Maine Mathematics Skill Building Workshop
November 13 & 14, 2024

GEAR UP Maine
RISE

Empowering Minds: Laying the Groundwork for Math Success
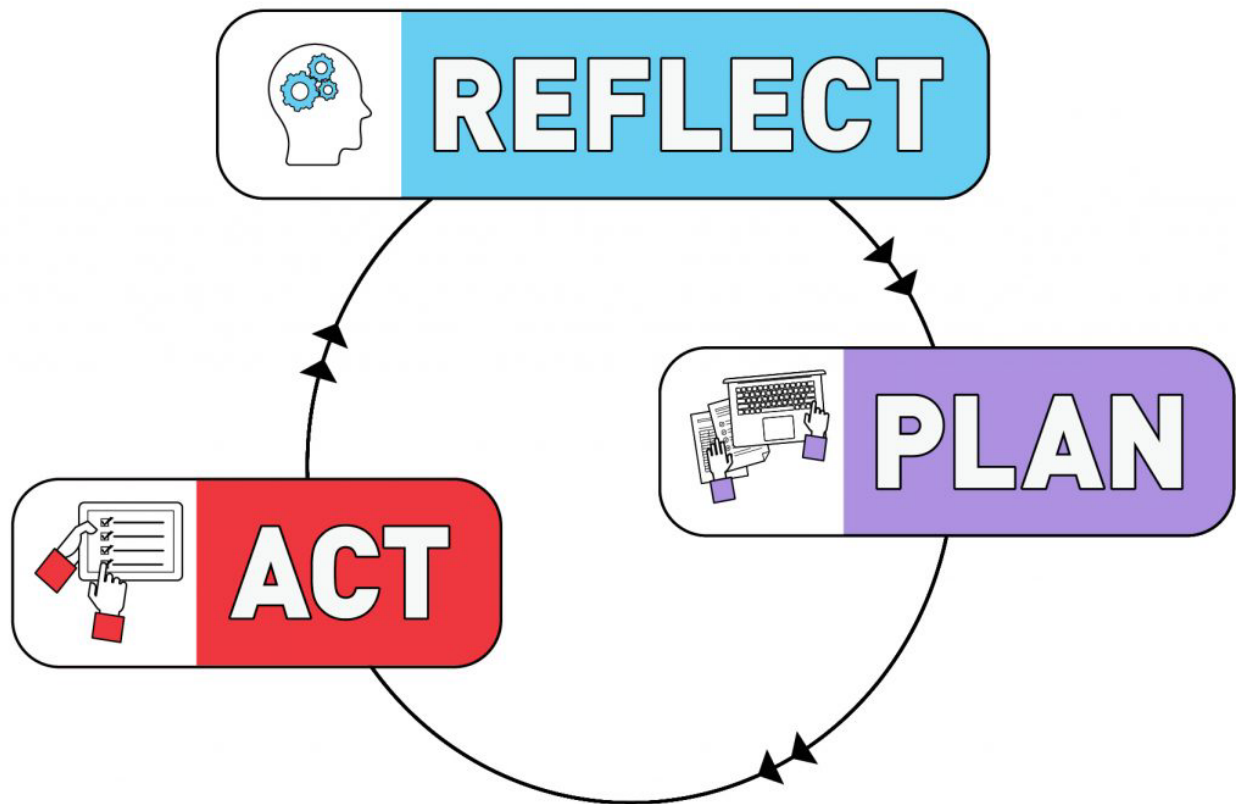
Beatrice Moore, PhD
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Day 1

- ➢ **Mathematical Practices and Executive Functions**
- ➢ **Problem Solving and Perseverance and Growth Mindset**

Day 2

- ➢ **Formative Assessment**
- ➢ **Student Retention-7 Brain Based Ways to Make Learning Stick**
- ➢ **Mathematical Literacy-Vocabulary and Writing Strategies**

Read Mathematical Practice 4.

- Mark up the text, what does it mean to you? Highlight the text, annotate the text, and write questions about the text
    - What strategies do you have or need?
    - What challenges do you face with teaching this practice?
    - What strengths/challenges do your students have with the practice?
    - How well do you understand this practice?
    - What resources do you have or need?
    - How often do you provide direct instruction on the practice?
- Now collaborate in small groups about the text.
    - What similarities do you have with your notes?
    - What ideas do you have about your next steps?
- Large group discussion and next steps.

Mathematical Practices

1. Make sense of problems and persevere in solving them

2. Reason abstractly and quantitatively

3. Construct viable arguments and critique the reasoning of others

4. Model with mathematics

5. Use appropriate tools strategically

6. Attend to precision

7. Look for and make use of structure

8. Look for and express reasoning in repeated reasoning

1. Make sense of problems and persevere in solving them

Problem-solving to be a daily experience. Problem-solving is to be a thinking and reasoning experience that **emphasizes process and sensemaking as much as, if not more than, solutions.** Students must be armed with ideas about how to persevere through problems. Opportunities to discuss problems, strategies, and solutions are necessary for students to become proficient with this practice. Post problem solving anchor charts. Post problem solving strategies. Use a consistent problem-solving format and plan to support metacognition.

2. Reason abstractly and quantitatively

Symbols and equations are efficiencies for solving problems and making sense of the world mathematically. Students must have opportunities to practice using equations to represent and solve problems and then contextualizing their solutions. As students do this, they determine whether their solutions make sense and whether further interpretation is needed. For example, 6 cars holding 4 people each are needed to transport 22 people rather than 5.5 cars. This practice also call for students to think flexibly about numbers and quantities, understand the meaning of variables, understand the concept of equality, and be able to interpret multiple representations.

Implementation & Practice

Keep Going,
Keep Growing
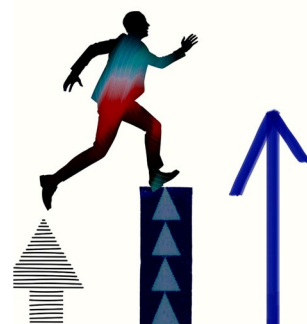
Explicitly teach these skills is the first week or two of school.

Use these suggestions to help you with planning.

3. Construct viable arguments and critique the reasoning of others

Use logic problems to practice these skills. For example, give a logic problem to the students in small groups, and have them work on it together. Then have the small groups present their "viable argument" to the class. The students would then focus on "critiquing their reasoning." The purpose of the activity was not the answer to the logic problem, but rather teaching the mathematical practice of, "Construct viable arguments and critique the reasoning of others." Students should construct arguments to justify their reasoning and solutions. However, their arguments do not have to be clad in written form. Instead, students should be charged with creating arguments scaffolded by representations, diagrams, and computations. This MP also calls for students to actively listen to the arguments of others and to ask questions and counter ideas as appropriate.

4. Model with mathematics

Using mathematics to model situations, make predictions, and draw conclusions is the intent of MP 4. This practice is applied frequently to medicine, engineering, and weather forecasts. Modeling with mathematics is a bit different in elementary grades. Here, students can model mathematics concepts and use models to solve problems. In middle and high school, students use models and model with equations and functions to make predictions about problems and investigations or to make conjectures about patterns in the world around them.

5. Use appropriate tools strategically

Grid paper, rulers, protractors, paper and pencil, calculators, manipulatives and mathematics software are tools students use to problem solve. Students at all grade levels are capable of exploring and expanding their conceptional understanding by selecting the appropriate mathematical tools to solve problems. When working with mathematical models, students are aware that technology may help them visualize the outcomes, compare data, and make predictions. Students are able to detect errors through estimation, process of elimination and other mathematical skills.

6. Attend to precision

Use real world examples to introduce math vocabulary. Young learners can learn to count using concrete objects. All learners can benefit from math verbal and visual word association (definition, symbols, picture, anonyms, synonyms), Concept definition mapping, semantic feature analysis, and other strategies that assist with skills and vocabulary retention. These strategies assist students in discussing mathematical processes as they continue to build upon their foundation. Allowing students to orally express their mathematical ideas, can develop concepts and the ability to reason mathematically. The students are able to explain the symbols they choose during problem solving. They know when and how to use inequalities and has a thorough understanding that the equal sign represents equality between two expressions. In geometry, the younger learners may begin with non-standard units of measurement such as same size paperclips before moving to a standard customary or scientific unit.

7. Look for and make use of structure

Students are actively looking for patterns and relationships while problem solving. Students are encouraged to develop and use multiple representations while problem solving; this can help them explain their reasoning. Therefore, students must be able to read left to right, right to left, diagonally, top to bottom and bottom to top as well as understanding numeric and mathematical symbols. Allowing students to explain both their pictorial and algebraic representation can help them explain their thinking process. During this process, teachers are using questioning strategies to support student comprehension of the material. While young learners are discovering patterns, older learners are developing rules.

8. Look for and express regularity in repeated reasoning

While looking for and expressing regularity in repeated reasoning, elementary students are encouraged to look for patterns in shapes and sets of numbers while they discover how to classify and organize information. They begin to notice

repetitiveness when performing operations of addition and subtraction, constantly checking for reasonableness in their process and solutions. In the middle grades when students understand the meaning of division as repeated subtraction, they can build on what they know about the division of whole numbers to help them learn the division of fractions. This includes complex fractions and rational numbers.

Implementation
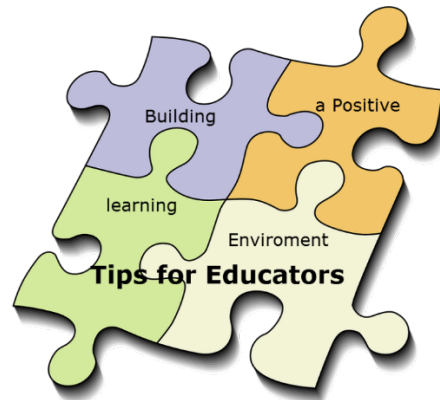
Classroom Strategy: Post and Refer

a. Create posters for the Mathematical Practices and hang them in your room.
b. Keep them there the entire year. Include them in your teaching on a daily basis. Tell the students what skill we were practicing along with the new material.
c. Have students tell you what skill they are practicing and have them write about what mathematical practice skill they were practicing on the assignment. The key for this to be successful is to refer to them and talk about them **on a daily basis.**
d. Let them become part of your vocabulary and the students' vocabulary.

Reflect and Plan
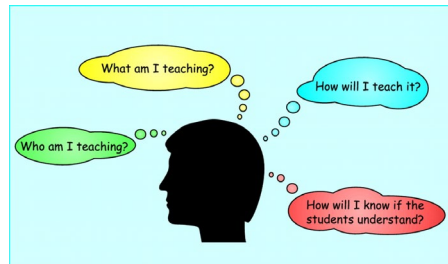
Mathematical Practice	Sometimes	Always	Never
MP 1: Do my students engage in problems daily? Do my students have diverse strategies for solving problems?			
MP 2: Do my students have opportunities to reason about numbers?			
MP 3: Do my students justify their thinking? Do they communicate their ideas clearly? Do they passively agree with classmates?			
MP 4: Do my students construct models of problems and situations with physical tools, drawings, and equations?			
MP 5: Do my students know their tools and how to use them?			
MP 6: Do my students use correct vocabulary, attend to unit labels, and recognize precision?			
MP 7: Do my students have opportunities to observe, discuss, and make sense of structures in mathematics?			
MP 8: Do my students know why shortcuts work?			

Practical Tips for Realizing the Mathematical Practices

1. Avoid key words and similar strategies for solving problems. Making sense of problems and solving them is not a procedure to be mastered (MP 1).

2. Make explicit connections between problems, drawings/diagrams, and equations (MP 2 and 4).

3. Explore numbers, number relationships, and operations daily (MP 2).

4. Challenge students to determine whether a tool is needed for a task or computation (MP 5).

5. Reflect on the frequency of tools used, the type of tools used, and discussion about the tools used during mathematics class (MP 5).

6. Avoid shortcuts for tools. For example, when measuring with rulers, one doesn't have to line up the edge of an object with zero on the ruler, instead, focus on understanding of the concept and the tool. (MP 5)

7. Record related equations in ways so that patterns are easily observed (MP 7).

8. Representations used must align to the mathematics. Equal group multiplication problems should be represented with equal groups rather than area models. (MP2,4 and 7)
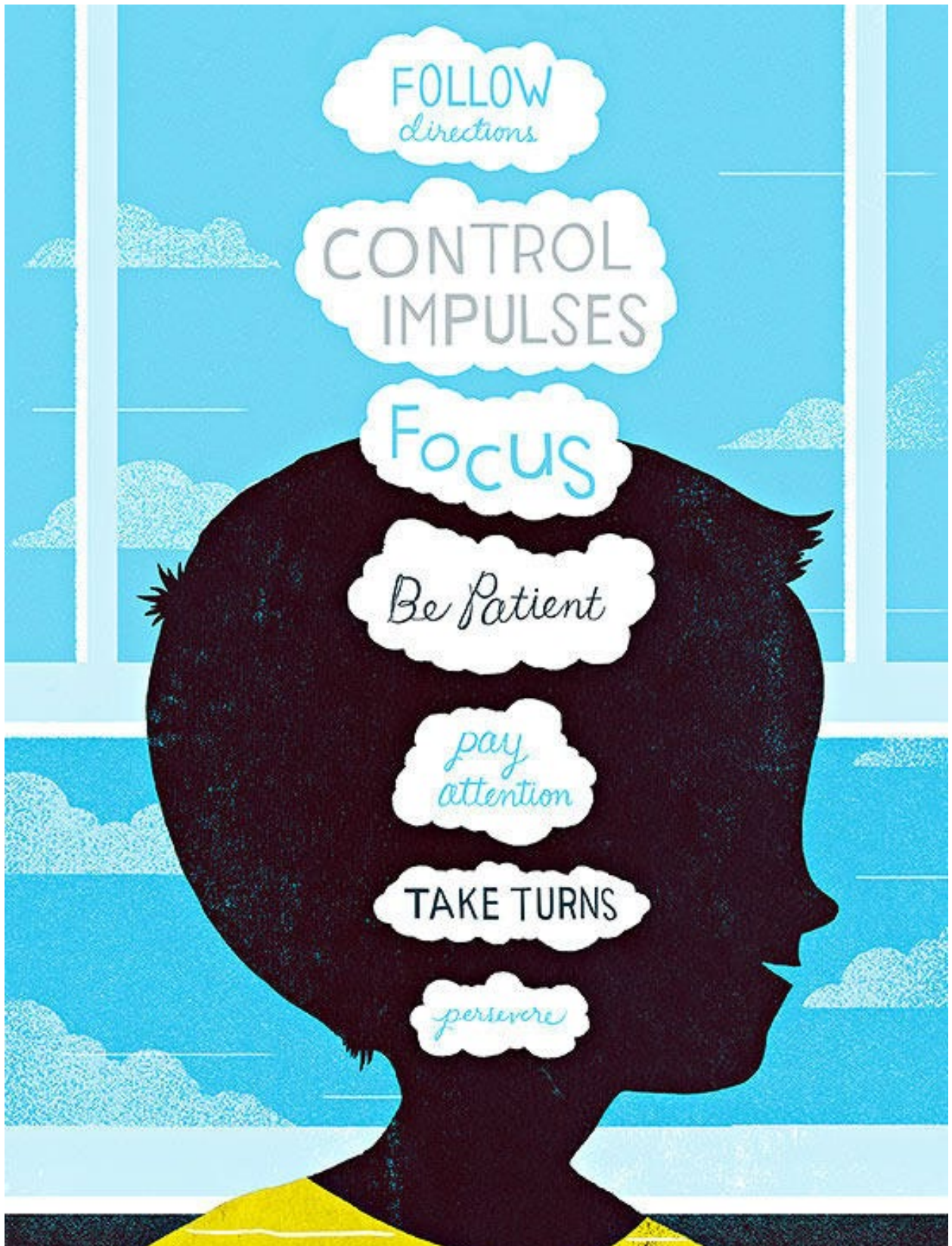
Executive Function

/Executive Function refers to a set of cognitive processes that help us **plan, monitor, and execute our goals**. These processes serve as a supervisory role in thinking and behavior, allowing us to analyze, plan, develop, adjust, organize, and prepare while maintaining responsibility for accomplishing tasks. Imagine a project manager overseeing a complex job—similarly, we, as educators, guide students in developing these essential skills to navigate and complete tasks successfully.

