Student Assessment

Response to Intervention in Elementary-Middle Math

naesp™ National Association of Elementary School Principals

About NAESP

The mission of the National Association of Elementary School Principals (NAESP) is to lead in the advocacy and support for elementary and middle-level principals and other education leaders in their commitment for all children.

Gail Connelly, *Executive Director*
Michael Schooley, *Deputy Executive Director*

National Association of
Elementary School Principals
1615 Duke Street
Alexandria, Virginia 22314
800-386-2377 or 703-684-3345
www.naesp.org

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About BEST PRACTICES FOR BETTER SCHOOLS™

Best Practices for Better Schools™, an online publications series developed by the National Association of Elementary School Principals, is intended to strengthen the effectiveness of elementary and middle-level principals by providing information and insight about research-based practices and by offering guidance for implementing them in schools. This series of publications is intended to inform discussion, strategies, and implementation, not to imply endorsement of any specific approach by NAESP.

About This White Paper

The content of this issue of Best Practices for Better Schools™ is excerpted with permission from Doing What Works (DWW), a website sponsored by the U.S. Department of Education. The goal of DWW is to create an online library of resources to help principals and other educators implement research-based instructional practice. DWW is led by the Department's Office of Planning, Evaluation & Policy Development (OPEPD), which relies on the Institute of Education Sciences (and occasionally other entities that adhere to standards similar to those of IES) to evaluate and recommend practices that are supported by rigorous research. Much of the DWW content is based on information from IES' What Works Clearinghouse (WWC), which evaluates research on practices and interventions to let the education community know what is likely to work.

NAESP was the only national education association awarded a grant to widely disseminate highlights of best-practice content from the DWW website. Readers are encouraged to visit the website to view all of the resources related to this best practice and to share this online resource with colleagues, teachers, and other educators. No additional permission is required.

NAESP cares about the environment. This white paper is available from NAESP as an online document only. NAESP members and other readers are encouraged to share this document with colleagues.

Deborah Bongiorno, *Editor*
Donna Sicklesmith-Anderson, *Designer*
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Response to Intervention in Elementary-Middle Math

PRINCIPALS KNOW that schools must help all students develop the foundational skills they need to succeed in class and to meet the literacy and mathematics demands of work and college. Response to Intervention (RtI) is a comprehensive early detection, prevention, and support system approach to help students before they fall behind. This white paper outlines implementation of an RtI framework along with these four recommended practices:

- Implement screening and monitoring;

- Focus on foundations of arithmetic;

- Provide intentional teaching;

- Build a systemwide framework.

Summaries of these practices follow.

Screen all students for potential math difficulties and monitor their progress.

The first step in RtI is universal student screening so schools can systematically identify those at risk for math difficulties. Accurate identification of at-risk students requires efficient, reliable, and valid measures of the most important math objectives. Because no one assessment is perfectly reliable, schools are encouraged to use multiple screening measures, including state assessment results. Once students needing intervention have been identified, regular progress monitoring is essential to determine if supplemental instruction is meeting their learning needs or if regrouping is necessary.

ACTIONS

The RtI team evaluates screening measures using reliability, efficiency, and validity criteria.

It is important for the district- or school-level RtI team to evaluate potential screening measures. The team should select efficient, reasonably reliable measures that demonstrate predictive validity. Most importantly, screening instruments should cover critical instructional objectives for each grade. In grades four through eight, state assessment results can be used in combination with a screening instrument to increase the accuracy of decisions about who is at risk.

Implement twice-a-year screening.

Screen students in the beginning and middle of the year to ensure that those at risk are identified and receive intervention services in a timely fashion. Using the same grade-level screening tools across the district facilitates analysis of patterns of results across schools.

Monitor student progress regularly.

Use grade-appropriate general outcome measures to monitor the progress of students receiving Tier two and Tier three interventions and borderline students receiving Tier one instruction at least monthly, and use the data to regroup

Intervention teachers at all grade levels should devote about ten minutes of each session to building fluent retrieval of basic arithmetic facts.

