From Research to Classroom Practice: A Collaborative Partnership for Implementing Cognitive Based High-Impact Math Strategies

The Palmetto Education Summit
June 15-17, 2026

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Candace Lane & Marie Holden, Horry County Schools

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Session Focus

- Introductions
- Horry County Schools Background
- Goal: Moving evidence-based cognitive strategies from professional development into consistent classroom practice.
- Forming the Partnership
- 3 Step Process
  - Step 1: Professional Development
    - Interleaving Practice
    - Worked Solution Strategy
  - Step 2: In-district School Level Planning
  - Step 3: External Coaching and Debriefing
- Lessons Learned
- Summary and Questions

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Horry County Schools

-Our Route to Greatness-

Seeking Solutions that stick and

Expertise that sparks change

- Hello Dr. Riccomini-HIIT the spot
  - September 4-5 Professional Development
  - Selected Targeted Schools for Coaching
  - Side by Side Coaching
  - Built capacity

Math Project #risewithreasoning

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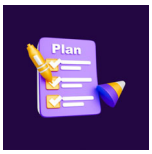
3 Step Process



The Plan

1. **Professional Development focused on Cognitive Based Instructional Practices**
   - **HIIT-4-Math**
2. **In-District School Level Planning**
   - **Math Coaches, Teachers, Principals, and District Supervisors**
3. **Supporting teachers through Classroom Coaching & Debriefing Sessions**
   - Teachers coached on their use of the techniques

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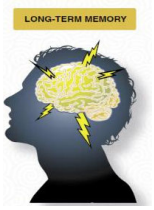
Cognitive Based Strategies

Step 1: PD focused on HIIT-4-Math

1. **Interleaving Practice – Boost retention**
   - Interleaving of skills vs blocking of skills



2. **Worked Solution Strategy- Support Reasoning**
   - Solving a problem versus interacting with a solution

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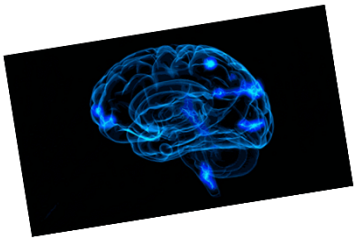
Meta-Analyses: How Good is IPF?

Hattie's Categories Visible Learning - Influences (visiblelearningmetax.com)	ES
Task Analysis	1.29
Mathematics Problem Solving	1.16
Mnemonics	0.80
Problem Solving Strategies	0.67
Math Direct-Guided Learning	0.61
Meta-cognitive strategies	0.60
Direct Instruction	0.59
Skill-Focused Content	0.58
Explicit Instruction	0.57
Setting Clear Goals	0.51
Interleaving Mixed Practice	0.44
Advance Organizers	0.42
Fully Worked Examples	0.37



Hattie, 2024:
https://www.visiblelearningmetax.com/Influences

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How are Learner Characteristics?

- **Strategic Learners**
  - Able to **analyze a problem** and develop a plan
  - Able to **organize multiple goals** and **switch flexibly** from simple to more complicated goals
  - Access their **background knowledge** and apply it to novel tasks
  - Develop new **organizational or procedural strategies** as the task becomes more complex
  - Use effective **self-regulated strategies** while completing a task
- **Non-Strategic Learners**
  - **Unorganized**, **impulsive**, unaware of where to begin an assignment
  - **Unaware of possible steps** to break the problem into a **manageable task**
  - **Exhibit problems with memory**
  - **Unable to focus** on a task
  - **Lack persistence**
  - Easily frustrated and **lacking persistence**

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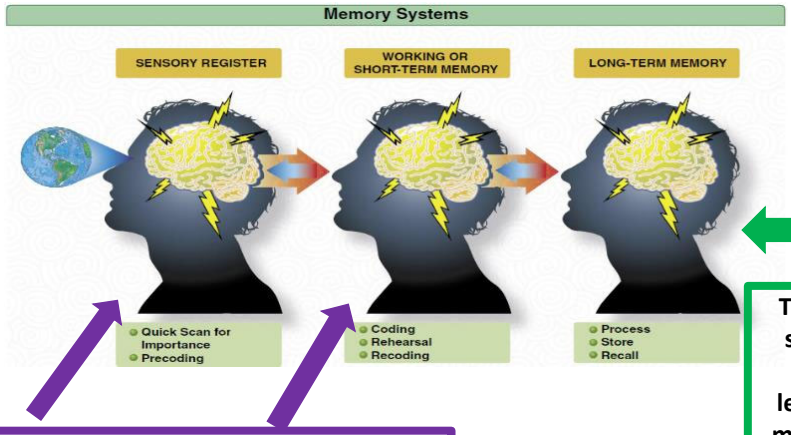
Cognitive Process of Learning