The core executive functioning skills include:

1. **Impulse Control/Inhibition**: Monitoring impulsivity.
2. **Emotional Control**: Understanding and reflecting on feelings.
3. **Flexible Thinking/Shifting Thinking and Behaviors**: Transitioning between activities.
4. **Working Memory**: Holding onto relevant information long enough to remember and use it.
5. **Self-Monitoring**: Observing behavior in relation to expectations.
6. **Planning and Prioritizing/Organizing**: Breaking down tasks into smaller steps to achieve a goal.
7. **Task Initiation/Initiation**: Beginning a task without procrastination.
8. **Organization/Task Monitoring**: Continuously assessing performance toward a goal.

By **Kate Kelly** Expert reviewed by **Philip D. Zelazo, PhD**

Kids with executive function challenges may struggle with math. Learn why, and find out how to help. Executive function skills play a big role in math success. They allow kids to apply the math knowledge they already have, plus build on it to acquire new math skills. So when kids have executive function challenges, they may run into trouble with math — even if they understand it.

Here are five ways executive function challenges can affect math.

1. Rushing through math homework

Some kids with executive function challenges can be impulsive or impatient. They may rush through homework, which can lead to errors.

With math problems, kids need to have a good understanding of the directions. But kids with executive function challenges may not take the time to really look at the assignment or think about what they're supposed to do. Instead, they tend to just dive right in.

For example, they might assume that the math homework involves addition because it did yesterday. In their rush to get started, they don't notice that in today's assignment, all of the problems have a minus sign, not a plus sign. So they end up getting all of the answers wrong.

2. Having trouble applying new math rules

Learning new things involves shifting gears as the activity changes. That takes flexible thinking skills. It also means that kids need to stop and reflect before they respond.

But kids who struggle with executive function may fixate on what they already know. They might have trouble stepping back and seeing that they may need a new strategy to complete a problem.

Let's say they're learning fractions. Kids who have trouble with flexible thinking might insist that ¼ is bigger than ½. They know the rule that 4 is bigger than 2. But a bigger number as the denominator means that the fraction is smaller. They have to keep this in mind and use a new rule for deciding which is larger.

3. Giving automatic answers to math problems

Kids who have trouble with executive function may answer problems based on habit. They don't see each situation as different. Instead, they give an automatic response.

When it comes to math, they may get stuck on doing equations in a certain way. And that can lead them to ignore key pieces of information. Let's say they've been practicing addition. They answer 3 + 3 with the number 6. Then they see 3 − 3 and write down 6 for that one, too. It's not that they don't know how to do subtraction. But when they see 3 and 3, they have trouble overriding their tendency to answer based on the first thing that comes to mind.

4. Getting lost in the middle of complex math problems

Kids rely on working memory to keep up with complex math problems. They have to hold on to information — like a formula, an answer from a previous step, or the steps of the problem itself — so they can use it later to complete the problem.

When kids have poor working memory skills, they can get lost in the problem. Here's an example. When doing long division, kids who have trouble with executive function can forget that they need to bring down the remainder after subtracting. They can't remember what to do next and give up. Or they come up with a wrong answer.

Also, kids might have to show their work on complex math problems. Often they'll use scratch paper to show the steps they've taken to arrive at the answer.

But kids with executive function challenges can struggle with organization. They may scribble information across the paper in a disorganized way. And that can make it hard to move from one step to another with the correct information.

5. Not catching mistakes

Kids have to use self-monitoring to keep track of how they're doing as they go. Executive function challenges can make it hard for kids to step back and reflect on their work. They may not realize their answer doesn't make sense. And that they should go back to see where they went wrong or get help.

Some kids might also finish their math tests early. But they don't go back and check their work, even though they have time. They're so confident that they did everything right that they see no need for a second look.

1. Working Memory

Being able to keep information in mind and then use it in some way. A child might use this skill to read a passage on an English test, hold on to the information, and use it to answer questions.

2. Cognitive Flexibility
(also known as flexible thinking)

Being able to think about something in more than one way. A child might use this skill to answer a math problem in two ways or to find relationships between different concepts.

3. Inhibitory Control
(includes self-control)

Being able to ignore distractions and resist temptation. A child might use this skill to keep from blurting out an answer in class. It helps kids regulate their emotions, and keep from acting impulsively.

Executive function is responsible for these five skills:

- Paying attention
- Organizing and planning
- Initiating tasks and staying focused on them
- Regulating emotions
- Self-monitoring (keeping track of what you're doing)

Mathematical Practice Standards		
1	PERSEVERE	I can make sense of problems and persevere in solving them by planning and checking my progress with different strategies.
2	REPRESENT	I can analyze and represent problems mathematically using symbols, words, pictures, and expressions.
3	EXPLAIN	I can explain my strategy using symbols, words and pictures and I can compare my strategy with others.
4	MODEL	I can apply what I know about math to different problems and I can show my work in many different ways.
5	TOOLS	I can choose appropriate tools and use them effectively to solve problems.
6	ACCURATE	I can accurately and precisely calculate, label and specify unit of measure when solving problems. I work carefully and check my work.
7	STRUCTURE	I can find patterns and use prior knowledge to solve new problems.
8	REPEATED REASONING	I can use patterns, properties, and structures to create and explain rules and shortcuts when solving problems.

Developed by DMPS Teachers on 10.30.13 at the District PLC Meetings.

Standards for Mathematical Practices

How can we use "I Can statements aligned with the Standards for Mathematical Practices to not only intentionally teach the standards, but also Executive Function Skills?

EXAMPLE

1. **I can make sense of problems and persevere in solving them.**

   a. **Cognitive Flexibility**
      i. explain to themselves the meaning of a problem
      ii. consider comparable problems
      iii. monitor and evaluate progress and change course if necessary
      iv. understand the approaches of others to solving complex problems and identify correspondences between different approaches

   b. **Inhibitory Control**
      i. plan a solution pathway rather than simply jumping into a solution attempt
      ii. monitor and evaluate progress and change course if necessary
      iii. understand the approaches of others to solving complex problems and identify correspondences between different approaches

   c. **Working Memory**
      i. make conjectures about the form and meaning of the solution
      ii. plan a solution pathway rather than simply jumping into a solution attempt
      iii. consider comparable problems
      iv. try special cases and simpler forms of the original problem in order to gain insight into its solution

1. How can you help your students develop these skills?

Developing executive function skills and fostering the Habits of Mind in students is crucial for their overall growth and success. Here are some practical strategies to support their development:

1. **Explicit Instruction and Modeling**:
   - Teach students about executive functions and the specific skills involved. Use clear language and provide examples.
   - Model how to plan, organize, and manage tasks. Show them step-by-step processes for problem-solving and decision-making.
2. **Scaffolded Practice**:
   - Break down complex tasks into smaller, manageable steps. Gradually increase the complexity as students become more proficient.
   - Provide templates, checklists, and graphic organizers to guide their planning and organization.
3. **Metacognition and Reflection**:
   - Encourage students to reflect on their thinking processes. Ask questions like:
     - "What strategies did you use to complete this task?"
     - "How did you plan and organize your work?"
   - Discuss effective strategies and help them identify areas for improvement.
4. **Goal Setting and Monitoring**:
   - Teach students to set realistic goals. Discuss short-term and long-term objectives.
   - Regularly review progress toward these goals. Adjust strategies as needed.
5. **Memory Aids and Techniques**:
   - Teach mnemonic devices, visualization, and memory techniques to enhance working memory.

- o   Encourage students to use memory aids like sticky notes, digital reminders, or mnemonic acronyms.
6. **Time Management Skills**:
    - o   Teach students how to allocate time effectively. Use tools like timers or schedules.
    - o   Discuss prioritization and help them understand the importance of managing time wisely.
7. **Self-Regulation and Emotional Control**:
    - o   Teach strategies for managing emotions during challenging tasks. Breathing exercises, mindfulness, and positive self-talk can be helpful.
    - o   Discuss the impact of stress and anxiety on executive functions and encourage healthy coping mechanisms.
8. **Flexible Thinking and Adaptability**:
    - o   Engage students in activities that require shifting between tasks or perspectives.
    - o   Discuss the value of adaptability and how it contributes to problem-solving.
9. **Real-Life Applications**:
    - o   Connect executive function skills to real-world scenarios. For example:
        - ▪   Planning a trip
        - ▪   Cooking a meal
        - ▪   Solving a puzzle
    - o   Encourage students to apply these skills beyond the classroom.
10.   **Feedback and Encouragement**:
    - o   Provide constructive feedback on their efforts. Celebrate small victories.
    - o   Encourage a growth mindset by emphasizing that these skills can be developed over time.

Remember that consistency and patience are key. As educators, we play a vital role in nurturing these skills and helping students become independent, thoughtful learners.

2. How can you assess students' progress in developing these skills?

Assessing students' progress in developing executive function skills and Habits of Mind involves a combination of **formative and summative assessments**. Here are some strategies:

1. **Observations and Anecdotal Notes**:
   - Observe students during class activities, group work, and independent tasks.
   - Take notes on their behavior related to planning, organization, time management, and emotional control.
   - Look for evidence of persistence, adaptability, and flexible thinking.
2. **Self-Reflection and Goal Setting**:
   - Ask students to reflect on their own executive function skills. Have them assess their strengths and areas for improvement.
   - Encourage them to set specific goals related to these skills. For example:
     - "I will use a checklist to organize my homework assignments."
     - "I will practice deep breathing when I feel stressed during tests."
3. **Checklists and Rubrics**:
   - Create checklists or rubrics that outline specific behaviors associated with executive functions and Habits of Mind.
   - Use these tools to assess student performance. For example:
     - Did the student break down a project into smaller steps?
     - Did they persist through challenges?
4. **Performance-Based Tasks**:
   - Design tasks that require students to apply executive function skills. Examples include:
     - Planning and executing a science experiment
     - Creating a timeline for a historical event
     - Organizing a debate or presentation
   - Evaluate their performance based on the quality of planning, organization, and follow-through.
5. **Behavioral Interviews**:
   - Conduct one-on-one interviews with students. Ask open-ended questions related to executive functions and Habits of Mind.

- o Explore their thought processes, decision-making, and problem-solving strategies.
6. **Portfolio Assessment**:
    - o Have students maintain portfolios that showcase their work over time.
    - o Include samples of planning documents, reflections, and completed projects.
    - o Regularly review and provide feedback on their portfolio entries.
7. **Standardized Tests and Cognitive Assessments**:
    - o Some standardized assessments specifically measure executive function skills.
    - o Consider using tools like the Behavior Rating Inventory of Executive Function (BRIEF) or the Delis-Kaplan Executive Function System (D-KEFS).
8. **Peer and Self-Evaluations**:
    - o Incorporate peer evaluations into group projects. Ask students to assess their peers' collaboration, organization, and persistence.
    - o Encourage self-evaluation by having students rate their own performance.
9. **Long-Term Observations**:
    - o Consider tracking students' progress over an extended period (e.g., a semester or school year).
    - o Look for growth trends and patterns in their executive function behaviors.
10.   **Parent and Teacher Input**:
    - o Collaborate with parents and other educators.
    - o Gather insights about students' behavior at home and in different contexts.

Remember that assessing executive function skills is multifaceted. Combine various methods to gain a comprehensive understanding of each student's development. Tailor assessments to individual needs and provide constructive feedback to support growth.

What are some common challenges students face in developing executive function skills?

Developing **executive function skills** is essential for students, but they can face various challenges along the way. Here are some common difficulties:

1. **Working Memory Challenges**:
   - Students may struggle to hold and manipulate information in their minds.
   - Remembering instructions, following multi-step directions, and organizing thoughts can be tough.
2. **Cognitive Flexibility Issues**:
   - Adapting to change can be challenging. Some students find it hard to shift between tasks or perspectives.
   - Rigidity in thinking may hinder problem-solving and creativity.
3. **Inhibition Control Difficulties**:
   - Managing impulses and distractions can be tough.
   - Students might blurt out answers, interrupt others, or struggle with self-control.
4. **Planning and Organization Problems**:
   - Breaking down tasks into steps and creating effective plans can be daunting.
   - Some students struggle with time management and prioritization.
5. **Emotional Regulation Obstacles**:
   - Emotional responses can interfere with focus and decision-making.
   - Stress, anxiety, and frustration may impact executive functions.
6. **Initiation Challenges**:
   - Starting tasks without procrastination can be hard.
   - Students might delay beginning assignments or projects.
7. **Task Monitoring and Completion Issues**:
   - Staying on track and monitoring progress can be difficult.
   - Some students struggle to complete tasks or projects consistently.
8. **Self-Awareness and Metacognition**:
   - Reflecting on their own thinking processes can be challenging.
   - Students may not recognize when they need to adjust strategies or seek help.

