Supporting Student Curiosity & Deeper Learning With Performance Assessments

McREL INTERNATIONAL

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Lateral Thinking Activity

Step 1

Draw a diagram of the human body's circulatory system. What are the parts? What is the process? What are the key vocabulary terms?

Step 2

Draw a diagram of the brain's information processing system. What is the process? What are some key ideas/vocabulary terms?

Brain-Based Learning Strategy #1: Spark Learning with Curiosity

Students' Brains Are Designed to Ignore Boring Stimuli and Pay Attention to What Sparks Their Curiosity.

Share In Chat

What hooks your students' curiosity?

Brain-Based Learning Strategy #2: Give Students a WIIFM

Students Only Learn What They Find Meaningful And Relevant – When They See What's In It For Me.

Chat Discussion

When do your students most commit to learning?

Brain-Based Learning Strategy #3: Show and Tell

All Students Are Visual Learners So We Neet To Model New Skills And Help Them Visualize Abstract Ideas.

Brain-Based Learning Strategy #4: Chunk Learning Into Bite-Sized Segments

Give Students Time To Pause and Process Learning.

Pause & Process

In your experience, how often do classroom learning conditions make learning visual?

In your experience, how often do students' learning experiences provide opportunities for them to pause and process their learning?

What differences might you see in student learning if they consistently experienced these learning conditions?

Brain-Based Learning Strategy #5: Space Practice Opportunities

Students Only Learn What They Practice In Multiple Sessions Spread Over Time.

Brain-Based Learning Strategy #6: Knowledge Is Like Paint; It Does No Good Until It's Applied

Students' Only Remember What They Apply Through Problem-Solving, Writing, Research, And Investigating

Pause & Process

In your experience, how often do students in your classrooms experience practicing and re-learning new knowledge and skills in sessions intentionally spread out over days and weeks?

In your experience, how often do students in your classrooms experience opportunities to develop deep neural connections to learning with 'minds-on' activities?

What differences might you see in student learning if they had regular exposure to these learning conditions?

Cognitive Writing

What Is It?

Cognitive writing engages students in extended writing assignments that supports their comprehension through high-order processing of new learning.

What Research Says

- Eight studies of classroom interventions that incorporated peer-assisted consolidation to support student learning in subject areas and grade levels reported improvement index scores[1] ranging from 14 to 49 percentile points.

What's The Point?

- Arranging thoughts, concept & ideas into sentences and paragraphs help us arrange them in our brains.
- Writing is a powerful tool for deep learning in all subject areas as it engages students in thinking about their learning, sharpens their understanding, and helps them make multiple connections to new learning

How Should Teachers Use Cognitive Writing?

- To help students process new learning (e.g., connecting ideas, comparing and contrasting concepts, developing and defending arguments).
- To teach thinking skills associated with writing (e.g., setting goals, identifying main ideas and expressing them in one's own words, developing original ideas, revising one's own thinking).

How Do Students Use Cognitive Writing?

- To engage in deep learning by aggregating disparate concepts into big ideas and mental schema that support retention and retrieval of new learning.
- To sustain curiosity and interest in learning by making personal connections to it and having opportunities to express their own ideas (finding "voice" in their learning).

[1] An improvement index score is the standard measure in the What Works Clearinghouse. It translates an effect size into a percentile score, indicating how much better an average student (i.e., at the 50th percentile) would perform after receiving the treatment intervention.

A Process For Engaging Students In Cognitive Writing	
Identify What Students Should *Think About* To Deepen Their Learning.	
Identify the enduring understandings, big ideas, key concepts, or themes students should think about.	
Identify the high-level thinking skills (e.g., comparison, analysis, synthesis) student should employ.	
Design A Writing Exercise That Prompts Students To Think About Their Learning	
Create a writing prompt that engages students in cognitive processing of their learning.	
Teach Students The Thinking & Writing Skills Needed To Engage In The Assignment	
Provide strategy instruction and modeling in the thinking and writing skills students need to use.	
Provide Students With Explicit Guidance For The Writing Assignment	
Create tools and guides (e.g., "thinksheets") to students through the process of thinking & writing.	
Provide students with a rubric they can use to assess and improve upon their work.	
Provide Students With Opportunities To Share And Revise Their Writing	
Engage students in sharing their writing, using the rubric to receive feedback and revise their writing.	