The cognitive process of supporting RETENTION (BACK END) heavily leverages the Long-Term memory part of the brain

The cognitive process of Initial learning (FRONT END) heavily leverages the Sensory Register and Working memory parts of the brain

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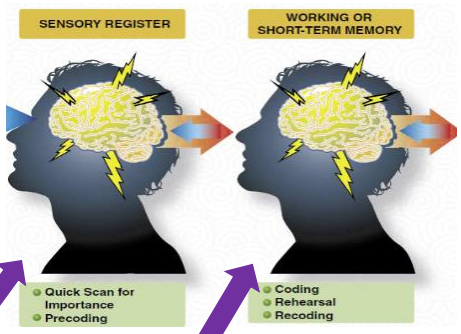
Cognitive Process of Learning

Vocabulary Development
Plays an essential role on the front end of learning and crucial for conceptual and procedural understanding



Fluency & Automaticity
Developing Fluency & Automaticity **off loads** working memory to better allow students to problem solve, reason, and understand.

Instructional Scaffolding through the Worked Solution Strategy
Techniques that off loads working memory to better allow students to problem solve, reason, and understand.

The cognitive process of Initial learning (FRONT END) heavily leverages the Sensory Register and Working memory parts of the brain

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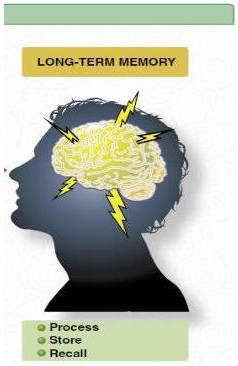
Cognitive Process of Learning

Activities that help students remember previously learned information must be designed to repeatedly engage the brain's long-term memory systems.



Activities must be designed in a way that requires students to RETRIEVE information REPEATEDLY

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How Fast do "WE" Forget?

- Learning loss happens much faster than most educators realize—students can forget up to 80% of what they've learned within just 10 days.
- This rapid decline is especially concerning for students with disabilities.
- To slow this decay, we need to incorporate more **purposeful and carefully designed practice**.
- By doing so, **teachers can flatten the forgetting curve** and significantly boost long-term retention.

Forgetting Curve

Ebbinghaus, 1885

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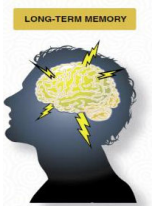
How do I Boost Retention?

What are the Key Mechanisms for Retention Activities?

1. **Interleaving Practice** – Sequencing of Problems
   – Interleaving of skills vs blocking of skills
2. **Practice Test Retrieval** - Free Recall paired with feedback
   – Regular and consistent recall without assistance paired with feedback in low stakes activities
3. **Spaced Learning Over Time** - Windows of Time
   – Purposeful spacing for revisiting content is critical



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How do I Boost my Students' Retention?

What is the purpose of Practice?

- Identifying the "purpose" of a practice activity is critical to achieving the desired outcome
- Focus on the **PURPOSE** of practice in both core and intervention.
  - Is the purpose acquisition…or initial learning?
  - **Is the purpose retention…cumulative review?**
  - Is the purpose to build fluency and/or automaticity?
  - Is the purpose to promote generalization?
- Different practice activities have different purposes

Flatten the Curve

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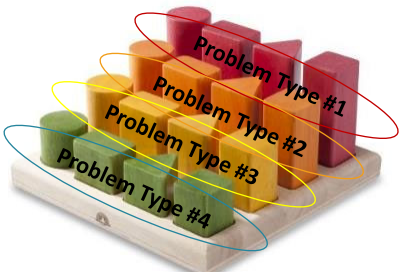
What is Blocked Practice?