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students when necessary. Curriculum-embedded assessments can be used in interventions as often as daily or as infrequently as every other week to determine whether students are learning from the intervention.

WHAT PRINCIPALS SAY

Principals can see how these actions are implemented in schools by viewing these web-based interviews with teachers and specialists:

Universal Screening in Math

Functions Progress Monitoring

Monitoring Student Progress

Data Team Meeting: Grade Five Math Review

The Power of Data

TOOLS

The following tools and templates are designed to help principals and teachers implement this best practice in their school. Each tool is a downloadable document that principals can adapt to serve their particular needs.

RtI Data Analysis Teaming Process Script: Guidelines for conducting a data team meeting.

Screening and Intervention Record Forms: Screening forms used by RtI data teams to record student performance, goals and skills.

Screening Tools Chart: Chart from the National Center on Response to Intervention identifies screening tools by content area and rates each based on reliability and accuracy.

Screening for Mathematics Difficulties in K-3 Students: Report examining the effectiveness and key components of early screening measures.

Graphing Progress "How-To" Packet: Directions for creating and analyzing student progress graphs.

Data Team Assessment and Planning Worksheet: Worksheet to assess the status of the data team process.

Problem Analysis and Intervention Design Worksheets: Excerpts from training modules to guide teams in data-driven instruction and learning.

The Foundations of Arithmetic: Focus Intervention on Whole and Rational Numbers, Word Problems, and Fact Fluency

In grades K through five, math interventions should focus intensely on in-depth treatment of whole numbers and operations, while grades four through eight should address rational numbers as well as advanced topics in whole number arithmetic, such as long division.

Interventions on solving word problems should include instruction that helps students identify common underlying structures of various problem types. Students can learn to use these structures to categorize problems and determine appropriate solutions for each problem type. Intervention teachers at all grade levels should devote about ten minutes of each session to building fluent retrieval of basic arithmetic facts. Primary-grade students can learn efficient counting-on strategies to improve math fact retrieval, and intermediate and middle-grade students should learn to use their knowledge of properties (e.g., the commutative, associative, and distributive laws) to derive facts in their heads.

Teach students about the structure of various problem types, how to use these structures to categorize problems, and how to determine appropriate solutions for each problem type.

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ACTIONS

Focus kindergarten through fifth-grade interventions on whole numbers.
For kindergarten through grade five students, Tier two and Tier three interventions should focus almost exclusively on properties of whole numbers and operations. Some older students struggling with whole numbers and operations would also benefit from in-depth coverage of these topics.

Focus fourth- through eighth-grade interventions on rational numbers.
Tier two and Tier three interventions in grades four through eight should focus on in-depth coverage of rational numbers and advanced topics in whole number arithmetic, such as long division.

Ensure in-depth coverage of math topics.
Districts should select math curriculum materials that offer an in-depth focus on the essential topics recommended by the National Math Panel. Tier two and Tier three interventions should follow the same in-depth treatment of these topics.

Interventions on solving word problems should include instruction that helps students identify common underlying structures.
Teach students about the structure of various problem types, how to use these structures to categorize problems, and how to determine appropriate solutions for each problem type. Teach students to transfer known solution methods from familiar to unfamiliar problems.

Interventions at all grade levels should devote about ten minutes each session to building fluent retrieval of basic arithmetic facts.
Extensive practice facilitates automatic retrieval. In kindergarten through second grade, explicitly teach students efficient counting-on strategies to improve their retrieval of mathematics facts. Students in grades two through eight should learn how to use properties such as the commutative, associative, and distributive laws to derive facts in their heads.