Checklist: Does Cognitive Writing …	
Prompt students to engage in cognitive processing of (thinking deeply about) their learning?	
Help students develop high-level thinking and writing skills?	
Provide student with adequate support and guidance to complete the assignment effectively?	
Give students opportunities to develop their own ideas and have "voice"?	

Four Steps for Designing Cognitive Writing Assignments

Step 1: Identify What Students Should Think About to Deepen Learning

Thinking Skill	Example
Comparison	What might they compare (contrasting two ideas/time periods, etc.)?
Analysis	What might they analyze (explaining relationships, processes, etc.)?
Evaluation	What might they evaluate (develop their own opinion about?)
Synthesis	How might they draw upon multiple concepts and knowledge to develop a single argument or idea?
Strategy	How might they reflect on or explain strategies they've used?

Your Turn: Which Thinking Skills Should Students Apply in An Upcoming Unit?

_____

_____

_____

Step 2: Teach Thinking & Writing Strategies Directly.

Thinking & Writing Skill	Description
Understanding The Task	Before plunging into writing, effective writers carefully read the prompts and ask clarifying questions to ensure they understand the task.
Setting Goals	Strong writers set mastery goals for their writing (e.g., I want to persuade my readers school should start later in the morning).
Reflecting On Prior Knowledge	While gathering evidence, effective writers reflect on their prior knowledge and how what they are learning supports, modifies, or conflicts with what they already know.
Extracting & Expressing Key Ideas in Your Own Words	Effective writers extract key ideas from text and restate them in their own words (e.g., How would you explain this concept to a friend or family member?)
Developing & Revisiting A Main Idea	Strong writers develop a key idea, thesis statement, or central argument and periodically revisit their idea, revising it as needed
Showing, Not Telling	Effective writers support their arguments with concrete examples and details that "show" readers what they're telling them.
Responding To Counter Arguments	After completing an initial draft, strong writers re-read their writing, anticipating how others might respond to their arguments and offer new arguments and/or evidence to strengthen their arguments.
Self-Monitoring & Self-Assessing Progress	Strong writers continually ask themselves, Am I on track? Is this evidence important? Am I accomplishing my goal?
Revising One's Own Thinking	Strong writers are flexible thinkers, able to revisit and clarify their ideas as they encounter new evidence or develop better ideas.

Which thinking & writing strategies will you need to teach directly to your students?

1. _____

2. _____

3. _____

4. _____

Step 3: Create A "Thinksheet" To Guide Writing

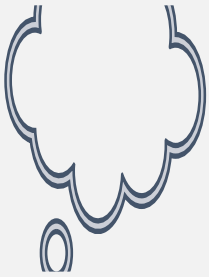
Key Thinking Strategy
(e.g., compare, analyze, synthesize)

Directions
As you read this text, pay close attention to ___.

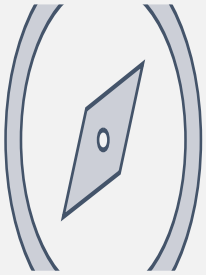
Guiding Questions
Why do you think…? Why should…?

Arrange Your Thinking And Writing
List key arguments and evidence.
List key ideas and examples.

Your Turn: What Would You Include in Your Thinksheet?



Key Thinking Strategy(ies)



Directions

Guiding Questions

Arrange Your Thinking And Writing

Step 4: Provide A Rubric To Help Students Assess Progress Toward Mastery

Success Criteria	Exemplary	Meets Expectations	Developing	Emerging
Developing An Original Idea	I have stated a main idea in my own words that reflects original thinking.	I have stated a main idea in my own words.	I have a main idea, but it's not yet written in my own words.	I don't have a main idea.
Using Evidence And Examples To Support Main Ideas (Showing Not Telling)	I use compelling examples and details to fully support all of my ideas.	I use details and examples to support most of my ideas (I'm *showing* not telling).	I use some examples and details but they don't always support my ideas well.	I don't have any details or examples (I'm telling, not showing).
Logical And Easy-To-Follow Organization	My response reflects logical organization with effective transitions to guide my readers.	My response reflects logical organization but some of my transitions are bit abrupt or awkward.	My response follows my outline but jumps around a bit and lacks transitions between ideas.	My response is not organized well. It goes from one idea to the next without connections between them.
Clear Reasoning	I share my solution, how I got there, why I chose that path, and why it think it's the best path.	I share my solution, how I got there, and why I chose that path.	I share my solution and how I got there but not why I chose that path.	I share my solution without explaining how I got to it.