BLOCKED (MASS) Structure:

- Problems of the same type are sequenced consecutively
  - aaaaaaaaaaaaaaaaaa
  - aaaa, bbbb, cccc, dddd

- **Purpose:**
  - Promotes initial acquisition of understanding and accuracy

- **IMPORTANCE:**
  - Initially VERY IMPORTANT



Blocked Practice =

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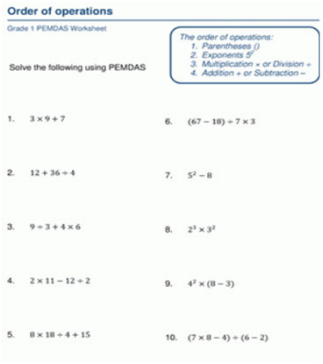
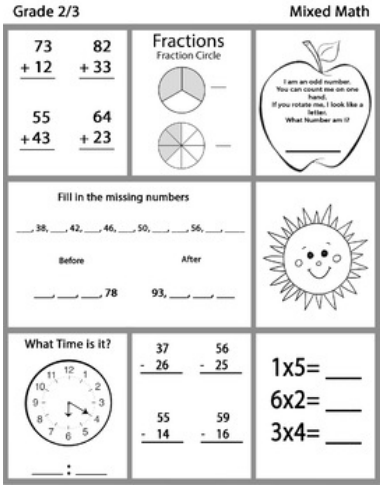
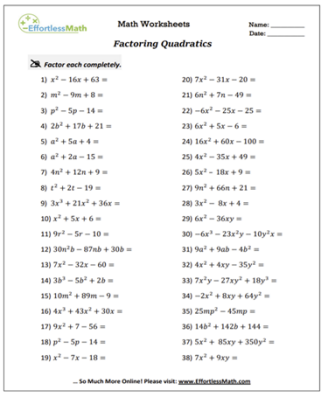
What does Blocked Practice Look Like?

90% of practice follows a blocked structure

Rohrer et al., 2020







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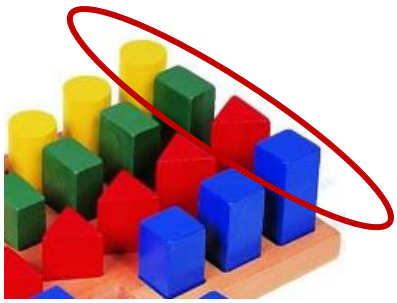
Interleaving Practice Format

Interleaving Practice Format (IPF):

- Problems of the same type are sequenced in a mixed format (NOT Consecutively)
- Abc abc abc
- Abcd, abcd, abcd

- **Purpose:**
  - Promotes long term **RETENTION** (DURABLE LEARNING)

- **IMPORTANCE:**
  - VITAL
  - Rarely occurs



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What does IPF look like?

1) How long is the pencil?

_____ centimeters

2) Is 57 greater than (>) or less than (<) 118?

57 ☐ 118

3) Solve the problem.

32+5= _____

4) How long is the scissors?

_____ inches

5) Is 22 greater than (>) or less than (<) 18?

22 ☐ 18

6) Solve the problem.

12+15= _____

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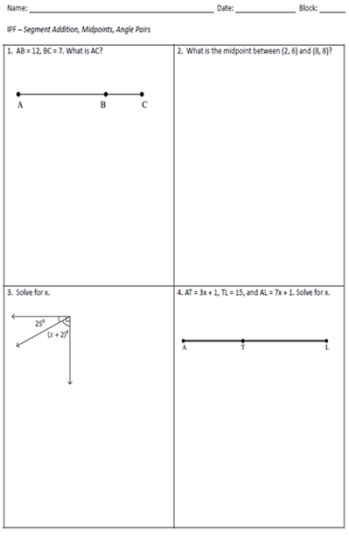
What does IPF look like?