9. **Generalization Across Contexts**:
   - Applying executive function skills beyond the classroom can be tough.
   - Students may struggle to transfer these skills to real-life situations.
10. **Individual Differences and Developmental Variability**:
    - Students develop executive functions at different rates.
    - Some may need more support or deliberate practice to strengthen these skills.

Remember that patience, explicit teaching, and targeted interventions can help students overcome these challenges and develop strong executive function skills.

4. How can I create a supportive classroom environment for executive function development?

Creating a supportive classroom environment that nurtures **executive function development** is essential for student success. Here are practical strategies to foster these skills:

1. **Clarity and Organization**:
   - **Reduce cognitive load**: Provide clear instructions, handouts, and presentations. Break longer lectures into smaller chunks to aid working memory.
   - **Organize materials**: Keep the classroom clutter-free. Designate spaces for different activities to minimize distractions.
2. **Common Language and Self-Expression**:
   - **Teach executive function terminology**: Help students understand and express their needs related to these skills.
   - **Identify strengths and areas of need**: Encourage students to communicate their challenges and preferences.
3. **Structured Routines and Expectations**:
   - **Consistent routines**: Establish predictable schedules and procedures. Students thrive when they know what to expect.
   - **Clear expectations**: Set guidelines for behavior, organization, and time management. Reinforce these consistently.
4. **Visual Supports and Reminders**:
   - **Visual schedules**: Display daily routines using visual aids. Include transitions and breaks.
   - **Checklists and reminders**: Provide visual cues for tasks, assignments, and deadlines.
5. **Flexible Seating and Movement Breaks**:
   - **Varied seating options**: Allow students to choose comfortable seating. Some may benefit from fidget tools.
   - **Movement breaks**: Incorporate short breaks for physical activity. Movement enhances focus and attention.
6. **Task Chunking and Time Management**:
   - **Break tasks into steps**: Teach students to divide assignments into manageable chunks.
   - **Time management tools**: Use timers, alarms, or digital reminders to help students allocate time effectively.

7. **Problem-Solving Activities**:
   - **Project-based learning**: Engage students in activities that require planning, decision-making, and problem-solving.
   - **Real-world scenarios**: Apply executive functions to practical situations (e.g., planning a trip or organizing an event).
8. **Emotional Regulation Strategies**:
   - **Mindfulness practices**: Teach deep breathing, relaxation techniques, and self-awareness.
   - **Positive self-talk**: Encourage students to manage stress and emotions during challenging tasks.
9. **Peer Collaboration and Support**:
   - **Group work**: Foster collaboration. Students can learn from each other's strategies.
   - **Peer modeling**: Showcase effective executive function skills through peer examples.
10. **Feedback and Celebrations**:
    - **Constructive feedback**: Provide specific feedback on organization, persistence, and planning.
    - **Celebrate progress**: Acknowledge small victories and growth in executive function skills.

Remember, creating a supportive environment involves understanding individual needs and adapting strategies accordingly. By integrating these practices, you'll empower students to develop strong executive function skills and thrive academically.

5. How can I involve parents in supporting executive function development?

Involving parents in supporting their child's **executive function development** is crucial. Here are practical strategies for parents:

1. **Understanding Executive Functions**:
   - **Educate parents**: Explain what executive functions are and their importance. Share that these skills help with focus, planning, self-regulation, and abstract thinking.
   - **Highlight variability**: Let parents know that children reach executive function milestones at different times, and some may face challenges.
2. **Promote a Supportive Home Environment**:
   - **Establish routines**: Consistent schedules help children develop organization and time management skills.
   - **Model executive functions**: Parents can demonstrate planning, decision-making, and emotional control in daily life.
3. **Encourage Play and Activities**:
   - **Play-based learning**: Engage in activities that promote executive functions (e.g., puzzles, board games, role-playing).
   - **Outdoor play**: Physical activity enhances cognitive flexibility and working memory.
4. **Use Visual Supports**:
   - **Visual schedules**: Create visual routines for tasks and transitions.
   - **Checklists and reminders**: Help children organize their responsibilities.
5. **Practice Self-Regulation Together**:
   - **Emotional awareness**: Discuss feelings and coping strategies.
   - **Mindfulness exercises**: Teach deep breathing or relaxation techniques.
6. **Collaborate with Teachers**:
   - **Communication**: Regularly connect with teachers to understand classroom expectations and reinforce skills at home.
   - **Support homework routines**: Assist with planning and organization[1].
7. **Promote Problem-Solving Skills**:
   - **Discuss real-life scenarios**: Encourage children to think through challenges (e.g., planning a family outing).
   - **Ask open-ended questions**: Foster critical thinking and decision-making[1].

8. **Celebrate Progress and Effort**:
    - ○ **Positive reinforcement**: Acknowledge small achievements related to executive functions.
    - ○ **Encourage persistence**: Celebrate effort and growth.
9. **Provide Resources**:
    - ○ **Workshops and webinars**: Share resources on executive function development.
    - ○ **Books and articles**: Recommend reading materials for parents.
10.   **Be Patient and Supportive**:
    - ○ **Individual differences**: Understand that each child develops at their own pace.
    - ○ **Encourage resilience**: Help children learn from setbacks and adapt.

Remember, parents play a vital role in nurturing executive function skills. By involving them, we create a collaborative effort to support children's growth and success.

6. How can I address parents' concerns about their child's executive function challenges?

Addressing parents' concerns about their child's **executive function challenges** requires empathy, understanding, and practical guidance. Here are some steps you can take:

1. **Active Listening and Validation**:
   - **Listen attentively**: Allow parents to express their concerns without interruption.
   - **Validate their feelings**: Acknowledge that it's natural for parents to worry about their child's development.
2. **Provide Information**:
   - **Explain executive functions**: Share what executive functions are and their role in daily life.
   - **Normalize variability**: Let parents know that children develop these skills at different rates.
3. **Individualized Approach**:
   - **Assess the child**: Understand the specific challenges the child faces. Is it working memory, organization, emotional control, or something else?
   - **Highlight strengths**: Emphasize areas where the child excels.
4. **Collaborate with Educators**:
   - **Teacher communication**: Connect with the child's teacher. Discuss classroom observations and strategies.
   - **Individualized Education Plan (IEP)**: If needed, explore an IEP or 504 plan to address specific needs.
5. **Share Practical Strategies**:
   - **Home routines**: Encourage consistent schedules and routines.
   - **Visual supports**: Use visual cues like schedules, checklists, and reminders.
   - **Break tasks down**: Teach parents to break tasks into smaller steps.
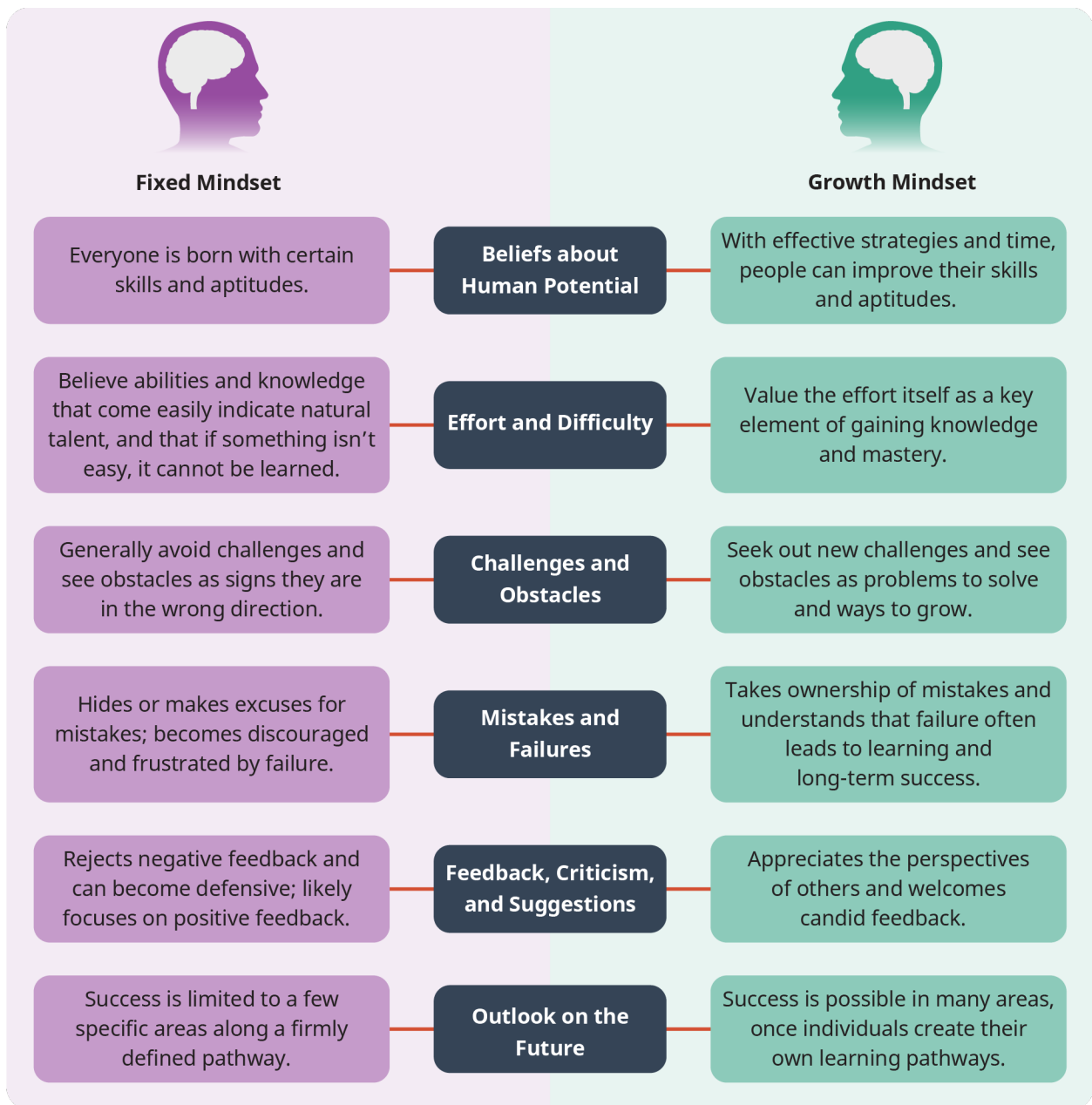6. **Emphasize Growth Mindset**:
   - **Shift focus from deficits**: Help parents see challenges as opportunities for growth.
   - **Celebrate progress**: Highlight small improvements and efforts.
7. **Self-Care for Parents**:

- o **Stress management**: Remind parents to take care of themselves. Parenting a child with challenges can be demanding.
- o **Seek support**: Suggest parent support groups or counseling if needed.

8. **Promote Advocacy Skills**:
   - o **Empower parents**: Teach them how to advocate for their child's needs within the school system.
   - o **Encourage open communication**: Regularly update teachers on progress and challenges.

9. **Provide Resources**:
   - o **Books and articles**: Recommend reading materials on executive functions.
   - o **Workshops and webinars**: Share information about workshops or online sessions.

10. **Reassure and Build Hope**:
    - o **Highlight progress**: Remind parents that growth takes time.
    - o **Share success stories**: Provide examples of children who have overcome similar challenges.

Remember, parents appreciate empathy and practical solutions. By working together, you can support both the child and the family.

Fixed Mindset		Growth Mindset
Everyone is born with certain skills and aptitudes.	**Beliefs about Human Potential**	With effective strategies and time, people can improve their skills and aptitudes.
Believe abilities and knowledge that come easily indicate natural talent, and that if something isn't easy, it cannot be learned.	**Effort and Difficulty**	Value the effort itself as a key element of gaining knowledge and mastery.
Generally avoid challenges and see obstacles as signs they are in the wrong direction.	**Challenges and Obstacles**	Seek out new challenges and see obstacles as problems to solve and ways to grow.
Hides or makes excuses for mistakes; becomes discouraged and frustrated by failure.	**Mistakes and Failures**	Takes ownership of mistakes and understands that failure often leads to learning and long-term success.
Rejects negative feedback and can become defensive; likely focuses on positive feedback.	**Feedback, Criticism, and Suggestions**	Appreciates the perspectives of others and welcomes candid feedback.
Success is limited to a few specific areas along a firmly defined pathway.	**Outlook on the Future**	Success is possible in many areas, once individuals create their own learning pathways.

What Is a Growth Mindset?

The concept of a growth mindset was first introduced by Dr. Carol Dweck, an American psychologist. Dr. Dweck posited that our mindset can play a major role in whether or not we succeed at anything, be it work, school, art, or sports. She has published several research papers and a book titled "Mindset: The New Psychology of Success" based on her findings.

People with growth mindsets see abilities, talents, and intelligence as something one can learn and improve through their own hard work, Goredema explains. On the contrary, she says someone with a fixed mindset sees those same traits as set in stone and unchangeable.

1. **Adaptability and Resilience**:
    o   Both a growth mindset and strong executive function skills promote adaptability and resilience.
    o   A growth mindset encourages individuals to embrace challenges, learn from setbacks, and persist in the face of obstacles.
    o   Executive function skills, such as cognitive flexibility, help individuals adjust to changing situations and bounce back from setbacks.
2. **Effort and Persistence**:
    o   A growth mindset emphasizes the value of effort and hard work.
    o   Similarly, executive function skills involve planning, organizing, and persisting through tasks.
    o   Both encourage individuals to invest time and energy to achieve their goals.
3. **Learning from Mistakes**:
    o   A growth mindset views mistakes as opportunities for learning and improvement.
    o   Executive function skills enable individuals to reflect on their actions, adjust strategies, and learn from both successes and failures.
4. **Goal Setting and Planning**:
    o   Both concepts involve goal-directed behavior.
    o   A growth mindset encourages setting ambitious goals and believing in one's ability to achieve them.
    o   Executive function skills help individuals break down goals into manageable steps, plan, and prioritize effectively.
5. **Self-Regulation and Emotional Control**:
    o   A growth mindset involves managing emotions related to challenges and setbacks.

