Secondary Mathematics: Case Study Analysis and Data Teaming Processes

2013 RTII Implementers' Forum

Going the Distance from Implementation to Sustainability

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Topics for this session

- The 8 core principles of an effective RTII model:
  - Belief System
  - Instruction
  - Interventions
- Recommendations for effective instructional practices for secondary students who have disabilities or struggle in math within an RTII Framework
- How to use explicit instruction to improve learning outcomes as recommended by the National Mathematics Advisory Panel and the IES RTI Practice Guide Critical features of classroom interventions for both large and small groups.
- The importance of scaffolding student learning of essential mathematical concepts and skills.
  - Content Scaffolding the Process of Problem Solving
  - Interleave Worked Solution Strategy (IWSS)

The Mathematical Challenges

- Success in mathematics is linked to graduation, higher education, and employment (Alderman, 1999; NMAP, 2008; NCTM 2010)
- National Mathematics Advisory Panel (2008) emphasize mastery of Algebra by high school and importance of pre-requisite to Algebra skills such as rational numbers (e.g., fractions)
- NEAP 8th grade assessment: 30% of the questions cover Algebra content, and an additional 20% of the questions are on number properties and operations (NAEP, 2009)
- Need for effective instruction (NMAP, 2008)

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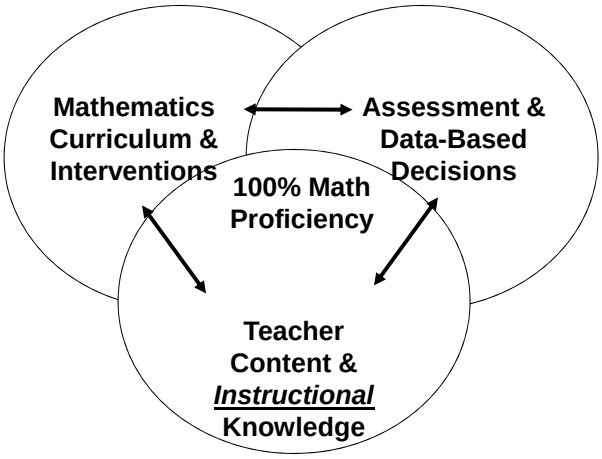
The Mathematical Challenges

Translated to Real World Performance

- 78% of adults cannot explain how to compute interest paid on a loan
- 71% cannot calculate miles per gallon
- 58% cannot calculate a 10% tip

Essential Elements of Effective RTII Framework for Mathematics

(Riccomini & Witzel, 2010)



IES RtI Recommendations for Mathematics

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Guiding Principles (Riccomini & Witzel, 2010)

1. Belief System
2. Universal Screening
3. Progress Monitoring
4. Instructional Tiers
5. Research-Based Interventions
6. Data Based Decisions
7. Refinement Procedures
8. Ongoing High Quality Mathematics Focused PD

#1 Belief System

Four Core Beliefs

1. All Students can be Mathematically Proficient
2. All Students need a High-Quality Mathematics Program
3. Effective Mathematics Programs must teach conceptual understanding, computational fluency, factual knowledge, and problem solving skills
4. Effective Instruction Matters and Significantly Impacts Student learning

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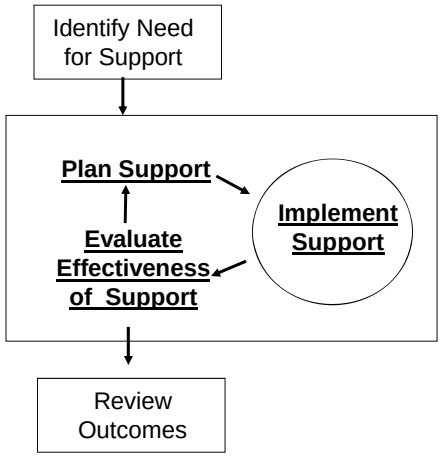
Instructional Tiers

- **Tier 3 –** additional instruction should be given to students who do not benefit from tier 2. Interventions should be delivered 1:1 or in small groups and should include specialized personnel.
- **Tier 2 –** additional instruction should be given to students who demonstrate weak progress. Interventions typically take 20-40 minutes per day, 4-5 times per week.
- **Tier 1** – high quality instruction and universal screening. High quality has a broad meaning. However, it means that at least 80% of your students are achieving on grade level.

Instructional Tiers



Modified from Dynamic Measurement Group General Outcome Model

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CORE Mathematics Instruction

- Standards Based Classroom
  - Common Core State Standards
- Include ***explicit*** and ***inquiry based instruction***
- Standards-based mathematics teaching and learning is a cooperative effort by teachers and students to actively engage in ***purposeful learning experiences*** that stimulate curiosity, enjoyment, and deep understanding of the mathematical concepts.
- Teachers and students are ***knowledgeable about learning objectives***, and have ownership of and are accountable for learning outcomes.