Name: _____ Date: _____ Block: _____

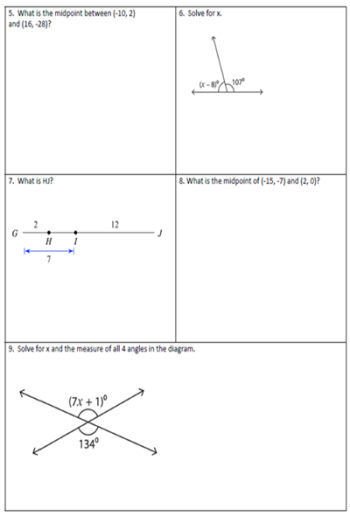
IPF – Segment Addition, Midpoints, Angle Pairs

1. AB = 12, BC = 7. What is AC?

2. What is the midpoint between (2, 6) and (8, 8)?

3. Solve for x.

4. AT = 3x + 1, TL = 15, and AL = 7x + 1. Solve for x.


5. What is the midpoint between (-10, 2) and (16, -28)?

6. Solve for x.

7. What is HJ?

8. What is the midpoint of (-15, -7) and (2, 0)?

9. Solve for x and the measure of all 4 angles in the diagram.

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Why is the Worked Solution Strategy Effective?

Discuss the following Questions:

- Why does embedding worked solutions in an alternating format improve learning?
- How does seeing a worked solution make practice activities more effective for students?
- In what ways does interacting with a worked example strengthen students' mathematical reasoning?

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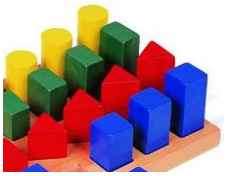
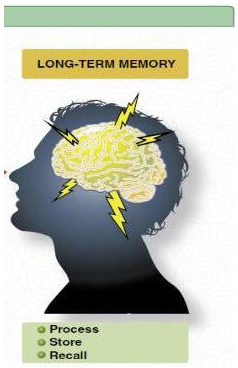
Cognitive Process of Learning

Interleaving practice results in repeated retrieval throughout the entire practice activity





Activities must be designed in a way that requires students to <u>RETRIEVE</u> information <u>REPEATEDLY</u>

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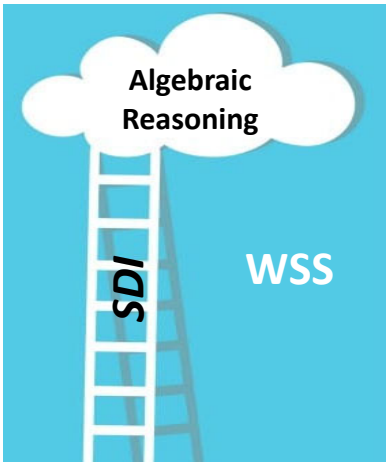
What is an Instructional Scaffold?

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

- Worked Solution Strategy (WSS)



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What is the Worked Solution Strategy?

A worked solution is a **teacher-provided**, **fully or partially solved** problem designed for students to **engage with through a purposeful activity** that highlights both the ***what* and the *why*** behind the solution.

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What is the Worked Solution Strategy?

- To strengthen learning, **ALTERNATE** **worked examples with unsolved problems** during instruction:
  - This means alternating between showing students a worked example (demonstrating one possible solution path) and giving them a similar problem to solve.
  - This approach significantly improves students' **engagement** and **mathematical reasoning and mathematical thinking**.

What is the Worked Solution Strategy?

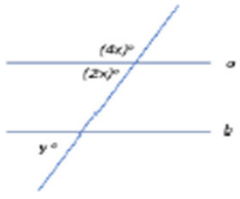
Typical practice consists of students solving unsolved problems.

- Pg. 155 #1-21 odd
- Complete the worksheet
- Computer practice
- Work with a partner
- Games

Students are solving unsolved problems

Problem

Lines a and b are parallel.
Find the values for x and y.



Riccomini & Morano, 2025

What is the Worked Solution Strategy?

Worked Solution activities means:

- Every other problem is solved for the student
- Students are told to study the solutions it will help you solve the next problem—focus on the What and why

Problem	Solution Steps Provided
Lines a and b are parallel. Find the values for x and y. 	$4x + 2x = 180^o$ $6x = 180^o$ $x = 30^o$ $y = 2x$ $y = 2(30^o)$ $y = 60^o$ Answer: $x = 30^o$ and $y = 60^o$

Riccomini & Morano, 2025

Why is the Worked Solution Strategy Effective?