Your Turn:

What is one criterion you'd likely include in a cognitive writing assignment in your class?

_____

_____

_____

What would meeting expectations look like for your students?

_____

_____

_____

Guided Investigations

What Is It?

Guided investigations engage students in experiments, inquiry-based learning, and research projects that require high levels of cognitive engagement.

What Research Says

- Eight studies of classroom interventions that incorporated investigations to support learning in multiple subject areas and grade levels demonstrated improvement index scores[2] ranging from 10 to 49 percentile points.

What's The Point?

- The more we reflect on, apply, and connect new learning to prior learning the more deeply we learn it.
- Students need hands-on and "minds on" opportunities to explore compelling questions, closely observe real-world phenomena, analyze evidence, and report on their discoveries.
- Minimally guided instruction is detrimental for younger and lower-performing students, so teachers must balance direct instruction with independent learning

How Should Teachers Use Guided Investigations?

- To engage students in extending and applying foundational knowledge and skills acquired during classroom-based, direct instruction.
- To help students consolidate and deepen knowledge by inviting them to observe and analyze scientific and social phenomena and reflect on their learning.

How Do Students Use Guided Investigations?

- To think deeply about their learning and develop rich neural networks that support greater retention and retrieval of new learning.
- To better understand social and scientific phenomena by observing and/or investigating them, collecting and analyzing data, and developing and defending ideas with evidence.
- To deepen their personal connections to learning.

[2] An improvement index score is the standard measure in the What Works Clearinghouse. It translates an effect size into a percentile score, indicating how much better an average student (i.e., at the 50th percentile) would perform after receiving the treatment intervention.

A Process For Engaging Students In Guided Investigations	
Identify The Essential Knowledge Students Should *Think About* To Deepen Learning	
Identify the enduring understandings, big ideas, and insights you want students to think about.	
Identify What Essential Knowledge You'll Teach And What Students Should Discover	
List the concepts, vocabulary terms, and skills are best learned through direct instruction.	
List the concepts, phenomena, and skills are best learned through discovery application	
Guide The Investigation	
Identify a purpose & guiding question for the investigation and how to engage students in goal setting	
Design & deliver a direct instruction portion of the unit (strategy instruction, vocabulary instruction)	
Provide step-by-step guidance for conducting investigations/research in small groups or as individuals	
Anchor Student Learning To A Performance Task That Reflects Mastery Learning	
Create structured opportunities for individual students to share/write about their findings	
Ensure students can connect what they learn and observe back to essential knowledge	

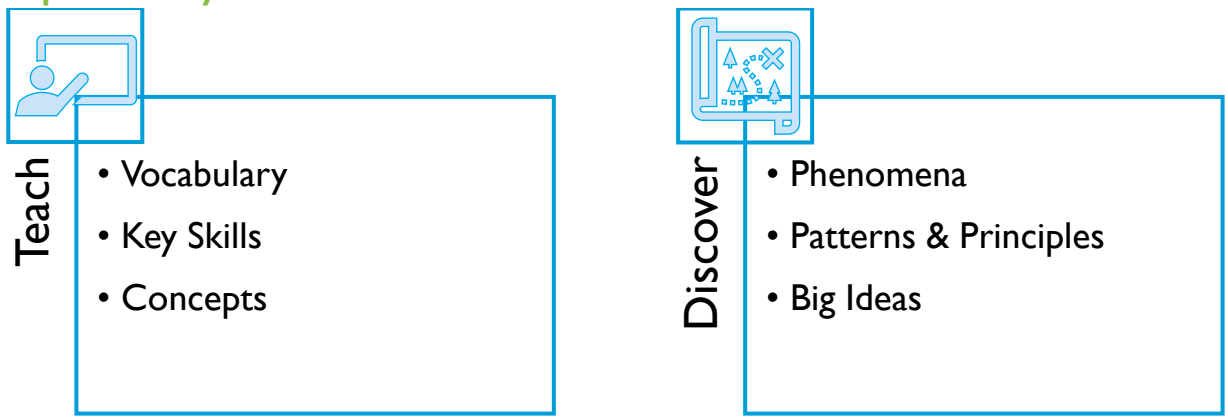
Checklist: Does The Guided Investigation …	
Engage students in a challenging learning task that prompts them to think deeply about learning?	
Offer an appropriate balance between teacher guidance and student self-directed learning?	
Engage students in extending and applying key concepts, academic vocabulary & essential knowledge?	
Ensure students return to thinking about key concepts, big ideas, and enduring understandings?	