WHAT PRINCIPALS SAY

Principals can see how these actions are implemented in schools by viewing these web-based interviews with teachers and specialists:

Math Content for Struggling Students

Word Problems

Reteaching Place Value in Tier Two

Content for Tiers Two and Three

Teaching Word Problem Structures

TOOLS

The following tools and templates are designed to help principals and teachers implement these best practices in their school. Each tool is a downloadable document that principals can adapt to serve their particular needs.

K-8 Essential Mathematics Concepts and Skills: Excerpt from the Iowa Core Curriculum reviewing essential skills.

K-7 Essential Mathematics Standards Assessment Form: Assessment form to record and track student progress on math proficiency.

National Mathematics Advisory Panel: Core Principals of Instruction: Fact sheet summarizing the Panel's core findings.

National Mathematics Advisory Panel: K-8 Benchmarks: Recommended standards based on international benchmarks.

RtI in Math for Elementary and Middle Schools: A PowerPoint providing an overview of math instruction recommendations.

Motivation is key for students struggling with math, so it is important to praise effort and engagement to encourage persistence.

Intentional Teaching: Provide Explicit Instruction and Incorporate Visual Representations and Motivational Strategies

Intervention instruction should be explicit and systematic, incorporating models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review. Instructional materials should include examples of easy and difficult problems. Students need guided practice with scaffolding, including opportunities to communicate their problem-solving strategies. Motivation is key for students struggling with math, so it is important to praise effort and engagement to encourage persistence.

Intervention materials should provide students opportunities to work with visual representations of math concepts, and interventionists should be proficient in their use. Tools such as number lines and strip diagrams have many different uses in explanation of mathematical concepts and problem solving. When introducing new concepts to students, it is helpful to begin with concrete experiences, follow up with visual representation, and then move to abstract concepts.

ACTIONS

Tier two and Tier three math instruction should provide clear explanations with thinkalouds.
Explicit teaching begins with the teacher's demonstration and modeling of proficient problem solving with thinkalouds.

Explicit teaching includes guided practice with scaffolding of the required problem-solving steps.
Students need many opportunities to work as a group and communicate their problem-solving strategies for easy and difficult problems. During guided practice, the teacher provides support to enable students to correctly solve problems, gradually withdrawing support as students master problem-solving steps.

Guided practice should include immediate corrective feedback.
Extensive guided practice during Tier two and Tier three instruction allows teachers to provide students with immediate feedback regarding the accuracy and appropriateness of their problem-solving strategies. Feedback should identify accurate understandings and guide students to the correct responses when they have made mistakes.

Use visual representations to explain math concepts.
Intervention materials should provide students opportunities to practice math concepts with visual representations such as number lines, arrays, and strip diagrams. Interventionists should be proficient in the use of visual representations.

Praise student effort and engagement.
Include motivational strategies in Tier two and Tier three interventions, reinforcing students' effort and attention to lessons and rewarding accomplishments. Help students persist by setting goals and charting progress.

WHAT PRINCIPALS SAY

Principals can see how these actions are implemented in schools by viewing these web-based interviews with teachers and specialists:

Explicit Instruction

Visual Representations

Concrete to Abstract Sequence

Organizing for Differentiation in the Core Classroom

Pacing Instruction in Tier Three

Explicit Teaching in the Fifth-Grade Math Core

Districts and schools need leadership and guidance at all levels to support implementation of a multi-tiered system.

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TOOLS

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Concrete-Representational-Abstract (CRA) Instructional Approach Summary Report: A strategy for teaching fractions that includes multiple opportunities for practice at each level

Solving Algebra and Other Story Problems With Simple Diagrams: A strategy for solving problems with visualization methods.

Teaching Students Math Problem-Solving Through Graphic Representations: Examples of visual representation techniques.

Establish a systemwide framework for RtI to support the three recommended practices.