Your mindset truly is your secret weapon when it comes to achieving your goals.

— OCTAVIA GOREDEMA, CAREE

- o Executive function skills include emotional regulation, impulse control, and self-monitoring.
- o Both contribute to effective decision-making and behavior.
6. **Flexible Thinking**:
    - o A growth mindset encourages open-mindedness and flexibility.
    - o Executive function skills, particularly cognitive flexibility, allow individuals to shift between tasks, perspectives, and strategies.
7. **Neuroplasticity**:
    - o Recent neuroscience research supports both concepts.
    - o The brain's plasticity (ability to change and develop) aligns with the idea that abilities can improve over time.
    - o Developing executive function skills involves creating new neural pathways, similar to adopting a growth mindset.

In summary, a growth mindset and strong executive function skills complement each other, fostering adaptability, persistence, and effective learning. Encouraging both can lead to greater success and well-rounded development.

How can I promote a growth mindset in my classroom?

Promoting a **growth mindset** in the classroom is essential for students' long-term success. Here are practical strategies to foster this mindset:

1. **Normalize Struggle**:
   - Encourage students to view challenges as opportunities for growth.
   - Discuss how effort and persistence lead to improvement.
   - Share stories of famous individuals who faced setbacks but persevered.
2. **Emphasize Effort and Process**:
   - Shift focus away from outcomes (grades, scores) and toward efforts and learning.
   - Praise hard work, strategies, and improvement.
   - Teach students that intelligence can be developed through dedication.
3. **Model a Growth Mindset**:
   - Demonstrate resilience and a positive attitude toward challenges.
   - Share personal experiences of overcoming obstacles.
   - Use language that reinforces growth (e.g., "I haven't mastered this yet, but I'm learning").
4. **Provide Constructive Feedback**:
   - Focus on specific efforts, strategies, and progress.
   - Avoid labeling students ("smart," "not smart").
   - Encourage revision and learning from mistakes.
5. **Teach Metacognition**:
   - Help students reflect on their learning process.
   - Discuss effective study habits, time management, and goal-setting.
   - Encourage self-awareness and self-regulation.
6. **Create a Safe Environment**:
   - Foster a classroom culture where mistakes are celebrated.
   - Encourage students to ask questions and seek help.
   - Avoid comparing students to each other.
7. **Use Challenging Tasks**:
   - Offer tasks that require effort and problem-solving.
   - Scaffold appropriately to ensure success is attainable.
   - Celebrate progress and growth.

8. **Celebrate Effort and Progress**:
    - Acknowledge hard work, persistence, and improvement.
    - Highlight specific strategies students used to overcome challenges.
    - Create a growth mindset bulletin board or display.
9. **Encourage Peer Support**:
    - Promote collaboration and peer feedback.
    - Have students share their growth stories with each other.
    - Foster a sense of community where everyone supports each other.
10. **Involve Parents**:
    - Educate parents about growth mindset.
    - Share strategies they can use at home to reinforce this mindset.
    - Collaborate with parents to create a consistent message.

Remember, fostering a growth mindset takes time and consistent effort. By integrating these strategies, you'll create a classroom environment where students believe in their ability to learn and thrive.

Fun activities
and games
to teach

Growth
Mindset

Online Resources:

[25+ Engaging Math Tasks That Promote a Growth Mindset](#)

[Tasks Archive - YouCubed](#)

Name: _____ Period: _____ Date: _____

First attempt: Points: _____/2 attempt   _____/2 explanation

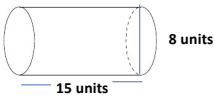What did you learn from this attempt? How will your strategy change on your next attempt?

Second attempt: Points: _____/2 attempt   _____/2 explanation

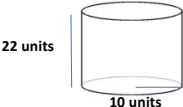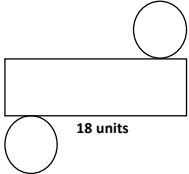What did you learn from this attempt? How will your strategy change on your next attempt?

Third attempt: Points: _____/2 attempt   _____/2 explanation

What did you learn from this attempt? How will your strategy change on your next attempt?

Name _____ Date _____

Sequence Chart

List steps or events in time order.

Topic
First
Next
Next
Next
Next
Next
Next
Last
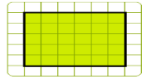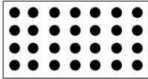
# Think- Write-Talk-Revise- Formula Translation Chart

Formula What does each variable represent?	Visual Analysis Identify the shape of the Base and the height of each cylinder below.	Perform Substitutions	Revisions if needed
V=Bh	8 units 15 units	V= Bh V =	
V=Bh	22 units 10 units	V= Bh V =	
V=Bh	18 units	V= Bh V =	

Select 3 different situations and complete the chart.

Number	List the Factors	Visual representations (Array)	Is it Prime?	Is it Composite?	My Explanation	My Revisions
30					I think the number is _____ because Equation that represents this number:	
28					I think the number is _____ because Equation that represents this number:	
15					I think the number is _____ because Equation that represents this number:	
9		XXXXXXXXX			I think the number is _____ because Equation that represents this number:	

3 details

3 details

3 details

Wrap it up

2

1

3

4
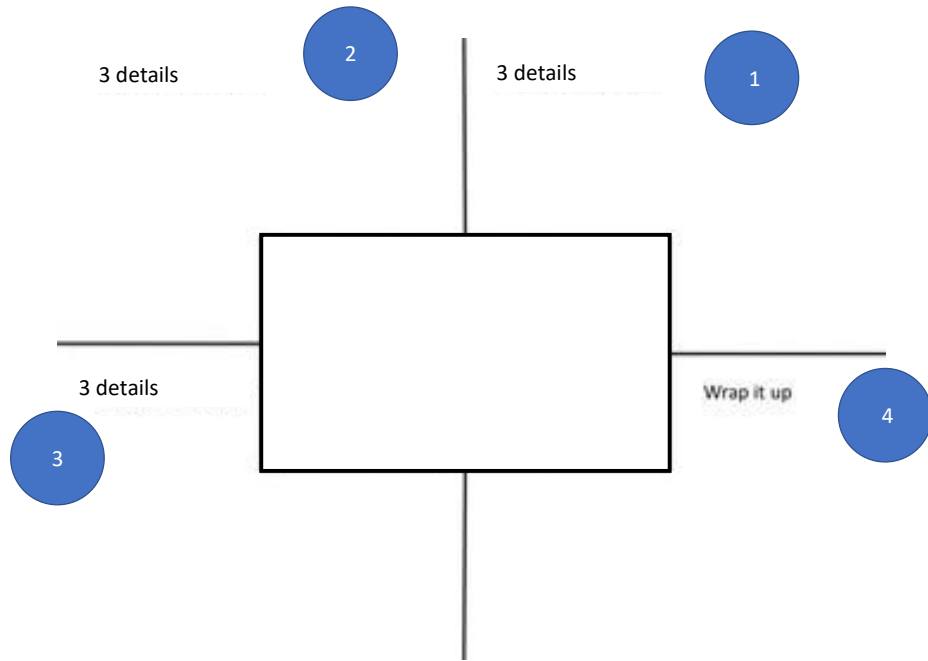
Exit Ticket

Erin designed a triangular shaped garden for the school atrium. One side of the garden measures 8 feet in length and the longest side measures 10 feet in length. One of the angles in the triangle measures 90°. The design includes a fence that will enclose the garden. The fence costs $ 25 per foot. <u>Determine the cost of the fencing for the garden.</u>

Task: I need to find

Math Concept:

Strategy I will use:

Tool(s) I will use:

Equation with labels:

Strategy: Student Reflection Activities

Problem/Task:		
My original answer	My new solution with work shown	The correct solution

Reflection: Why I missed the original:
❑ Didn't understand
❑ Thought it was right
❑ Skipped a step
❑ Made a mistake in step_____
❑ Studied but forgot _____
❑ No clue
❑ Ran out of time and guessed
❑ Careless mistake made in_____
❑ Other:_____
Why I know I now have the right answer:
What I need to do (or not do) in the future:
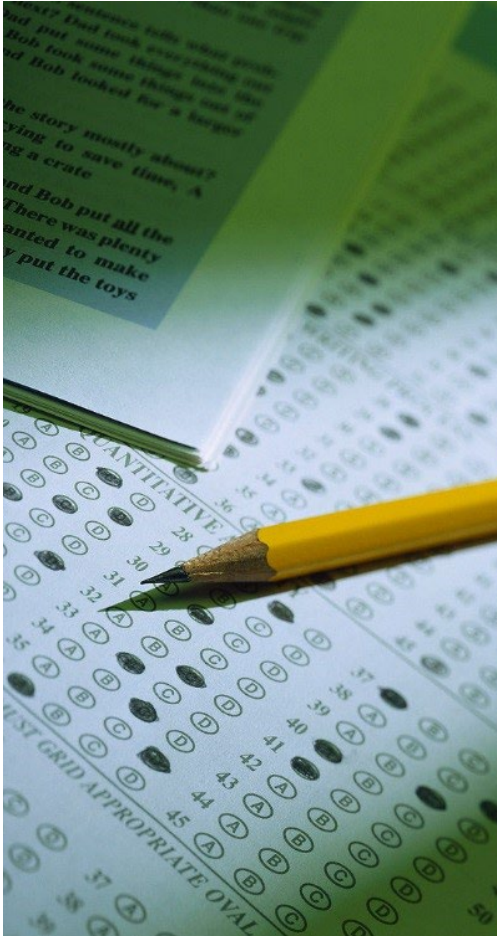
Test Review Strategies

- After scoring the test, select the top 3 -5 most missed items.

- Organize students into groups.

- Distribute copies of these items to groups.

- Have group members discuss strategies and
- solutions.

- Have each group explain the strategies and solutions

Crafting SMART goals helps you identify the aspects of what you desire to implement to improve instruction and impact student achievement in a positive manner.

When writing SMART goals, use concise language and include only relevant information. This worksheet is designed to help you succeed, so be positive when answering the questions.

Though it's important that you clearly define your goal using the method above, remember that it's still worthwhile to brainstorm all your various ideas. Once you see all the potential options, work with a partner to refine the list and create SMART goals.

The "right" SMART goals will be in line with larger team or organizational objectives-your standards and campus/district/state initiatives. Don't commit to any new goal that conflicts with or counteracts an existing goal. Instead, make sure all goals align and work together to achieve success.

| Specific	• Try and make your goal as precise and defined as possible
Measurable	• Establish a criteria to measure your progress • How will you know when you are on your way?
Accountable	• Determine a person who will help you and keep you responsible for your goals
Reachable	• Set reachable goals that you will be able to attain (high expectations are good) • Set small goals toward bigger goals
Time specific	• Create a timeline • Having an end time will help you stay accountable to your goals

Time Management

Study Strategies

Study partner(s)

Organization of Notes/Materials

Class Participation

Collaboration in Group Work

Use of Resources

Venn diagram
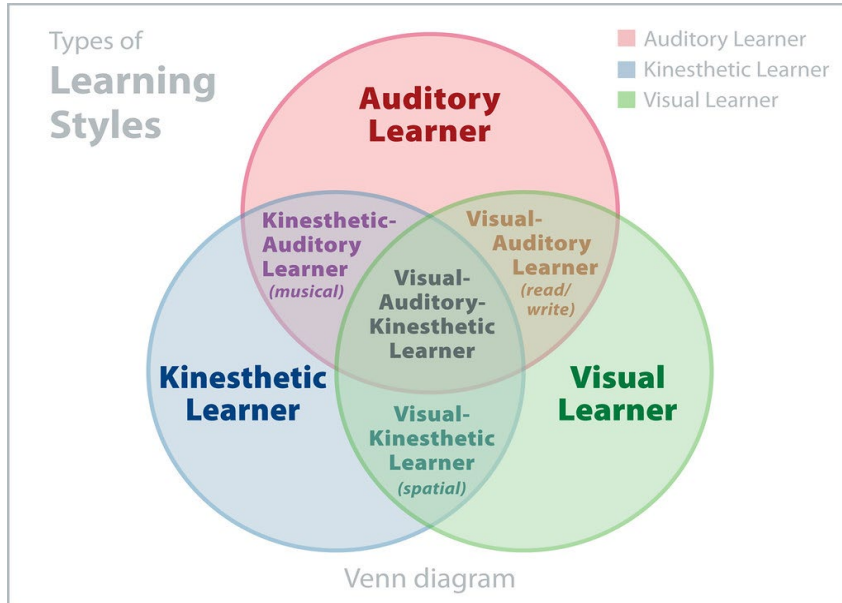
Specific study strategies based on learning styles

Learning styles refer to how individuals process and retain information. While there's ongoing debate about the effectiveness of tailoring study strategies to specific learning styles, some strategies align with different preferences. Here are strategies based on common learning styles:

1. **Visual Learners**:
   - **Preferred Style**: Visual learners grasp information through visual aids, diagrams, and images.
   - **Effective Strategies**:
     - Create **mind maps** or **concept maps** to organize ideas visually.
     - Use **color-coded notes** to highlight key points.
     - Watch educational videos or animations.
     - Convert information into **charts, graphs**, or **infographics**.
2. **Aural (Auditory) Learners**:
   - **Preferred Style**: Aural learners learn best through listening and verbal explanations.
   - **Effective Strategies**:
     - **Record lectures** and listen to them later.
     - Explain concepts aloud to yourself.
     - Use mnemonic devices or **rhymes** to remember information.

- Participate in **group discussions** or study with a partner.

