementing each element, and an implementation goal for each element. As teachers become more effective at implementing math interventions and student data is tracked, goals should be adjusted.

Figure 2.3: RtI Implementation Checklist

<table>
<thead>
<tr>
<th>CRITICAL ELEMENT</th>
<th>DATE</th>
<th>WHO IS RESPONSIBLE?</th>
<th>ACTIVITY</th>
<th>GOAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics screening system that provides reliable and valid data is chosen and implemented at least three times per year.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics progress monitoring system that provides frequent, reliable, and valid data on student progress is chosen and implemented.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoolwide screening data in mathematics are examined and discussed by teams following screening to evaluate current core programs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>An evidence-based core instructional program in mathematics is implemented with fidelity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evidence-based mathematics interventions for Tiers 2 and 3 are identified, scheduled, and implemented with fidelity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A routine for progress monitoring of students in Tiers 2 and 3 in mathematics is established and data are discussed routinely using data decision rules.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fidelity checks on core mathematics instruction, mathematics enrichment for Tier 1 students, and mathematics intervention for Tier 2 and Tier 3 students are scheduled, completed, and discussed on a frequent basis.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Lembke, Hampton, and Beyers

**MODELS FOR INTERVENTION DELIVERY**

While instructional practices should be consistent, frameworks and models for intervention can vary, reflecting the different ways that schools and districts strategize to increase the intensity or frequency of math instruction. Methods for delivering math interventions and increasing the intensity of the intervention according to a students’ needs include:

- Adjusting the level of instruction;
- Lengthening instructional time;
- Reducing the size of the instructional group and increasing the amount of individualization;

---

76 Figure contents quoted verbatim with modification from: Lembke, Hampton, and Beyers, Op. cit., p. 270.

Increasing the frequency of instructional sessions; and
Providing instruction and support from a more experienced or specialized teacher (e.g., a reading specialist or a special educator).

In the following sections, we discuss these different strategies in turn.

**Increasing Learning Time**

Increasing the amount of time spent teaching and learning math – one of the most common methods for delivering math interventions to struggling students – can effectively improve students’ math achievement. Districts can increase instructional time by increasing the frequency of the intervention, the length of instructional sessions, or the duration of the intervention. For example, a school can increase the frequency of an intervention by providing additional instruction five days per week rather than three days per week. Increasing the length of intervention sessions, such as from 20 minutes to 40 minutes, also intensifies the intervention. However, teachers should monitor student engagement, which can decrease as the length of the session increases, especially for younger students.

For example, with students in Grades K-1, the COI notes that shorter intervention sessions that occur several times a day can more effectively address young students’ interest and attention span. In addition to increasing the length or frequency of the intervention, teachers can also increase an intervention’s intensity by increasing the duration. While some students may only require additional instruction for shorter time spans or specific content areas, some students benefit from interventions that continue over an extended period of time. For example, research shows that students in Grades K-2 benefit from interventions up to 20 weeks long, while older students who are multiple grades behind may need longer interventions.

When designing the scope of an intervention, teachers should consider the frequency, length, and duration that best meet the student’s needs. Variables such as a student’s grade and age, the content, and the student’s progress can affect the frequency, length, and duration. For example, student engagement should be considered. Other variables to consider when choosing the amount of instructional time include:

- How far the student’s achievement level is below grade-level expectations;
- The length and frequency of the previous interventions; and
- The complexity of the learning tasks at hand.

Furthermore, the COI emphasizes that increasing the intervention time should be used to accelerate learning and provide more instruction, not to provide the same amount of

---

79 Ibid.
80 Ibid., p. 23.
81 Bullet points quoted verbatim with modification from: Ibid., p. 25.
instruction over a longer time period.\textsuperscript{82} Whether instructional time is increased via increasing session frequency, length, or duration, teachers can use the additional time to:\textsuperscript{83}

- Teach additional skills and strategies;
- Provide additional practice opportunities with feedback;
- Deliver more explicit, systematic, (step-by-step) instruction; and
- Monitor student progress in the interventions to ensure that the additional learning time increases student mastery of skills.