Four Steps for Designing Guided Investigation Assignments

Step 1: Identify The Essential Knowledge Students Should Think About To Deepen Learning

Type Of Essential Knowledge	Example
Recurring Theme	Individual freedoms vs. social cohesion
Conceptual Framework	The water cycle
Paradoxes	Smaller nations often prevail over larger ones
Insights & Wisdom	Our wants and desires often bring unhappiness
Guiding Ideas & Principles	Supply & demand drives prices

Step 2: Identify What You'll Teach And What Students Should Discover

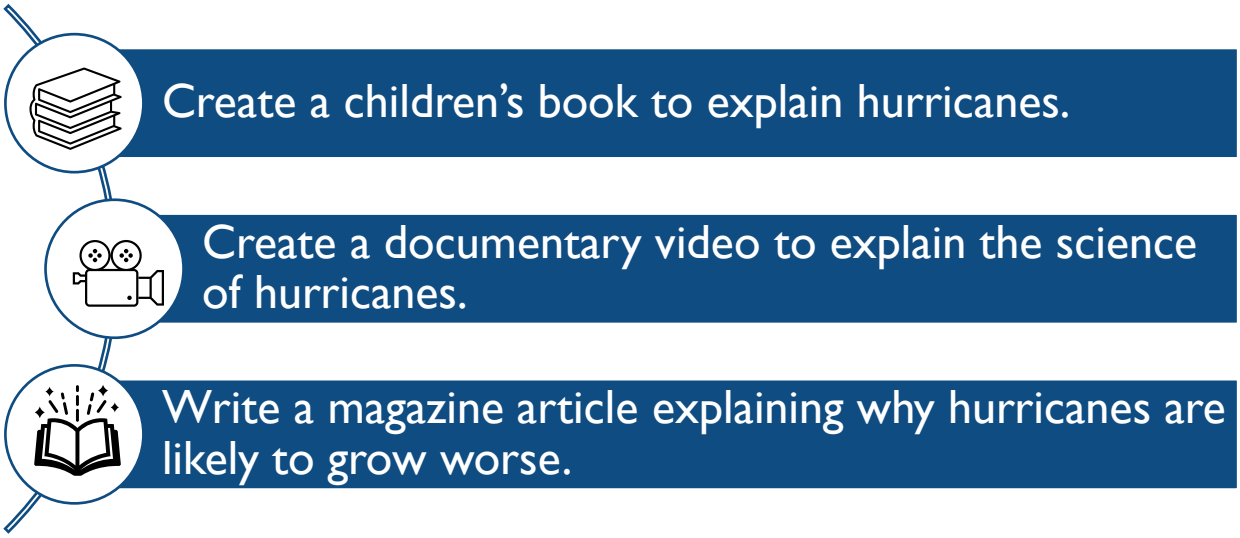


Step 3: Guide The Investigation

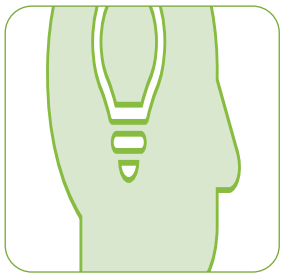
- Identify a purpose & guiding question for the investigation and how to engage students in goal setting
- Design & deliver a direct instruction portion of the unit (strategy instruction, vocabulary instruction)
- Provide step-by-step guidance for conducting investigations/research in small groups or as individuals

Step 4: Engage Students In A "Minds-On" Learning Task With An Accompanying Performance Assessment.

Some Examples



Your Turn: Create a Plan for a Guided Investigation



1: What Essential Knowledge Or Big Idea Do You Want Students To Think About?

2: What Must You Teach And What Should They Discover?

3. What Step-by-step Guidance Will You Provide For The Investigaion?

4. What Will Students Create To Demonstrate Their Learning?

Structured Problem Solving

What Is It?

Structured problem-solving helps students develop mental schema by teaching them step-by-step processes for using mathematical and quantitative skills to solve complex, real-life problems.