3. **Reading/Writing Learners**:
   - o **Preferred Style**: These learners excel with written material and enjoy reading and writing.
   - o **Effective Strategies**:
     - **Summarize** information in your own words.
     - Create **detailed notes** during lectures.
     - Rewrite or **rephrase** concepts from textbooks.
     - Use **flashcards** with written cues.
4. **Kinesthetic (Tactile) Learners**:
   - o **Preferred Style**: Kinesthetic learners thrive through hands-on experiences and movement.
   - o **Effective Strategies**:
     - **Act out** concepts or scenarios.
     - Use **physical models** or manipulatives.
     - Take **study breaks** for physical activity.
     - Engage in **role-playing** or simulations.

Remember that most individuals exhibit a mix of learning styles, and it's essential to adapt strategies based on individual preferences. Encourage students to explore different approaches and find what works best for them.

Learning Styles Study Tips and Strategies

VISUAL

· Doodle diagrams of your written information in the margins

 · Create a flowchart for the progression of your notes and ideas

· Make flashcards that include pictures or diagrams as visual clues

· Highlight key information in your texts or notes

· Create a chart or a series of boxes to remind you how to complete math equations

 · Use a computer to convert data and notes into charts, tables, graphics, pictures, etc.

· Vocabulary mnemonics

· Hangman game

· Timelines

AURAL/AUDITORY

· Use a computer to record your notes read aloud. Convert this information to download for iPod using iTunes

· Read your notes aloud when studying (mind your surroundings!)

 · Work with a regular study partner to review out loud

· Work in a group where you can discuss the information

· Tape lectures. If available, set the counter to zero when it begins and note the number at difficult times during lecture. Review these recorded times later for extra review.

· When learning new material, especially equations, talk your way through the material.

· Singing/ creating a song

 · Use of metaphors/similes to compare and remember (as long as they are voiced)

· Use Internet resources like YouTube.com

· Invent acronyms

· Mnemonic devices

READING/WRITING

 · Re-write your notes after class.

· Use colored pens and highlighters to focus in on key ideas

 · Write notes to yourself in the margins

· Write out key concepts and ideas

· Compose short explanations for diagrams, charts, graphs

· Write out instructions for each step of a procedure or math problem

· Print out your notes for later review

· Post note cards/post-its in visible places (when doing dishes, on the bottom of the remote, etc.)

· Vocab mnemonics

· Organize your notes/key concepts into a Powerpoint slideshow

· Compare your notes with someone else's

· Repetitive writing

· Hangman game

KINESTHETIC

· Type your notes after class -Create a YouTube video as a group to study later individually

· Write your notes onto flashcards - Scrabble -Make posters

 · Review flashcards while walking, at gym, etc.

· Dog-ear pages in the reading where you can find critical information

· Sit near the front of the room

· Walk back and forth, move in some way, when studying notes

· Read your notes out loud

· As much as possible, create models for the information at hand

· Use the internet to research your subject material

· When possible, visit locations for your material (library, museum, historical sites, etc.)

· To learn a sequence or equation, use one note card for each step.

· Highlight material when reviewing/studying

· Use a dry-erase or chalk board to study or review

· Taboo-type game/ charades

· Correlate physical movements with ideas/terms

Created by Miss B.
www.realteacherslearn.blogspot.com

The Impact of Praise

The impact of **praise** on mindset is fascinating and has significant implications for learning and motivation. Let's explore this further:

1. **Effort-Focused Praise vs. Ability-Focused Praise**:
   - Research shows that the type of praise matters. **Effort-focused praise** positively affects motivation, while **ability-focused praise** can have negative effects.
   - When we praise someone for their **effort,** we reinforce the idea that hard work and persistence lead to growth and improvement.
   - In contrast, praising someone solely for their **innate ability** (such as being "smart" or "talented") may create a fixed mindset, where individuals believe their abilities are fixed and unchangeable.
2. **Effects on the Praisee**:

- When students receive effort-focused praise, they are more likely to embrace challenges, persist through difficulties, and view setbacks as opportunities for learning.
- Ability-focused praise, on the other hand, can lead to performance anxiety, fear of failure, and a reluctance to take risks.
- The way we praise students significantly influences their mindset and approach to learning.

3. **Effects on the Praiser**:
   - Surprisingly, few studies have explored the impact of praise on the person offering it (the **praiser**).
   - Recent research suggests that the praiser's mindset is also influenced by the type of praise they give.
   - Offering ability-focused praise may negatively affect the praiser's own endorsement of a **growth mindset**.
   - In other words, praising someone's innate ability may inadvertently reinforce a fixed mindset in the praiser as well.

4. **Educational Implications**: use video here
   - Teachers often use praise as a motivational tool in the classroom.
   - Being mindful of the **type** of praise we offer is crucial. Effort-focused praise encourages a growth mindset, while ability-focused praise may hinder it.
   - By promoting effort, persistence, and learning strategies, we can foster a positive learning environment and enhance students' resilience.

5. **Takeaways for Educators and Parents**:
   - **Be specific**: Instead of generic praise ("You're so smart"), acknowledge specific efforts ("I noticed how hard you worked on that project").
   - **Celebrate progress**: Focus on growth and improvement rather than fixed abilities.
   - **Model a growth mindset**: Demonstrate resilience, embrace challenges, and highlight the value of effort.
   - **Encourage self-reflection**: Help students recognize their own growth and effort[3].

In summary, praise has a profound impact on the mindset. By using mindful and effort-focused praise, we can cultivate a growth mindset in both the praisee and the praiser, leading to greater motivation and success in learning.

Student Self-Report Note

While doing this assignment, I felt (check one):

[ ] confident that I knew how to do all the problems. I think I know the material well enough to teach others how to do the work.

[ ] like I knew how to do some of the problems but not all of them.
*Explain*_____

[ ] like I thought I knew how to do the problems when I started, but then I got confused and lost.
*Explain*_____

[ ] lost from the beginning. When the teacher was explaining how to do the problems, I did not understand.
*Explain*_____

_____

Exit Ticket

1 Thing I Have A Question About

2 Things I Learned

3 Things I Know That I Can Build On

Name   Class

Application	What is the math concept?	What strategy will you use?	What tools do you need?

Application	What operation should you use?	What strategy will you use?	Is a visual helpful?

Application	Is this a multi-step problem?	What strategy will you use?	Is there extraneous information?

Application	Are there any words you do not understand?	Does this remind you of a similar problem you have seen or worked before?	What resources do you have that can help you with this problem?
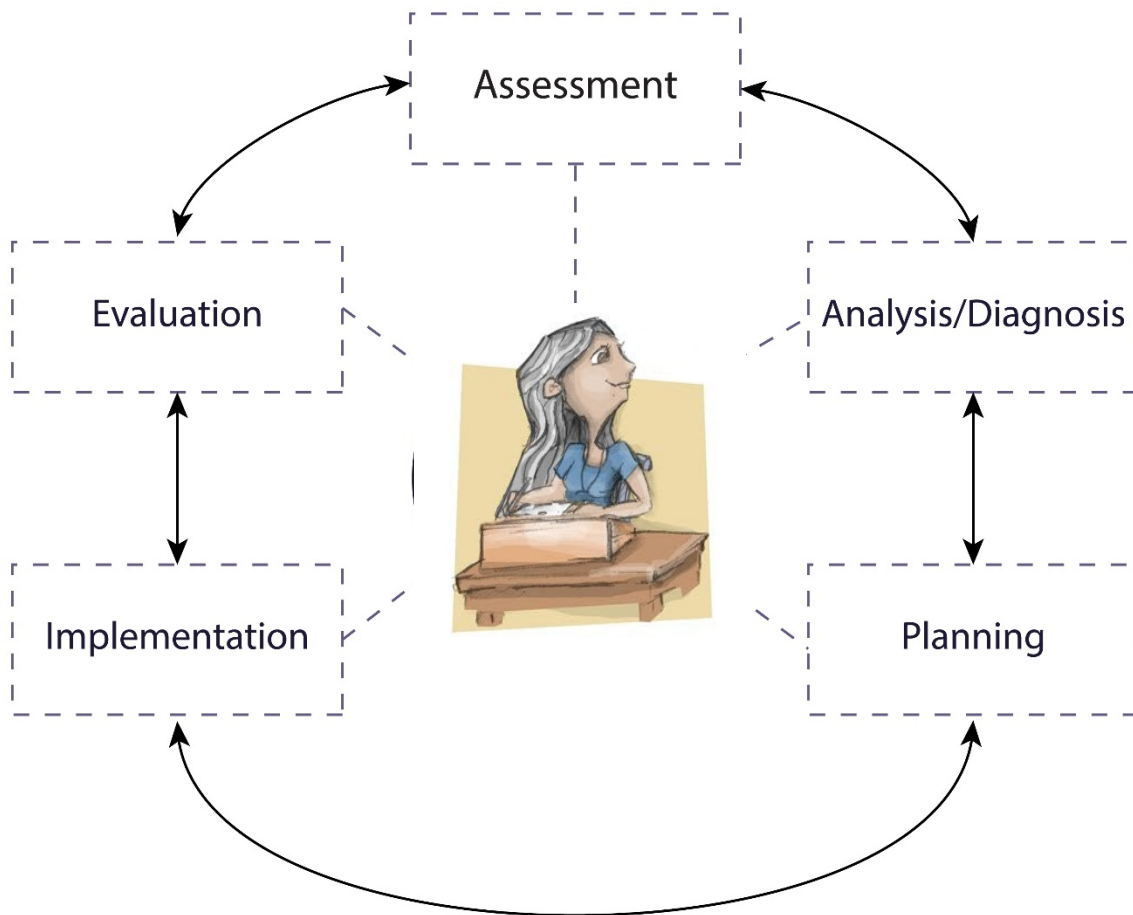
How can I provide effective feedback to students?

Providing **effective feedback** to students is crucial for their growth and learning. Here are research-based tips to enhance your feedback practices:

1. **Be as Specific as Possible**:
   - Avoid generic praise like "Great job!" or vague criticism like "Not quite there yet."
   - Instead, provide specific information on what students did well and where they can improve.
   - Highlight changes or improvements since their last assessment.
2. **Timeliness Matters**:
   - **Immediate feedback** is more effective than delayed feedback.
   - Provide feedback as soon as possible after an assignment or task.

- Students benefit from timely insights into their performance.

3. **Focus on Progress and Process**:
   - Communicate how students are progressing toward their goals.
   - Emphasize effort, strategies, and learning rather than fixed abilities.
   - Encourage reflection on the learning process.

4. **Balance Positive and Constructive Feedback**:
   - Acknowledge strengths and achievements.
   - Offer constructive feedback for improvement.
   - Maintain a supportive and encouraging tone.

5. **Involve Students in the Feedback Process**:
   - Encourage self-assessment and self-reflection.
   - Ask students to identify areas for growth and set goals.
   - Make feedback a collaborative effort.

Remember, effective feedback guides students toward success, motivates their learning, and helps them develop a growth mindset.

Self-assessment strategies and group assessment – find strategies and templates for students to assess their group work.

Self-assessment strategies empower students to reflect on their own learning, monitor progress, and take ownership of their academic growth. Here are some effective approaches:

1. **Reflective Journaling**:
   - Encourage students to keep journals where they write about their learning experiences.
   - Prompt them to reflect on what they've learned, challenges faced, and strategies used.
   - [Regular journal entries promote self-awareness and critical thinking](#).
2. **Goal Setting**:
   - Teach students how to set specific, measurable, achievable, relevant, and time-bound (SMART) goals.
   - Have them assess their progress toward these goals periodically.
   - [Goal-setting fosters self-directed learning and motivation](#).
3. **Self-Rating Scales or Checklists**:
   - Provide students with rubrics, scales, or checklists related to specific skills or learning outcomes.
   - Ask them to rate their own performance based on the criteria provided.
   - [Self-rating scales enhance metacognition and self-monitoring](#).
4. **Portfolios**:
   - Have students compile portfolios that showcase their work over time.

- Include samples of assignments, projects, reflections, and self-assessments.
- [Portfolios allow students to track their progress and demonstrate growth](#).

5. **Traffic Lights**:
   - Use a simple visual system where students indicate their understanding or confidence level.
   - Green (I understand), yellow (I have some questions), and red (I need help) cards can be used during class discussions or activities.
   - [It promotes self-awareness and helps teachers gauge student comprehension](#).

6. **Paired Marking**:
   - Pair students to review each other's work.
   - Provide clear criteria or a rubric for assessment.
   - [Students learn from evaluating their peers' work and receive feedback on their own](#).

7. **Peer review for writing assignments**

8. **Think-Talk-Write-revise**
   - Students are given independent time to think , then discuss with partner or group then jot down a summary or response.
   - The whole class discuss occurs and student make changes/revision to their writing to improve communication of ideas.

9. **Think-Write-Talk-Revise**
   - Students are given independent time to think , then write down their ideas, then discuss with partner or group , or whole class.
   - After discussion occurs and student make changes/revision to their writing to improve communication of ideas.
   -

10. **Open Worksheets**

Remember, self-assessment encourages students to be realistic judges of their own performance, promotes reflective practice, and contributes to lifelong learning habits.

FACT
FORMATIVE ASSESSMENT FOR CLASSROOM TEACHERS

Formative assessment practices are those that provide teachers and students with information about learning as it develops— not just at the end of a project, unit, or year. The information is formative because it enables adjustments that deepen learning: Teachers use formative assessment to make adjustments to instruction, and students use the feedback from formative assessments to make revisions to their work and their approaches to it.
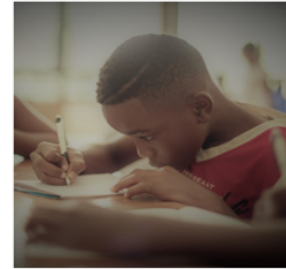
Taken from: Math Formative Assessment Examples by **Richard Blankman**   May 9, 2022

This article discusses different examples and strategies of formative assessment in mathematics. Since effective formative assessment informs both your teaching and your students' learning, the examples below will look different across students and classrooms. These examples of formative assessment can all be integrated into your class in whatever way best suits you and your students' needs.

Math Exit Tickets

Exit tickets are brief questions or problems that teachers give to students at the end of a lesson. They're frequently used as a student's "ticket" to exit the class. They can be incredibly effective because with just one or a few questions, teachers get so much control over what's in the ticket and what to do with the information.

Exit Ticket

Show how to solve $9 + 8$ in two ways.

Exit Ticket

A rectangular garden has a width of $(x - 4)$ meters, a length of $(x + 3)$ meters, and an area of 44 square meters. What are the dimensions of the garden?