When students **interact with solutions** focusing on the process (what and why) before attempting to solve a problem from start to finish learning is enhanced.

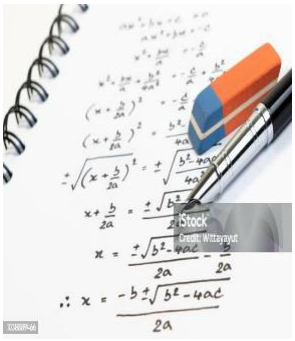
- Interacting with a worked solution **off loads working memory** and supports a **higher-level processing** of mathematical concepts and processes.

- Interacting with a solution prompts, supports, and/or encourages **self-explanation**

How do I Develop WSS Activities?

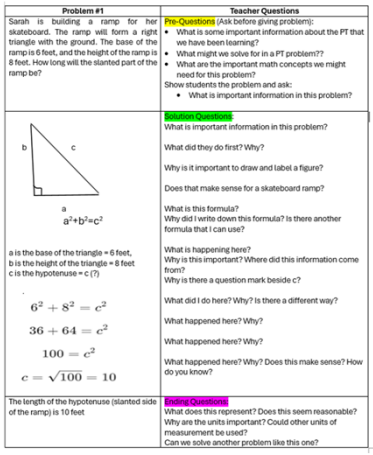
6 Steps to Developing WSS Activities

Step 1: Select Problem
Step 2: Pre-Questioning
Step 3: Solve Problem
Step 4: Solution Questions
Step 5: Answer/Solution
Step 6: Ending Questionings



Worked Solution Activity

Teacher Materials

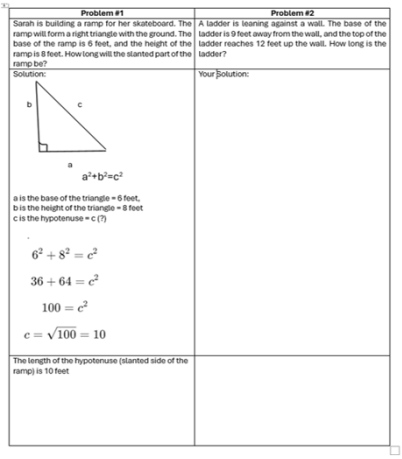


Problem #1	Teacher Questions
Sarah is building a ramp for her skateboard. The ramp will form a right triangle with the ground. The base of the ramp is 6 feet, and the height of the ramp is 8 feet. How long will the slanted part of the ramp be?	Pre-Questions (Ask before giving problem): • What is some important information about the PT that we have been learning? • What might we solve for in a PT problem?? • What are the important math concepts we might need for this problem? Show students the problem and ask: • What is important information in this problem?
b c a $a^2+b^2=c^2$ a is the base of the triangle = 6 feet, b is the height of the triangle = 8 feet c is the hypotenuse = c (?) $6^2+8^2=c^2$ $36+64=c^2$ $100=c^2$ $c=\sqrt{100}=10$	Solution Questions What is important information in this problem? What did they do first? Why? Why is it important to draw and label a figure? Does that make sense for a skateboard ramp? What is this formula? Why did I write down this formula? Is there another formula that I can use? What is happening here? Why is this important? Where did this information come from? Why is there a question mark beside c? What did I do here? Why? Is there a different way? What happened here? Why? What happened here? Why? What happened here? Why? Does this make sense? How do you know?
The length of the hypotenuse (slanted side of the ramp) is 10 feet	Ending Questions What does this represent? Does this seem reasonable? Why are the units important? Could other units of measurement be used? Can we solve another problem like this one?

Teachers guide students through a series of questions about the solution.