What Research Says

- _____ studies of classroom interventions that used structured problem solving to develop students' mathematical and quantitative skills demonstrated improvement index scores[3] ranging from 16 to 48 percentile points.

What's The Point?

- Anchoring learning in real-life problems _____ student motivation and problem-solving skills.
- Many students benefit from direct instruction to learn how to recognize problem structures of real-world problems and retrieve _____ methods for solving them.
- The ability to recognize problem _____, retrieve and apply methods for solving them is known as *mental schema* and is what distinguishes experts from novices.
- Thus, helping students develop the mental _____ needed to apply foundational knowledge and skills to solve real-world problems reflects the culmination of learning.

How Should Teachers Use Structured Problem Solving?

- To increase student interest and motivation in _____ and quantitative reasoning by engaging them in solving meaningful, real-world problems.
- To help students _____ math and quantitative skills into long-term memory by calling upon them retrieve and apply these skills in multiple situations.
- To show students how to solve complex problems by providing them with graphic organizers and _____ that guide them through the process (e.g., reading the problem carefully, identifying the problem type, solving the problem, checking one's answers).
- To help students develop mental schema by encouraging them to think _____ as they solve problems (What kind of problem is this? Have I solved something like it before?).

How Do Students Use Structured Problem Solving?

- To better understand the purpose of mathematics by seeing how the math and quantitative skills they learn in the classroom can be used to solve ____-_____problems.
- To develop mathematical reasoning skills by developing the mental schema needed to recognize and _____ complex quantitative problems.
- To develop important habits of mind (e.g., productive struggle, _____ self-talk) that are needed to solve complex problems.

[3] An improvement index score is the standard measure in the What Works Clearinghouse. It translates an effect size into a percentile score, indicating how much better an average student (i.e., at the 50th percentile) would perform after receiving the treatment intervention.

A Process For Engaging Students In Structured Problem Solving	
Identify Ways To Anchor Math Learning In Complex And Relatable Problems	
Identify a meaningful challenge (e.g., sports, environment, building, health) for students to solve.	
Pose the challenge(s) as a realistic scenario that requires math skills and quantitative reasoning to solve.	
Provide Guidance And Memory Aids To Help Students Solve Complex Problems	
Teach students how recognize and categorize problem types (grouping, change, compare).	
Teach a problem-solving process (e.g., grasp problem, make plan, work problem, review answer)	
Provide students with graphic organizers/memory aids to recall these steps.	
Teach Students Meta-Cognitive Skills & Positive Self-Talk Needed To Solve Problems	
Model what positive self-talk during productive struggle looks like (What's my goal? Don't give up!)	
Involve Students In Presenting And Explaining Their Answers	
Engage students in brief cognitive writing exercises to defend their answer and explain their strategy.	

Checklist: Does The Structured Problem-Solving Activity …	
Engage students in solving a meaningful, realistic problem?	
Scaffold students' ability to solve the complex problem?	
Help students develop the mental schema needed to solve other similar problems later?	
Help students develop the positive self-talk needed to engage in productive struggle?	

Step 1: Anchor Math Learning In Complex And Relatable Problems

Topic Area	Scenario Examples
Construction Problems	Calculating the materials and costs for building skateboard ramps, sets for school plays, backyard projects, robotics projects.
Environmental Challenges	Calculating energy and costs savings of conservation, waste reduction, or recycling; measuring the carbon output of various forms of school transportation.
Financial Puzzles	Calculating total net earnings of various professions, creating a budget and calculating accrued savings, determining best value of cell phone plans.
Health Challenges	Calculating calories burned during various forms of exercise, correlating links between mental well-being and social media usage and/or sleep habits.
Sports Challenges	Calculating speed and arc of a 3-point basketball shot, ideal pitching distance to increase batter reaction time, whether to punt vs. go for first down in football.

Step 2: Provide Guidance & Memory Aids To Help Students Develop Mental Schema & Solve Complex Problems

Grasp The Problem

What kind of problem is it?

Develop A Plan

What strategies will we use to solve it?

Work The Problem

What's our answer?

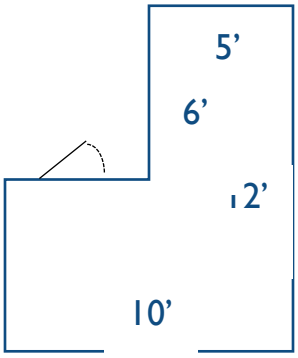
Review The Solution

Does it make sense?