While research shows that increasing instructional time can improve student achievement, the majority of research has focused on reading rather than math.\textsuperscript{84} One of a small number of math intervention studies, published in the \textit{Elementary School Journal}, used data from the Early Childhood Longitudinal Study- Kindergarten Cohort to determine that an increase in the amount of time spent on math instruction is positively and significantly associated with an increase in student math achievement. While differences between groups and the effect size were small, the researchers note that an increase in instructional time was beneficial for all students, regardless of their initial achievement levels. \textbf{Notably, the researchers found that student engagement had a greater effect on achievement than instructional time.}\textsuperscript{85}

\textbf{Reducing Instructional Group Size}

Many math interventions rely on reducing the size of the instructional group, which increases the amount of individualized instruction a student receives. Instruction can occur in small groups of a few students or one-on-one. Often, as the intervention is intensified, instruction becomes more individualized. The COI cites research that \textit{students receiving instruction in small groups of three to four students make more gains than students in large groups of eight to ten students}, noting that “small groups of two to four students or one-on-one instruction may provide the most intensive intervention and that some students make sufficient progress in larger groups.”\textsuperscript{86}

In addition to small group instruction, research shows that one-on-one tutoring is also effective for assisting students struggling with math. For example, in an article published in the \textit{Journal of Educational Psychology}, researchers conducted an experimental study of the effects of number combination tutoring and word problem tutoring on Grade 3 students with math difficulties, within two urban school districts. Tutoring sessions occurred for 20-30 minutes, three times per week for 16 weeks.\textsuperscript{87} The researchers found that tutored students

---

\textsuperscript{82} Ibid., p. 26.
\textsuperscript{83} Bullet points quoted verbatim with modification from: Ibid.
\textsuperscript{84} Ibid., p. 22.
\textsuperscript{86} Vaughn et al., Op. cit., p. 28.
outperformed control group students who were not tutored, with effect sizes of 0.55 for number combination tutoring and 0.62 for word problem tutoring.\textsuperscript{88}

\textbf{Peer-Assisted Learning and Tutoring}

Peer tutoring and peer-assisted learning, where students work in pairs and alternate the roles of tutor and tutee, can help students struggling with learning math. In a study published in the \textit{Elementary School Journal}, researchers conducted a meta-analysis of 15 studies of math interventions for students with low math achievement. The researchers found that peer-assisted learning was effective at improving students’ math capabilities, especially in computation. Across six studies that implemented peer-assisted learning, the average effect size was 0.62, which is considered moderately strong and represents a nearly two-thirds of a standard deviation improvement for the experimental group compared with the control group.\textsuperscript{89}

Similarly, the Best Evidence Encyclopedia (BEE), a web-based resource funded by the U.S. Department of Education that reviews and rates research on educational interventions, reviewed 87 studies and found strong evidence supporting the effectiveness of peer-assisted learning strategies and class-wide peer tutoring, two programs where students work in pairs.\textsuperscript{90} However, the COI notes that cross-age peer-assisted instruction, where a student in a higher grade tutors a student in a lower grade, can be more effective than within-class tutoring. Students who are very far behind and students with learning disabilities may need additional support than they can receive from a peer in their same grade. The COI analyzed two studies of cross-age peer tutoring and found a mean effect size of 1.02.\textsuperscript{91}

\textbf{Intervention Delivery by RTI Tier}

\textit{Tier 1}

Tier 1 requires delivering a high-quality curriculum to all students as a whole class.\textsuperscript{92} While strategies such as explicit instruction and visuals are delivered to the whole class, implementation often includes differentiating instruction through flexible grouping and peer tutoring.\textsuperscript{93} Experts recommend that teachers ensure they are implementing the curriculum with fidelity by conducting self-checks. Teachers should check that they:

- Provide an objective for the lesson in concrete and measurable terms;