Exit Ticket

The morning temperature in Newtown was $-5\ °$F. A warm front moved in from the south, and the temperature rose 30°F. Write and evaluate an expression showing the current temperature.

Thumbs Up/Down

Ideally, formative assessment checks in on student progress quickly and adaptively. One technique to try is to have students use a thumbs-up/down technique.

There are many ways to extend this idea. Students could also use other hand gestures, for example holding up three fingers to mean, "I have something to say." Ultimately *you* get to decide what the hand gestures mean and when you want to use them.

In-Class Discussions

Discussions in and of themselves are not necessarily assessments. But they can be! Discussions can reveal misconceptions and help guide teachers in what to teach next. <u>Facilitating classroom discourse with and among students can be a form of formative assessment</u>. Teachers must constantly make moment-by-moment classroom decisions like "should I ask a follow-up question?" or "what's another way of showing this concept?" In-class discussions are a way for teachers to come up with quick answers, check in on student knowledge, and figure out how to proceed.

Just because in-class discussions aren't formal, that doesn't mean they can't be prepared for. Teachers can build formative assessment opportunities into classroom conversations by being strategic about what questions to use. Being cognizant of your students' most common errors and use this to help guide discussions.

Homework

The structure and frequency of homework will no doubt vary depending on the student, teacher, and school. However, when a class environment permits it, homework does not need to be graded for performance and can instead be leveraged as a <u>tool for students</u> to think through problems on their own pace and for you to check in on their strengths and challenges.

Homework becomes in effect a guide for your teaching. Education professor Cathy Vatterott offers her perspective in _Rethinking Homework: Best Practices That Support Diverse Needs_: "The current consensus is that homework should be formative assessment that helps prepare students for summative assessment. Therefore, in a truly standards-based system, homework is not graded [but] is reviewed and feedback is given."

In this vein, homework is not usually rote practice of what was learned that class. Instead, it becomes a way for students to independently explore new ideas. In fact, homework doesn't always need to be directly related to the skill or concept being taught! Homework can be an opportunity for students to learn deeply about topics they're already interested in that already have rich mathematical connections, for example sports, homebuilding, fashion design, or entrepreneurship.

KWL Chart

A <u>KWL chart</u> is a tool that students can use to organize their knowledge

The KWL chart is useful as formative assessment in the classroom. It allows the teacher to find out students' prior knowledge on a particular topic and then gear upcoming lessons based upon this information. The KWL chart can be completed when starting a new topic and be added to throughout the unit. Further, when planning across a year, the teacher is able to find out what the students have learned by the end of their lessons.

KWL Chart

Topic: _____

Know	Wonder	Learned
What do you think you already know about this topic?	What do you wonder about this topic? Write your questions below.	After you complete your project or assignment, write what you learned.

<u>Digital Games and Apps</u>

Student digital experiences, whether educational video games, math practice apps or anything in between can be a dynamic way to assess students. Sometimes it's the software itself doing the assessment, where based on the results of one level or activity, the app determines what the student should do next. Digital and online experiences have the added benefit where most students will find it a safe and positive learning environment, and some who struggle with a traditional classroom environment challenging will thrive.

Many digital games and apps provide data for teachers about anything from curriculum-based performance **to student mindset.** That data can turn digital experiences into formative assessment too, helping teachers what to do nest. Consider the challenges of forming effective small groups and what to do with them. Are students ready for new concepts? Or is reteaching in order?

<u>Polls</u>

Trying to figure out what your students should do next? Ask them! Polls can be administered during or after any classroom activity. They also work well whether the teaching is in person or online. They can range from a variation of an exit ticket ("What do you think the solution is?") to metacognitive reflections ("How do you feel about this math topic?").

Polls are an especially flexible tool. <u>Teachers can exploit polls to cater to many specific instructional purposes in mind.</u> As examples, polls can do the following:

- Give the teacher a status check by polling student confidence
- Stimulate discussion with questions having multiple reasonable answers
- Quickly assess prior knowledge
- Elicit a misconception

These are powerful tools that grab students' attention and, depending on how the polls are used, can <u>foster the activation of other formative assessment strategies</u>.

Self-Assessment: Mathematics Checklist

Understand the task	I can clearly state what the problem is asking me to find
Explain what is known	I can clearly explain the given information (what I know from the problem) I use words, numbers, diagrams as appropriate
Plan an approach	I can clearly describe my chosen strategy, which is efficient (make a table, organized list, draw a diagram)
Solve the problem	I use my plan to solve every part of the problem. If my strategy does not work, I will try a new one. I write all the steps in my solution, so the reader doesn't have to guess how or why I did what I did. I use words, numbers, and diagrams, charts, graphs as appropriate. My work is labeled.
Explain the solution	I clearly explain my solution and why I believe it's correct using precise and correct math vocabulary and notations. I check to make sure my solution is reasonable. I check for possible flaws in my reasoning and computations. If I can, I solve the problem in a different way and get the same answer.
Check the solution	I check my solution according to the scoring criteria. **Scoring Criteria:** ___ Appropriate formula ___ Diagram with clear labels ___ All work shown and connected to final answer ___ Correct calculations ___ Final answer clearly identified ___ Answer labeled with units, if appropriate If my solution is incorrect. I find my mistake, determine a new plan, solve the problem, and justify my new answer.

Source: Andrade, H., & Warner, Z. (2012). Beyond "I give myself an A": Meaningful, rubric-referenced student self-assessment. *Educator's Voice, V*(42), 42-51
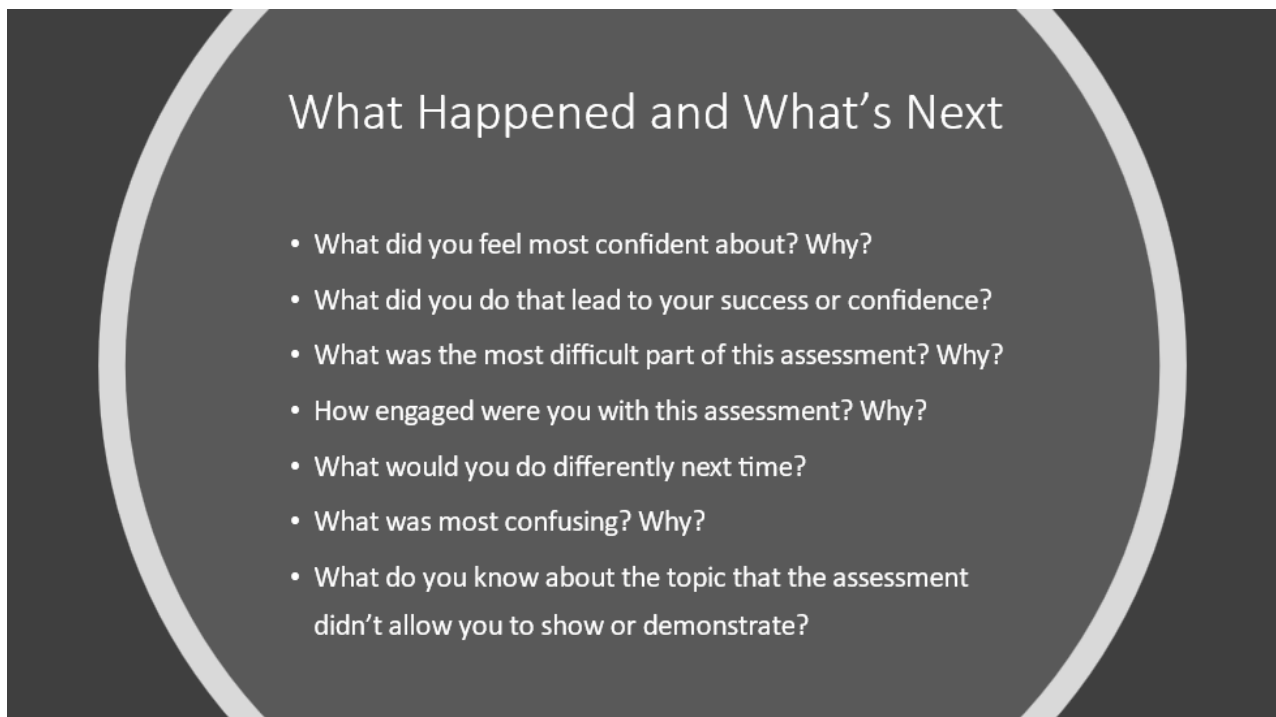
What Happened and What's NEXT?

The purpose of this tool is to support students to better prepare for and engage in future assessments. Teachers can also use students' reflections to reveal their need for support.
Below is a list of questions that will allow the learners to reflect on their assessment experience. You might have them reflect individually and then share in small groups. During large group discussion, collect ideas as new information to support learners.
The tool is appropriate for any content, grades 3-12
Source: Kathy Dyer

What Happened and What's Next

- What did you feel most confident about? Why?
- What did you do that lead to your success or confidence?
- What was the most difficult part of this assessment? Why?
- How engaged were you with this assessment? Why?
- What would you do differently next time?
- What was most confusing? Why?
- What do you know about the topic that the assessment didn't allow you to show or demonstrate?

Collaborative Learning

An Effective Strategy for Successful Group Work

Articulating what good teamwork looks like takes planning, reflection, and respect for student choice.

By [James Fester](#)

February 22, 2024

Sjoerd van Leeuwen / The iSpot

One of my all-time favorite reflective protocols is the *Start-Stop-Continue* exercise. It encourages learners to consider the impact of whatever is being learned by asking them about its perceived impact. A teacher or facilitator completes a lesson or an instruction sequence and then pauses, asking their audience to consider what they're going to start doing, stop doing, or continue doing based on a learning experience.

One example of how this structure was impactful for my growth occurred after I participated in a series of professional learning communities (PLCs) focused on collaborative learning. I was teaching middle school, and while collaborative learning can and should be done at any grade level, it's especially important in middle school, because tween learners need support as they encounter more complex emotions and social situations for the first time.

Based on what I learned from the PLC and the impact those strategies had in my classroom, I committed to start, stop, and continue certain things in regard to collaboration, each of which had profound impacts on how I viewed work time within project-based learning (PBL) context.

START: Differentiate between group work and team work

Calling project work time "group work" is a bit of a misnomer. I once heard a colleague of mine, who also happened to be an experienced little league coach, explain the importance of this distinction in a very clever way: "There is a reason why we call them baseball teams rather than baseball groups." His point was that groups are not invested in the long-term success of their partners, while teammates recognize that individual efforts contribute to the success of all and are therefore more invested.

The reason this differentiation is key is that it reminds teachers to provide temporary grouping structures throughout the course of an assigned project that are different from the team that is producing the final product. There are many benefits to this, but here are three that I've observed:

1. It provides students access to different perspectives and solutions that may exist outside their project team.

2. It allows teachers to leverage protocols that might call for pairs, trios, or larger groupings than the project teams may provide.

3. It gives students a break from the people they're collaborating with the most. This is sometimes critical to the continued harmony in a classroom, especially at the middle school level where relationships and hormones seem to change with the tides.

STOP: Assuming That collaboration is built by experience alone

Having students work in groups is not the same as teaching them to collaborate. It's akin to teaching someone to swim by throwing them in a lake and shouting at them from a distance until they figure it out; it's skill development born out of desperation, and there are definitely less stressful ways to learn.

CONTINUE: Include student voice in groupings

While student choice can promote positive class culture and engagement, students don't always make grouping decisions based on who will be their most effective learning partner. Despite this, still advocate for occasionally allowing students to have some say in their groups, but this doesn't mean completely unstructured, or on scaffolded control.

5 Tips for Successful Group Work in the Classroom

Collaboration is a learned behavior.
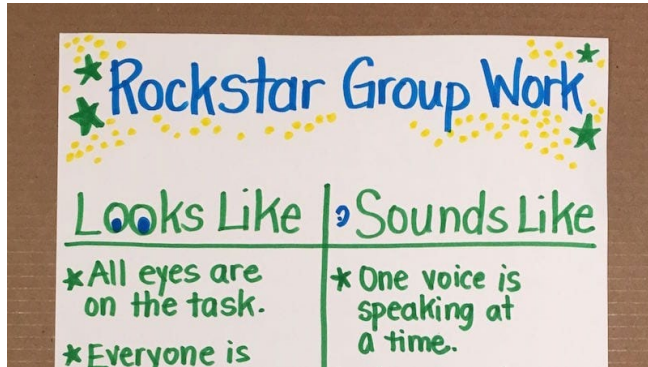
By [We Are Teachers Staff](#)   Aug 29, 2018

Picture it—you design an exciting, collaborative lesson that that you're sure your students are going to love. The best part about it? They get to work together in groups! Everything is going amazingly until:

- One group has that slacker who's not doing their fair share.

- Another group has that student does all of the work while the others look on.

- And in the end, one group's project turns out awful, and the group turns on each other.

Here are some words of wisdom our teachers offered to conduct successful group work in the classroom.

1. Assign roles.

"Assign each student in the group a unique role so that everyone has to work together to make the project a success," said Jaime L. Being solely responsible for a portion of the work gives students ownership over the project's success. The nature of the project will dictate the roles, but some examples are: proofreader, fact-checker, and scribe.

2. Make sure every group member has access.

Technology makes it easy for each group member to have access to all work and collaborate. "I have each member share any and all work on Google drive," advised Sonja L. This helps facilitate the notion of working together and contributing equally.

If your students don't have daily access to technology, make sure they have a system to store hard copies of their group work in the classroom. "When I do group work, I have a work-in-progress folder for each class. That way, they always have the work even if someone is absent." —Karen K.

3. Ask for input.

Becky M. shares, "At the end of a project, I have each student write a reflection. What was easy about the project? What was challenging? What grade would you give each person in your group, and why?" Let students know the contents of their letter will remain confidential but will also factor into their final grade. Listening to your students can help give you insider information about who really worked and who didn't. It can also help you structure your project differently next time, if necessary.

4. And grade accordingly.

Include a participation grade into your rubric and make a point of observing each group's activity during class. When students know that their grade is dependent on their participation, they are more likely to work toward the project's success. "If I see that only one member is doing most of the work, I absolutely adjust grades to incorporate that information," says Sonja L.