Step 3: Teach Students The Meta-Cognitive Skills And Positive Self-Talk

- Do I understand the direction? What's still fuzzy or unclear?
- Can I visualize what's happening with this problem?
- What's my goal? Am I getting closer to it?
- Am I getting distracted? What can I do to get myself back on task?
- Don't give up! Struggle makes my brain stronger.

Step 4: Involve Students In Presenting And Explaining Their Answers [A Sample Problem]



Your grandmother is letting you use her shed as a hangout. To make it feel more comfortable, you want to install real flooring over the plywood floor. The floorplan is shaped like this.

How would you calculate the costs if:

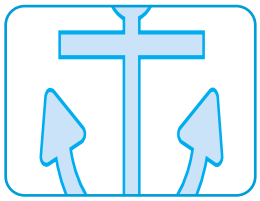
- carpet is $6.45 / sq. yard
- wood is $10.00 / sq. foot
- tile is $7.50 / sq. foot

Create **three different** designs for your flooring, calculate the costs (and show your calculations) and describe the pro and cons of each approach.

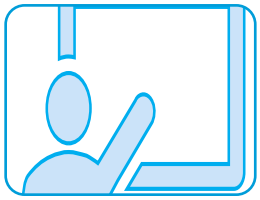
[Your name] construction company proposal

- ☐ Draw three versions of the plan to scale.
- ☐ Identify exact costs for each plan.
- ☐ Show how you calculated each cost.
- ☐ Describe the pros & cons of each plan.

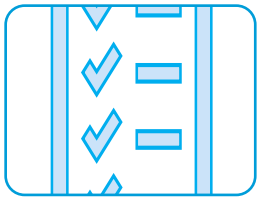
Your Turn: Design A Structured Problem Solving Activity



1: Identify A Meaningful Challenge To Anchor The Learning



2: What Problem-solving Process Do Students Need To Learn?



3. How Will You Help Students Visualize Or Recall The Problem-Solving Process?

4. What Meta-cognitive Skills And/Or Positive Self-talk Might You Help Students Develop?

Breakout Room Questions

1. What will be most challenging?

2. What will be most difficult for students?

Thank you!

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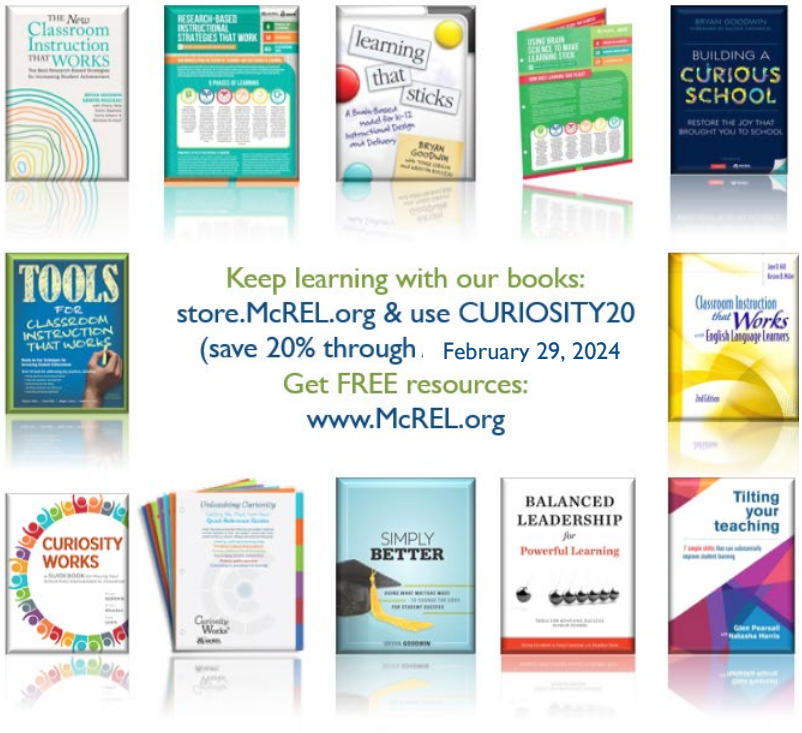

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