Implementation encompasses the groundwork and support needed to put the recommended practices into action. RtI begins with a systemwide framework that includes universal screening and progress monitoring; content focused on whole numbers in grades kindergarten through fifth and rational numbers in grades four through eight, including word problem structure and daily fact fluency practice; and systematic, explicit teaching incorporating visualizations. Districts and schools need leadership and guidance at all levels to support implementation of a multi-tiered system. State-level teams can inform policy decisions and provide guidance on assessments, instructional resources, and funding allocation. Some states have provided high-level support for RtI implementation through special training or technical assistance centers that are charged with working with local districts and schools. In those cases, district-level teams can access professional development and coaching in RtI implementation. Schools will need to provide extensive training and ongoing support to staff to ensure fidelity and sustain an RtI framework.

ACTIONS

Build a comprehensive framework that addresses reading and mathematics.
The components of an RtI framework are consistent whether or not a district is focusing on reading or math or addressing both subjects at the same time. Components include: universal screening, ongoing progress monitoring, quality core instruction for all students, and a system of tiered interventions to address students' skill needs. When schools take stock of what they already have in place, it is likely that some components of an RtI system are already part of the instructional program—for example, a system of formative assessments for monitoring progress. Districts and schools will take different paths to building out an RtI framework depending on what is already working well and what components they need to develop. Implementation will involve cooperation among school personnel at many levels so it is a good idea to create a leadership team that includes representatives from special education, services to English learners, subject matter and assessment specialists, and classroom teachers. Full implementation of an RtI framework usually requires several years.

Establish core mathematics instructional programs focused on foundational skills.
Once schools have established a core curriculum aligned with state and district standards, they can choose intervention programs that are compatible with the core program and then provide intensive small-group or individualized instruction.

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Alignment with the core program is not as critical as ensuring that tiered instruction is systematic, explicit, and focuses on high priority mathematics skills.

Create leadership teams in districts and schools to facilitate implementation of RtI components.

Leadership teams are responsible for building the infrastructure to support an effective RtI framework. District teams are able to provide guidance to schools in evaluating and selecting core programs and assessment measures, managing data collection and reporting, and coordinating professional development opportunities and instructional resources across schools. Building-level teams facilitate direct implementation of the key components by coordinating staff and resources, scheduling and other logistics, and guiding teacher teams in using data and providing interventions at the students' level of need.

Provide professional development and instructional supports to sustain high-quality implementation.

Staff members will require adequate training and support to successfully implement recommended practices. Districts can work with regional and state networks to bring external opportunities for training and technical assistance to schools. At the building level, coaches and specialists can provide staff development, ongoing classroom support, and collaborative experiences to advance teachers' skills in implementing RtI components.

WHAT PRINCIPALS SAY

Principals can see how these actions are implemented in schools by viewing these web-based interviews with teachers and specialists:

How RtI Changes Special Education

The Phases of RtI Implementation

Partnering General and Special Education

State Leadership: Building an RtI System

Setting the Stage for RtI Implementation

Lessons From Iowa About RtI

RtI Training for School Districts

Principal's Role in Instructional Decision Making

Charting the Path

Powerful RtI Training Experiences

TOOLS

The following tools and templates are designed to help principals and teachers implement these best practices in their school. Each tool is a downloadable document that principals can adapt to serve their particular needs.

RtI Self-Assessment Tool for Elementary Schools: Tool that assesses ten readiness categories for implementing an RtI framework.

Scaling-Up Instruction and Technical Assistance Briefs: Framework for developing capacity to make statewide use of evidence-based practice.

Funding Considerations for Implementing RtI: Guide from the Pennsylvania Department of Education with potential funding sources for specific RtI components.

Professional Development Continuum: Training continuum for staff on RtI components, from beginning to advanced level.

District Implementation Tracking Plan: A resource from Oregon to prepare districts as they implement RtI.

RtI Implementation Self-Report: A form for reporting the status of implementation across ten effectiveness indicators.

To ensure that math instruction gets the attention it deserves, principals have access to solutions through NAESP and DWW.

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RtI Comprehensive Evaluation Tool: Tool from Colorado to evaluate RtI components and continuing needs.