\textsuperscript{88} Ibid., p. 15.
\hspace{1cm}http://www.centeroninstruction.org/files/COI%20SPED%20synopsis.pdf
\textsuperscript{90} “Elementary Mathematics: Top-Rated Programs.” Best Evidence Encyclopedia.
\hspace{1cm}http://www.bestevidence.org/math/elem/top.htm
\textsuperscript{91} Jayanthi, Gersten, and Baker, Op. cit., p. 11.
\textsuperscript{92} Lembke, Hampton, and Beyers, Op. cit., p. 266.
\textsuperscript{93} Ibid.
\textsuperscript{94} Bullet points quoted verbatim with modification from: Ibid.
Provide students a rationale for the strategy that you will be teaching them. Introduce the strategy through modeling;

- Use the strategy with the students with several problems (guided practice);
- Have the students repeat back the steps in the strategy;
- Have students work independently or in pairs to implement the strategy as they work on some problems together;
- Teach for generalization; and
- Teach for maintenance.

Tiers 2 and 3 involve interventions delivered with increased levels of intensity and individualization.

**Tier 2**

Students who struggle with general instruction are provided intervention strategies in Tier 2. Tier 2 intervention is delivered in small groups of students, where instruction can be further differentiated. Students may receive additional instruction using the strategies in Section I for 20- to 40-minute sessions four to five times per week for 10 to 15 weeks. Essential to the implementation of Tier 2 intervention is frequent progress monitoring to determine whether students are responding to the intervention and whether it needs to be increased or adjusted. The NCRTI notes that Tier 2 interventions should be teacher-led, occur in small groups, follow validated intervention strategies, and be implemented with fidelity.

**Tier 3**

Students who do not benefit from the secondary intervention level receive more intensive, individual instruction in Tier 3. In an article on intensive math interventions for elementary students published in *Learning Disabilities Research & Practice*, researchers note that in Tier 3, “mathematics content and pedagogy are substantially different from that delivered at Tiers 1 and 2.” Interventions in Tier 3 provide the instructional strategies described in Section I one-on-one so that instruction is fully individualized and responsive to the student, thus frequent progress monitoring is crucial. The researchers recommend using the Tier 2 program as a platform for developing a Tier 3 intervention, where teachers modify a standard intervention according to progress monitoring data to create fully individualized, intensive instruction. A key strategy here is that teachers and interventionists approach intervention as a problem-solving activity, “modifying” components of the intervention program and

---

99 Ibid.
100 Ibid., p. 183.
continues to employ frequent progress monitoring to evaluate which components enhance the rate of student learning.\textsuperscript{101}

APPENDIX A

EFFECTIVE INSTRUCTIONAL PROGRAMS FOR PURCHASE

The What Works Clearinghouse (WWC) at the U.S. Department of Education regularly reviews research on commercially-developed mathematics intervention programs. Through this assessment process, the WWC identified five elementary math intervention programs for which research meeting the WWC’s strict research design standards find potentially positive effects on student math outcomes (presented in in Figure 2.4 on the following page and below):102

- Odyssey Math
- Everyday Mathematics
- Accelerated Math
- DreamBox Learning
- Saxon Math

The WWC defines a potential positive effectiveness rating as “evidence that the intervention had a positive effect on outcomes with no overriding contrary evidence.”103 The WWC similarly defines the magnitude of effects – the improvement index – as “an indicator of the size of the effect from using the intervention. It is the expected change in percentile rank for an average comparison group student if the student had received the intervention.”104

The WWC categorizes the amount of evidence available as small or medium to large depending on the number of studies that meet WWC evidence standards and the total sample size across the studies.105 Many more programs do not have an effectiveness rating due to a lack of studies that meet WWC standards.