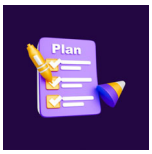
- Teacher you will ask your student Pre-questions, Solution question, and ending questions.
- Student, you will use the solution to answer the teacher questions

Student Materials



Problem #1	Problem #2
Sarah is building a ramp for her skateboard. The ramp will form a right triangle with the ground. The base of the ramp is 6 feet, and the height of the ramp is 8 feet. How long will the slanted part of the ramp be?	A ladder is leaning against a wall. The base of the ladder is 9 feet away from the wall, and the top of the ladder reaches 12 feet up the wall. How long is the ladder?
Solution: b c a $a^2+b^2=c^2$ a is the base of the triangle = 6 feet, b is the height of the triangle = 8 feet c is the hypotenuse = c (?) $6^2+8^2=c^2$ $36+64=c^2$ $100=c^2$ $c=\sqrt{100}=10$	Your Solution:
The length of the hypotenuse (slanted side of the ramp) is 10 feet	

3 Step Process



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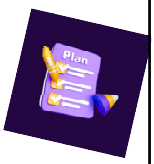
Step 2: In-District School Level Planning

School Teams Accountability, Support, Follow Up, and Feedback: Prior to Coaching Visits

- IPF
  - School teams designed an implementation plan for IPF
  - PLC's were designed for ongoing teacher support
  - Instructional coaches supported planning and IPF design
  - Math learning specialist school visits supported the design and implementation of IPF
  - Teachers practiced the strategies
  - Executive Director walked classrooms with Principals and Instructional Coaches for feedback
- Work Solution Strategy was selected for specific teachers to implement
  - Math learning specialist visited and supported planning for implementation of WSS
  - Math learning specialist provided feedback
- Math Learning Specialist planned with math teachers at selected schools prior to Dr. Riccomini on site coaching visits



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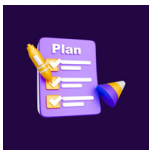
3 Step Process



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Step 3: Embedded Classroom Coaching

Purpose:

- Embedded classroom coaching **bridges professional development** to classroom practice by supporting teachers in implementing evidence-based strategies, providing **individualized feedback**, enhancing instructional fidelity, and strengthening instructional decision making.

Desired Outcome:

- The outcome of embedded classroom coaching is i**ncreased implementation of evidence-based practices**, improved instructional effectiveness, and **greater teacher confidence** and self-efficacy in meeting students' academic needs.

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Step 3: Embedded Classroom Coaching

Coaching and Debriefing Structure

1. **Coaching Schedule is created at the school level well in advance of the coaching date**.
   - Specific strategy is selected
   - 20-30 minutes for classroom coaching
   - 10-15 minutes for debriefing
2. **Coaching Participants**
   - Teacher and External Coach
   - Internal coach
   - Other teachers
   - Principals (at least in the debriefing Sessions)

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Step 3: Embedded Classroom Coaching

Coaching and Debriefing Structure

3. **Debriefing Sessions**
   - Immediately follows the classroom observation
   - Best practice is a substitute teacher takes over as soon as the classroom activity is completed to allow the teacher to step out and debrief.
   - Positive focus about what went well and discussion about considerations for future use
   - Teachers and grade level teams can ask questions which allows for trouble shooting
   - Principal involvement in the debriefing sessions are essential for sustainability

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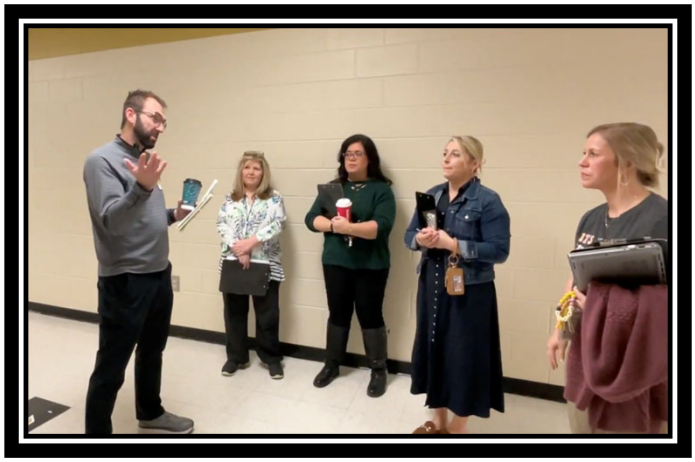
Lessons Learned

1. Accountability
2. Scaffolding Teachers
3. Starting small and building
4. Follow-up, Follow-up Follow-up!!!
    1. Within the school year
    2. Across school years



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