Progress Monitoring Training Plan: A plan for training staff on the principles of progress-monitoring and implementation.

RtI Parent Guides: Guide and a brochure describing the RtI framework to parents.

Conclusion

Good math instruction is built on screening and monitoring of students, teaching the foundations of arithmetic, and practicing intentional teaching. These three practices are, in turn, supported by the Response to Intervention (RtI) approach, which is dedicated to helping students before they fall behind. To ensure that math instruction gets the attention it deserves, principals have access to solutions through NAESP and the DWW website. These solutions are based on solid research and the best thinking currently available in the field. As more white papers in NAESP's Best Practices for Better Schools™ series are developed, principals will continue to find help in addressing critical issues in elementary and middle school education.

SITE PROFILES

Cornell Elementary School (Iowa): RtI has been evolving at Cornell Elementary over the last 15 years.

Durham Elementary School (Oregon): Durham Elementary's key to success is its strong building-level leadership team.

Tri-Community Elementary School (Pennsylvania): Tri-Community's RtI framework has helped foster school turnaround.

John Wash Elementary School (California): John Wash Elementary's framework involves a three-tiered pyramid of instruction and intervention.

Related Links

The Access Center: Resources to enhance students with disabilities' access to general education, including these reports:

- Concrete-Representational-Abstract (CRA) Instructional Approach

- Direct or Explicit Instruction and Mathematics

- Strategy/Implicit Instruction and Mathematics

Center on Instruction (COI): Funded by the U.S. Department of Education, this research hub offers free resources, including:

- Curriculum-Based Measurement in Mathematics: An Evidence-Based Formative Assessment Procedure (PDF)

- Early Mathematics Assessment (Power-Point)

- Pre-Algebra and Algebra Instruction and Assessments (PowerPoint)

Center on Instruction, continued

- Principles of Effective Assessment for Screening and Progress Monitoring (PowerPoint)

- Progress Monitoring for Elementary Mathematics

- Screening for Mathematics Difficulties in K-3 Students (PDF)

Council for Exceptional Children (CEC): Instructional Support Teams Help Sustain Responsive Instruction Frameworks

IDEA Partnership: Response to Intervention Collection: Library of tools, partnership briefs and dialogue guides.

Institute of Education Sciences (U.S. Department of Education): Organizing Instruction and Study to Improve Student Learning (PDF)

Iowa Heartland Area Education Agency (AEA): IDM—How to Get Started and Instructional Decision Making (IDM)

The IRIS Center: A national center devoted to providing free, online interactive training enhancements for educators working with students with disabilities.

Math Forum: Mathematics and Motivation—An Annotated Bibliography

MathVids: Instructional strategies, teaching plans and videos for educators working with struggling math students.

National Association of State Directors of Special Education (NASDSE): RtI Project

National Council of Teachers of Mathematics: The Council's Illuminations library provides hundreds of online activities and lessons for educators.

National Center on Response to Intervention (NCRtI): Housed at the American Institute for Research, the Center provides technical assistance to states and districts for building capacity for RtI implementation.

National Center on Student Progress Monitoring: Math Web Resources Library: Downloadable articles, PowerPoints, FAQs and links to additional resources on student monitoring.

National Research Center on Learning Disabilities (NRCLD): Effective Mathematics Instruction

Oregon Response to Intervention Project (OrRTI): How the EBIS/RTI Process Works in Elementary Schools (PDF)

Pennsylvania Training and Technical Assistance Network (PaTTAN): Materials to build capacity of education agencies serving special education students.

RTI Action Network: An organization devoted to guiding educators to RtI implementation.

TeachingLD: Teaching How To's—Math and Teaching Students Math Problem-Solving Through Graphic Representations (PDF)

U.S. Department of Education (USDE): Implementing RTI Using Title I, Title III, and CEIS Funds—Key Issues for Decision-Makers Response to Intervention Framework in Mathematics (PDF)