5. Speak to outliers privately.

Slackers are easy to redirect, but students who can't help themselves from taking over have their own set of issues that need addressing too. "Sometimes high-achieving students are afraid of letting others do any work for fear it won't be good enough," says Mark J., "and so they control all of the work, which leads to them doing everything." If that's the case, talk with the student about the importance of collaboration and letting go.

Self & Peer Evaluation for Group Work/Project

Students are required to evaluate the personal productivity of each group member, including themselves. Rate yourself and your group members on each of the following 6 categories. Total the score for yourself and each of the group members. You may also provide additional comments about group members (or the dynamics of the group) on the back of this paper.

Name of each member of group	Participation			Preparation			Communication		
	High	Med	Low	High	Med	Low	High	Med	Low
Your name									
Group Member									
Group Member									
Group Member									

Rubric

Participation	High Contributes ideas. Actively speaks up. Brainstorms **Med** Contributes some ideas but is mainly passive. **Low** Sits passively. Does nothing.
Preparation	**High** Does more than required. **Med** Does what was committed to do. **Low** Does nothing
Communication	**High** Listens to other's ideas. Gives broad ideas and expands on them or encourages others to do so. Builds on contributions of others **Med** Listens fairly well. Contributes ideas but the ideas do not deepen the discussion rather maintain it at current level. Interrupts at times. **Low** Overbearing. Interrupts. Doesn't allow discussion of ideas other than own and/or does not listen or contribute.

Trying Out the Assessment Strategies

These strategies do not work in isolation. They are designed to help you determine where students are in their mathematical progress and how you should proceed to prepare them for success. Try them with your students, and if one strategy doesn't work, try another!

Trying Out the Strategies

Use this reflection form to correlate with the Mathematical Practices, Executive Functions and Growth Mindset Principles.
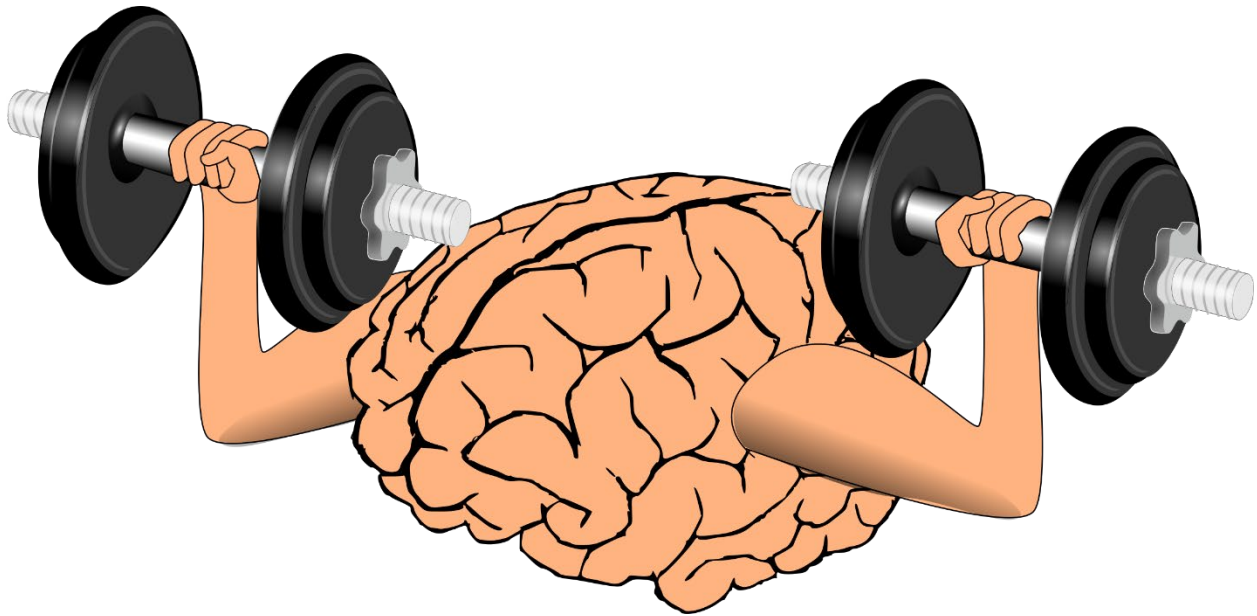
Assessment Strategy	Mathematical Practices	Executive Functions	Growth Mindset Principles	Ones I will Implement and why...
Reflective Journaling				
Goal Setting				
Self-Rating Scales or Checklists				
Portfolios				

Traffic Lights				
Paired Marking				
Peer review for writing assignments				
Think-Write-Talk-Revise				
Open Worksheets				
KWL				

Thumbs Up Thumbs Down				
Homework				
Polls				
Exit Tickets				
In class discussion				
Digital Games/Apps				
Student Self-Assessment				
Self & Peer Assessment for Collaborative Group Work				

Mathematical Practices	Executive Functions	Growth Mindset Principles
1. Make sense of problems and persevere in solving them	1. Impulse Control/Inhibition: Monitoring impulsivity.	1. Put for Effort and Energy
2. Reason abstractly and quantitatively	2. Emotional Control: Understanding and reflecting on feelings.	2. Value Process over Procedure
3. Construct viable arguments and critique the reasoning of others	3. Flexible Thinking/Shifting Thinking and Behaviors: Transitioning between activities.	3. Set Goals
4. Model with mathematics	4. Working Memory: Holding onto relevant information long enough to remember and use it.	4. Welcome Challenges
5. Use appropriate tools strategically	5. Self-Monitoring: Observing behavior in relation to expectations.	5. Taking Feedback Constructively
6. Attend to precision	6. Planning and Prioritizing/Organizing: Breaking down tasks into smaller steps to achieve a goal.	6. Learn from Mistakes
7. Look for and make use of structure	7. Task Initiation/Initiation: Beginning a task without procrastination.	
8. Look for and express reasoning in repeated reasoning	8. Organization/Task Monitoring: Continuously assessing performance toward a goal.	

Excerpt from: 7 Brain-Based Ways to Make Learning Stick

BY **MIDDLEWEB** · PUBLISHED 04/22/2018 · UPDATED 05/28/2023

By Marilee Sprenger

What I have discovered by visiting schools and observing thousands of teachers is that two of these steps – **reflect** and **recode** – are often missed. Lack of time is usually the culprit.

For this short article I am going to share some of my favorite cross-content strategies for each of the steps.

Step 1: Reach

When students enter the room to study the Lewis and Clark expedition, instead of beginning with a short lecture, there's a picture of a very large mosquito on the smartboard or screen. Beneath the picture is written: *One of the biggest obstacles of the Lewis and Clark expedition is mosquitoes. There are so many that you often inhale them! Research how you might deal with this problem as a member of the expedition.* Visuals get students' attention.

Step 2: Reflect

I know my students may not think about their learning without a tool. I like to give them a question to think about, talk about, or write about. All three modes lead to reflection. Such a question might be, "What do you know about this topic that might help others understand it?"

Step 3: Recode

I was fortunate to have small white boards in my classroom with enough for each student. They recode and I walk around watching them. From a standing position, I can read what they are writing or drawing. This lets me know in just a few minutes whether they "get" it. If you don't have white boards, slide a sheet of white paper in a page protector and use these with dry erase markers.

 Exit cards can also be used. Students can recode what they've learned in just a few minutes before the end of class or school. Have students write about the day's learning on an index card or small piece of paper. This is the first retrieval practice they will have, and many other practices will follow.

Step 4: Reinforce

A study by several prestigious universities recently shared the 19 word-phrase that provides the strongest effects from feedback. *"I'm giving you these comments because I have very high expectations and I know that you can reach them."* Share

this message with your students as you check their recoding and reinforce the learning. Even on their Exit cards, write something!

Step 5: Rehearse

I have many favorite rehearsal strategies. Once the students have the basics of what you want them to learn, it's time to practice. At this point in the learning I focus on the five memory systems: semantic, episodic, emotional, procedural, and automatic.

Here's an example. Studying fractions? These ideas address all five systems:

Semantic: Work problems on the board.
Episodic: Take a "field trip" around the school and find items that are fractions (half-full glass of water; a room with some stacked and some unstacked chairs; etc.)

Emotional: Bring in a pizza and cut it into fractions making exactly equal pieces. Discuss how they would feel if the cut was random and they got the smallest piece. (Click!)
Procedural: Bring in a bag of different colored candies. Have students sort the candy by color. Ask students to count the total number of candies and figure out what fraction of the total each color represents.
Automatic: Use flashcards for students to learn fractions and decimals. There are also fraction videos with fun songs filled with information.

Step 6: Review

Usually review revolves around the question, "Do you have any questions?" or "What would you like to review?" But kids don't know what they don't know.

Writing down what's in their brains, comparing with other students, and discussing differences raises test scores!

I like to have groups of students create mind maps using their notes, texts, etc. Then we hang up the maps and the students compare. They can see what they forgot, what is inaccurate, and what is unimportant. Practice tests (retrieval practice) are always a strong component of review.

Step 7: Retrieve
Practice testing, also called retrieval practice, is possibly the BEST way to know if students know. I like using Blank Page strategies as I describe in detail in my book *How to Teach So Students Rememb*er (ASCD, 2018). If you are giving a selected response test, add a blank page at the end of the test on which students can write what they know about the topic. This recognizes that sometimes we don't ask the right questions in the right way for every student!
When we think about students learning, we usually think about how to get information into memory. But we know that we also have to get the information out. Practice these steps to strengthen their connections to the learning and make memories permanent.

_____

How to Build a Brain-Based Curriculum: 7 Ideas

As mentioned above, a brain-based curriculum can look like anything, so long as lessons are built to encourage students' neuroplasticity and optimal knowledge retention. It's important to note that **not all strategies work for all students,** so rely on trial and error to see what works and what doesn't for your classroom.

1. **Break learning into chunks.**

This may seem obvious to many educators, but it bears repeating. Students learn best when they can digest new concepts bit by bit; break lessons down into bite-sized pieces that fall into introductory, practice and review segments before moving on to a new concept or topic.

2. **Include "turn and talk" time in your lessons.**

Take breaks during each lesson or unit for students to talk amongst themselves and solidify their understanding of the topic. This can fall into the "review" stage mentioned above. You can also task students with explaining a new concept to a parent or someone unfamiliar with it. After all, teaching is the best way to grasp a new skill or subject.

3. **Move!**

Not all "chunks" need to involve learning! Leave space in each lesson for movement or stretch breaks. You can even create lessons that get students moving *while* they learn — e.g. role playing a historical event or reading out loud "popcorn"-style with a tossed ball.

4. **Include multisensory elements in each lesson.**

For some topics, using visual elements may be a no-brainer; but challenge yourself to activate other senses during your lessons. Can you help students "physicalize" parts of speech? How can you bring a history lesson to life through sound?

5. **Practice retrieval.**

Encourage students to try to remember what they've learned from a lesson, even if the topic is fairly new to them. The process of remembering strengthens memory

and identifies gaps that call for a refresher. For example, rather than providing a study guide with bullet points covering key points of a lesson, build your study guides around questions that students will need to answer, thereby creating their own study guide through retrieval.

6. **Use concept mapping.**

Concept mapping is the act of connecting separate elements of a topic or unit into a web of comprehension. For example, in a unit on cell structure, students can list out what they've learned about each component of a cell, then visually connect the components to each other by explaining their relationships. **In math, students can list what they have learned about polygons and create a map of the polygons based on their understanding. Or, in math, students can list what they know about the 4 operations with whole numbers and map out how this relates to decimals, integers, fractions, etc. Or, they can list what they know about parent functions.**

7. **Make it real.**

Whenever possible, get your students out of the classroom to apply their learning in the real world. Field trips are a classic example of experiential learning, but even taking your students for a walk around campus to talk about the weather or photosynthesis can help make abstract concepts easier to understand.

This is just a sampling of the ways in which creative educators can leverage neuroscience to help their students succeed in the classroom.

The best teachers never stop pursuing new ways to make learning accessible for all students.

How to Use Total Physical Response (TPR) in the Classroom

Daphne Heflin   Elementary school principal; Ed.S. in Educational Leadership and Administration   **September 1, 2020**

Have you ever taught or considered teaching a student whose primary language is not English, a student who struggles with vocabulary and comprehension, or a student who has trouble sitting during a lesson? Perhaps you know or taught students whose minds tend to wander during crucial instructional lessons. Or perhaps you were a student who could have been described as one of the above.

Each type of student described above can be found in any typical classroom; classrooms include a variety of learners. Teachers, therefore, need a variety of instructional strategies to meet learners where they are. Total Physical Response (TPR) is a strategy that supports the learning styles and needs of many different learners on many different levels, especially in the areas of vocabulary and language acquisition.

What is TPR (Total Physical Response)?

Total Physical Response is a strategy in which students make connections to words, phrases, and sentences by creating physical movements to define them. TPR is a way to physically interact with language and to solidify and demonstrate

comprehension. The strategy can be used to learn new vocabulary words, to demonstrate comprehension of words, phrases and sentences, to demonstrate the understanding of a sequence of sentences, or even the progression of events in a story.

Benefits of Total Physical Response

Physically interacting with language requires mental connections that trigger memory and increase recall; so, with the repetition of meaningful movement with hearing and/or reading words, students improve their ability to recall particular words and definitions.

[Struggling students](#) are many times hesitant to engage during instructional times because of their challenges, challenges like sitting still, paying attention, or understanding. TPR allows struggling learners time and ample opportunities for physical activity, repetition of content/concepts, and mirroring of others, all of which improve outcomes for struggling learners. Having more time and being allowed to mirror others reduce anxiety and the chances of embarrassment for students who struggle to respond in front of others.

Physical activity stimulates blood circulation thus oxygenation in the body. With an increased blood and oxygen flow, students are more alert and attentive. Also, physical activity reduces the chances of students becoming sleepy, bored, or "zoned out."

TPR is engaging not only to students who are physically present in the classroom but to students who are participating in virtual, synchronous learning as well. When videos are activated, students and teachers can see each other create physical movements to define words and concepts. They can respond to each other's physical definitions, mimic others, and engage in learning.

How to Use Total Physical Response in the Classroom

When using Total Physical Response in the classroom, a proper teaching cycle should be used; after following the cycle of teaching new language, words, or concepts, a variety of games can be played with the strategy.