#3 Instructional Support System

- **Core Instruction:** Core curriculum
- **Strategic instructional support**: Additional intervention
  - Extra practice
  - Adaptations of core curriculum
  - Supplementary curriculum/program
- **Intensive instructional support:** Substantial intervention
  - Focused, explicit instruction
  - with supplementary curriculum/program
  - Individual instruction or interventions
  - Core Replacement

Adapted Dynamic Measurement Group

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Standards Based Classroom

Daily Lesson Breakdown

1. Fluency Practice
2. Review Standards & Vocabulary
3. Mini Lesson-Whole Class Instruction
4. Work Sessions- Flexible Grouping and Small Group Intervention
5. Closure & Sharing

Breakout Activity (Handout 1)

Mathematics Instructional and Intervention Needs Assessment

- Complete the needs assessment individually and then discuss with your team members
- Identify areas of strengths and areas of weaknesses

District	Respond to these questions	Yes	No	Comment
Core Program Effectiveness	Are there concerns with scores and growth among subgroup populations (AYP)?			
	Are all teachers fully versed in the standards required at each grade level?			
Instructional Supports	Do students who are struggling in math receive more instructional support? Is there a district wide intervention?			
School	**Respond to these questions**	**Yes**	**No**	**Comment**
Effectiveness	Do scores vary widely within a classroom?			
	Do scores vary widely between classes and teachers?			
Integrity	Do classes vary widely in instructional delivery?			
	Are there curriculum variations between teachers and classes?			
Content	Are all math teachers knowledgeable on standards? Equal emphasis of conceptual and procedural knowledge?			
Informed Instruction	Is there an ongoing assessment to monitor student progress on end of year goals?			
	Do all teachers use results of assessments throughout the year to inform instruction and guide instructional changes?			
Differentiated Instruction	How much emphasis is placed on differentiated instruction on a regular basis? Is it documented? How? Monitored? Is it based on NMAP and IES Recommendations?			
	Which one(s) of the following strategies are used on a regular basis: 1. Increased Instructional Time 2. Instructional Scaffolding 3. Fluency & Automaticity Strategies 4. Flexible Grouping 5. Small group interventions 6. Retention Strategies			

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Components of Instruction & Intervention

1. Begin a lesson with a short review of previous learning
2. Present new information in small steps, with student practice after each step
3. Ask a large number of questions and check the responses of all students
4. Provide models
5. Guide student practice
6. Check for student understanding
7. Obtain a high success rate
8. Provide scaffolds for difficult tasks
9. Require and monitor independent practice
10. Engage students in weekly and monthly review

(Rosenshine, 2012, p.12)

Two Instructional Strategies

1. Instructional Scaffolding
   - Content Progression for Algebraic Problem Solving
2. Interleave Worked Solution Strategy
   - Multiple Step Algebra Problems

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Instructional Scaffolding

Instructional scaffolding is a process in which a teacher adds supports for students to enhance learning and aid in the mastery of tasks.

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SCAFFOLDED PROGRESSION

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Instructional Scaffolding

- **Content Scaffolding**
  - the teacher selects content that is ***not distracting*** (i.e., too difficult or unfamiliar) for students when learning a new skill.
  - allows students to ***focus on the skill being taught***, without getting stuck or bogged down in the content
- 3 Techniques for Content Scaffolding
  - Use Familiar or Highly Interesting Content
  - Use Easy Content
  - Start With the Easy Steps

Instructional Scaffolding

- **Math Word Problems Strategy Instruction**
  - Remove irrelevant information
  - Include answer in the problem (i.e., no question)
  - Allows students to focus in process of strategy
- For example:
  - **Robert planted an oak seedling. It grew 10 inches the first year. Every year after it grew 1 ¼ inches. How tall was the oak tree after 9 years?**

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Instructional Scaffolding

- **Math Word Problems Strategy Instruction**
  - Remove irrelevant information
  - Include answer in the problem (i.e., no question)
  - Allows students to focus in process of strategy
- For example (Handout #2):
  - Robert planted an oak seedling. It grew 10 inches the first year. Every year after it grew 1 ¼ inches. How tall was the oak tree after 9 years?
  - **An oak seedling grew 10 inches in the first year. Every year after it grew 1 inch. After 9 years the oak tree was 18 inches tall.**

Instructional Scaffolding

- Write a number sentence for the word problem:
  - An oak seedling grew 10 inches in the first year. Every year after it grew 1 inch. After 9 years the oak tree was 18 inches tall.