---

### Figure A.1: Math Intervention Programs Reviewed by WWC with Potentially Positive Results

<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>PUBLISHER</th>
<th>DESCRIPTION</th>
<th>AVERAGE PERCENTILE GAIN (IMPROVEMENT INDEX)</th>
<th>EVIDENCE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odyssey Math</td>
<td>Compass Learning</td>
<td>A web-based math instruction program that supports differentiated and data-driven instruction. No longer explicitly available for purchase.</td>
<td>12</td>
<td>Medium to Large</td>
</tr>
<tr>
<td>Everyday Mathematics</td>
<td>University of Chicago School Mathematics Project and McGraw-Hill Education</td>
<td>A math curriculum for students in Grades pre-K–6 that provides students with multiple opportunities to reinforce concepts and practice skills. Focuses on real-life problem solving, student communication of mathematical thinking, and appropriate use of technology.</td>
<td>11</td>
<td>Small</td>
</tr>
<tr>
<td>Accelerated Math</td>
<td>Renaissance Learning</td>
<td>A software tool used to customize assignments and monitor progress in mathematics. Creates individualized assignments that align with state standards and national guidelines, scores student work, and generates formative feedback through reports for teachers and students.</td>
<td>7</td>
<td>Medium to Large</td>
</tr>
<tr>
<td>DreamBox Learning</td>
<td>DreamBox Learning, Inc.</td>
<td>A supplemental online mathematics program for students in grades K–5 that provides adaptive, individualized instruction and focuses on number and operations, place value, and number sense.</td>
<td>4</td>
<td>Small</td>
</tr>
<tr>
<td>Saxon Math</td>
<td>Houghton Mifflin Harcourt</td>
<td>A core curriculum for students in grades K–12 that uses an incremental approach to instruction and assessment. New concepts are introduced gradually and integrated with previously introduced content so that concepts are developed, reviewed, and practiced over time rather than being taught during discrete periods of time, such as in chapters or units.</td>
<td>3</td>
<td>Medium to Large</td>
</tr>
</tbody>
</table>

Source: What Works Clearinghouse

---

**Figure B.1: What Works Clearinghouse’s Levels of Evidence Definitions**

<table>
<thead>
<tr>
<th>LEVEL OF EVIDENCE</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong</strong></td>
<td>Refers to consistent and generalizable evidence that an intervention program causes better outcomes.</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td>Refers either to evidence from studies that allow strong causal conclusions but cannot be generalized with assurance to the population on which a recommendation is focused (perhaps because the findings have not been widely replicated)—or to evidence from studies that are generalizable but have more causal ambiguity than offered by experimental designs (such as statistical models of correlational data or group comparison designs for which the equivalence of the groups at pretest is uncertain).</td>
</tr>
<tr>
<td><strong>Low</strong></td>
<td>Refers to expert opinion based on reasonable extrapolations from research and theory on other topics and evidence from studies that do not meet the standards for moderate or strong evidence.</td>
</tr>
</tbody>
</table>

Source: What Works Clearinghouse

---

112 Figure contents quoted verbatim from: Gersten, Beckmann, et al., Op. cit., p. 1.
PROJECT EVALUATION FORM

Hanover Research is committed to providing a work product that meets or exceeds client expectations. In keeping with that goal, we would like to hear your opinions regarding our reports. Feedback is critically important and serves as the strongest mechanism by which we tailor our research to your organization. When you have had a chance to evaluate this report, please take a moment to fill out the following questionnaire.


CAVEAT

The publisher and authors have used their best efforts in preparing this brief. The publisher and authors make no representations or warranties with respect to the accuracy or completeness of the contents of this brief and specifically disclaim any implied warranties of fitness for a particular purpose. There are no warranties that extend beyond the descriptions contained in this paragraph. No warranty may be created or extended by representatives of Hanover Research or its marketing materials. The accuracy and completeness of the information provided herein and the opinions stated herein are not guaranteed or warranted to produce any particular results, and the advice and strategies contained herein may not be suitable for every client. Neither the publisher nor the authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages. Moreover, Hanover Research is not engaged in rendering legal, accounting, or other professional services. Clients requiring such services are advised to consult an appropriate professional.