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Instructional Scaffolding

- Write a number sentence for the word problem
  - An oak seedling grew 25 feet in the first year. Every year after it grew 5 feet. After 4 years the oak tree was 40 feet tall.

Instructional Scaffolding

- Now solve this problem
  - An oak seedling grew 4 meters in the first year. Every year after it grew 2 meters. After 7 years, how tall was the oak tree?

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Interleave Worked Solution Strategy

- Interleave worked example solutions and problem-solving exercise
- Literally, alternate between worked examples demonstrating one possible solution path and problems that the student is asked to solve independently
- This can markedly enhances student learning

IES Practice Guide, (2007, September)

Interleave Worked Solution Strategy

- Typical Math Homework assignment
  - Pg. 155 #1-21 odd
- Students are required to solve all problems.

Solve $5 + 3x = 20$ for x

IES Practice Guide, (2007, September)

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Interleave Worked Solution Strategy

- Interleaved Homework assignment
  - Pg 155 1-10 (all)
  - Odd problems

Below is an example solution to the problem:

"Solve $12 + 2x = 15$ for x"

Study each step in this solution, so that you can better solve the next problem on your own:

$$12 + 2x = 15$$
$$2x = 15-12$$
$$2x = 3$$
$$x = 3/2$$
$$x = 1.5$$

Interleave Worked Solution Strategy

- **Other considerations:**
  1. The amount of guidance an annotation accompanying the worked out examples varies depending on the situation
  2. Gradually fade examples into problems by giving early steps in a problem and requiring students to solve more of the later steps
  3. Use examples and problems that involve greater variability from one example or problem to the next
     - Changing both values included in the problem and the problem formats.

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Interleave Worked Solution Strategy

- **During Whole Class instruction**
  1. Start off discussion around an already solved problem
     - Pointing out critical features of the problem solution
  2. After discussion have students pair off in small groups or work individually to solve a problem (JUST ONE!) on their own
  3. Then back to studying an example, maybe one students present their solutions and have others attempt to explain
  4. Then after studying the solved example, students are given another problem to try on their own.

IES Practice Guide, (2007, September)

IWSS Example #1 Distributive Property

Example 2:

Problem: 24 + 36

12 is the GCF

(24 ÷ **12**) + (36 ÷ **12**)

(24 ÷ 12) + (36 ÷ 12)

12 (2) + (3)

Final Answer: 12 (2 + 3)

Check: 24 + 36 = 12 (2 + 3)

60 = 12 (5)

60 = 60 √correct

Now, you try (use examples for guidance):

1. 49 + 63

GCF = 7

(49 ÷ 7) + (63 ÷ 7)

7(7 + 9)

2. 18 + 81

3. 15 + 35

4. 25 + 80

GCF = 5

(25 ÷ 5) + (80 ÷ 5)

5 (____ + ____)

5. 92 + 42

6. 39 + 45

7. 88 + 32

GCF = _____

(88 ÷ ____) + (32 ÷ ____)

_____ (_____ + _____)

8. 72 + 27

9. 64 + 48

10. 56 + 21

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IWSS Example #2
Distributive Property

Own Your Own: Use distributive property to rewrite each expression.
(*Remember: express each sum with a common factor as a multiple of a sum of two whole numbers with no common factor.*)

1. 14 + 38 — GCF = 2; (14 ÷ 2) + (38 ÷ 2); 2 (7 + 19)
2. 42 + 60 — GCF = 6; (____ ÷ 6) + (____ ÷ 6); 6(_____ + _____)
3. 99 + 44 — GCF = 11; (99 ÷ 11) + (44 ÷ 11); 11 (9 + 4)
4. 64 + 24 — GCF = 8; (____ ÷ 8) + (____ ÷ 8); 4(_____ + _____)
5. 36 + 84 — GCF = ; (____ ÷ __) + (__ ÷ __); (_____ + _____)
6. 66 + 42 — GCF = ; (____ ÷ __) + (__ ÷ __); (_____ + _____)
7. 72 + 16
8. 25 + 70
9. 54 + 24
10. 100 + 4

11. **What if...(*think a little more*)**

I had the problem 2x + 3x? What would be the greatest common factor? Two and three are both prime, so the only factor they have in common is _____.

(True or False) Using the distributive property, **I** could rewrite **2x + 3x = x(2+3).**

12. **What if...(think a little harder)**

YOU had the problem 4y + 6y? The greatest common factor would be 2y. If you use the distributive property, you could rewrite 4y + 6y = 2y (_____ + _____)

Instructional Scaffolding

Key Information

- 3 Types of Scaffolding (Task, Materials, and Content)
- Scaffolding Instruction can help students better focus on the problem solving process
- Many Different ways to scaffold student learning
- Scaffolding is a necessity for students with disabilities

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Questions

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