The proper teaching cycle to use when employing TPR starts with preparation. The teacher gathers the vocabulary words, phrases, sentences, and/or passages that allow for enactment. The words and phrases should include highly descriptive nouns that are representable by actions, verbs that can be physically shown, or language that is not abstract.

After preparation the teacher models by stating the word, phrase, etc. and then by creating a physical movement to represent or define that which was stated. Next the teacher asks a sampling of students to represent the language using their own physical movements.

Following the teacher's model and the student volunteers' models, all students are asked to participate or engage. The teacher repeats the word, phrase, sentence, etc. and all students define it or demonstrate meaning by creating physical movements to match.

Up to this point, the interaction with language has included auditory stimuli, which is the verbally stated language, and physical stimuli, which is the definitions through motion. Now that students have made connections to the language and can demonstrate their understanding, teachers should write the words, phrases, sentences, etc. for students to see. The teacher or the group reads and then physically responds to show meaning. By writing and reading the content, visual stimuli and visual literacy is involved.

Repetition and practice with the same words and language will increase the longevity of the learning, so it should be done consistently.

As spiral review or even **formative assessment** opportunities, the teacher can create games using TPR. For example, the teacher and students can play "Simon Says" by having the teacher call a word, phrase, etc. and the students only physically define it if the teacher said, "Simon Says."

Another game using the TPR strategy is called "Circles." It's similar to an old childhood favorite, "Duck, Duck, Goose." Students make a circle around the teacher. The teacher calls out a word and students act out the meaning of the word; however, the last student to respond is "out." This is repeated until there is one student remaining and that student becomes the winner.

Teaching and learning can be challenging due to differences in people: different languages, **different learning style preferences**, different intelligences, different attention spans and memories, and the list goes on. Finding a strategy that addresses many needs and improves the learning outcomes of many different learners is golden; Total Physical Response is golden.

VOCABULARY Words Are Important!

Mathematics is a universal language we use to understand and make sense of the world.

It is a language that helps us describe and explain the most intricate concepts in science, engineering, and technology.

However, it is not only the concepts that matter when it comes to understanding math but also the vocabulary.

We cannot fully grasp and communicate mathematical concepts without the right vocabulary. This is why teaching math vocabulary is vital. In this blog, we'll explore the reasons why.

- Understanding Mathematical Concepts
Mathematical concepts are complex, and they require a lot of abstract thinking. To understand them, students need to know the specific terminology used in math. Vocabulary words like "fraction," "integer," and "polygon" are just a few examples of essential math terms that students need to know. Without this knowledge, anyone would struggle to understand even the simplest of math problems.

- Communicating Mathematical Ideas
Mathematical vocabulary is the key to communicating mathematical ideas. When you know the right vocabulary, you can explain thought processes and reasoning behind solving a math problem. Naturally, it is easier for communicate ideas when we have the right words to use. This is essential for success in every field and of course is true if you want to build a strong foundation in mathematics.

- Building Mathematical Confidence When we understand math vocabulary, we feel more confident in our ability to solve math problems. The knowledge of math terms and concepts empowers students to solve complex math problems and understand the logic behind mathematical operations. When you feel confident in your abilities, you are more likely to engage in the learning process and feel a sense of pride in your accomplishments.
- Preparing for Standardized Tests As you know, standardized tests such as the SAT, ACT, and GRE all include math sections. These tests often use complex math vocabulary, and without knowing the right terminology, it is easy for students to struggle to understand the questions. Math vocabulary, is a vital foundation to have and can impact a person's future academic and career opportunities.
- Enhancing Critical Thinking Skills Mathematics is a subject that requires critical thinking skills. It is not enough to memorize formulas and procedures; students must be able to understand how and why they work. By teaching math vocabulary, educators can help students build critical thinking skills by requiring them to analyze and understand the meanings behind mathematical terms.

Math vocabulary is a crucial component of mathematics education. Understanding math vocabulary is essential for understanding concepts, communicating ideas, building confidence, preparing for standardized tests, and enhancing critical thinking skills. By prioritizing math vocabulary instruction, we can help students build a strong foundation in mathematics and set them up for success in future academic and career endeavors.

Math Talk

1. **Explain:** "This is my solution..."
   - explain & show your thinking
   - "My first step..."

2. **Evaluate:** "I agree/disagree with ___ because..."
   - offer a different solution or another way to solve the problem

3. **Extend:** "This makes me think..."
   - "I still have a question about..."
   - "Why did you...?"   "How did you...?"
   - "What if...?"
   - "Could you have...?"

3rd GRADE Thoughts

MATH SYMBOLS

Symbol	Name	Symbol	Name	Symbol	Name	Symbol	Name
*	Asterisk	/	Division slash	$	Dollar sign	=	Equality
a^b	Caret	∫	Integral	≤	Less than or equal	≈	Approximately equal
≠	Not Equality	≥	Big than or equal	"	Quotation Mark	>	Greater than
<	Less than	;	Semicolon	:	Colon	+	Paddition
()	Parentheses	%	Percentage	—	Dash/hyphen	÷	Division
—	Subtraction	&	Ampersand	Ω	Ohm sign		
√a	Square root	∞	Infinity	X	Multiply/times		
π	Pi constant	Σ	Summation	[]	Brackets		

Vocabulary

•Research has demonstrated that vocabulary learning occurs most successfully through instructional environments that:

- are language-rich,
- actively involve students in using language,
- require that students both understand spoken or written words and also express that understanding orally and in writing, &

•require students to use words in multiple ways over extended periods of time.

MARZANO'S 6 STEPS

1) Provide a description, explanation, or an example of the new term

2) Ask students to restate the description, explanation, or example in their own words

3) Ask students to construct a picture, symbol, or graphic representing the term or phrase

4) Engage students periodically in activities that help them add to their knowledge of the term in their notebooks

5) Periodically ask students to discuss the terms with one another

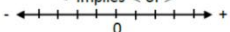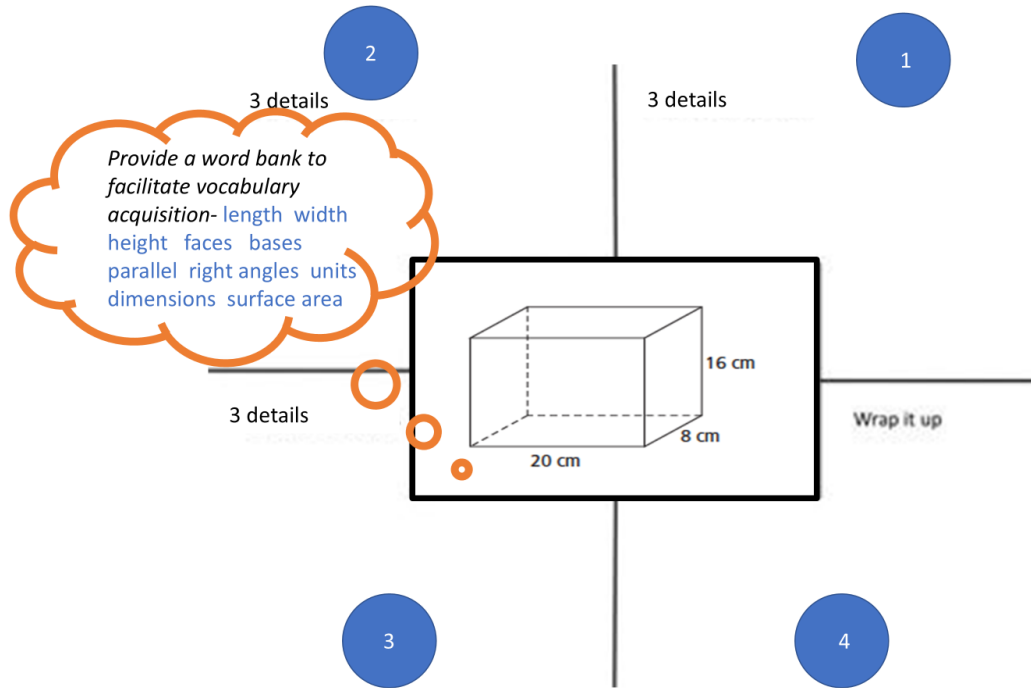6) Involve students periodically in games that allow them to play with term

Reporting Category 2: Computation and Algebraic Relationships

The student will demonstrate an understanding of how to perform operations and represent algebraic relationships.
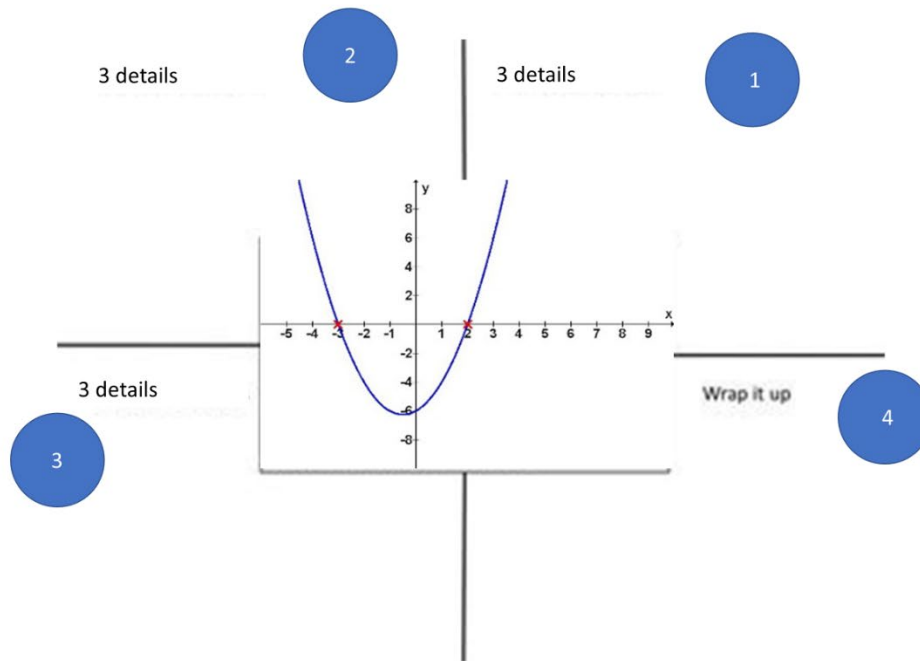
TEKS 6.9: Expressions, equations, and relationships. The student applies mathematical process standards to use equations and inequalities to represent situations. The student is expected to

6.9B represent solutions for one-variable, one-step equations and inequalities on number lines. *Supporting Standard*

Language Elements		
Content Vocabulary	**Academic Vocabulary**	**Symbolic Notation**
closed circle number line open circle one-step equations one-step inequalities one-variable equation one-variable inequality solutions	represent	= read as "is equal to" < read as "is less than" > read as "is greater than" ≤ read as "is less than or equal to" ≥ read as "is greater than or equal to" • implies =, ≤, or ≥ ○ implies < or > Number Line

2

1

3 details

3 details

Provide a word bank to facilitate vocabulary acquisition- length width height faces bases parallel right angles units dimensions surface area

16 cm

8 cm

20 cm

3 details

Wrap it up

3

4

3 details

3 details

3 details

Wrap it up

Vocabulary Formative Assessment using Agree/Disagree Graphic Organizer

Before		Statement/Application	After
Agree **Disagree** **Not Sure**		A one-variable equation is an equation in which there is only one variable used. The variable can be used multiple times and/or used on either side of the equation; all that matters is that the variable remains the same.	
Agree **Disagree** **Not Sure**		Variables are the same as constants.	
Agree **Disagree** **Not Sure**		Rational coefficients are simply coefficients that are rational.	
Agree **Disagree** **Not Sure**		In the expression "3 + y," the coefficient is *3* and the variable is *y*.	
Agree **Disagree** **Not Sure**		In the formula $A = \pi r^2$, pi is a constant.	

Mathematical Literacy

Three Strategies: Fill-in-the-Blank, Cloze Reading, and Sentence Frames

Fill-in-the-Blank	Cloze Reading	Sentence Frames
– focus on vocabulary and recall – usually missing a single word or short phrase – determines factual knowledge – usually one right answer	– focus on deeper level comprehension and syntax – students use context to determine missing words – can have multiple possibilities	– gives structure to academic language – focused on comprehension skills and strategies or writing genres – used for expressive language skills

How are they different?

In a nutshell, the differences between these strategies have to do with the differences in required output and depth of understanding required by the student.

These strategies – the Fill-in-the-Blank, Cloze Reading, and Sentence Frames – are powerful tools in your educational arsenal. Each one, in its unique way, engages learners and paves the path for a deeper understanding.

Fill-in-the-Blank Strategy

The fill-in-the-blank strategy is a classic approach used to assess a learner's understanding and recall. Here, sentences are stripped of certain words, and learners are tasked to complete them. This strategy is widely used because it directly engages learners in the content.

There is one correct answer, usually a single word or a short phrase. This strategy is often used to determine factual knowledge and is closely tied to the content being learned. In fact, most often the fill-in-the-blank strategy is used after reading a text about a topic or at the end of a unit study.

When Should Teachers Use Fill-in-the-Blank Questions?

Teachers should consider using fill-in-the-blank questions primarily for reinforcing factual knowledge and recall. This strategy is particularly effective after a lesson or unit of study when students have a firm understanding of the content. It is a great way to test student comprehension of key terms, facts, or concepts covered in the material.

In addition, fill-in-the-blank can be used as a tool for students to practice language skills, such as grammar and vocabulary.

Lastly, they can be used as a warm-up activity to engage students and activate https://whatihavelearnedteaching.com/important-to-elicit-prior-knowledge/ prior knowledge before delving into a new lesson or topic.

Using this strategy, teachers can provide differentiated instruction, scaffolding the learning for students who need more support while offering a challenge to those who are ready for it.

Cloze Reading Strategy

Cloze reading takes the fill-in-the-blank strategy up a notch. It involves presenting learners with a passage that has missing words throughout, requiring a deeper level of comprehension.

Cloze reading is used with longer passages and paragraphs. Words are selectively removed from a reading passage, typically every 7-10 words, and can belong to any part of speech. Multiple answers may fit the space, requiring students to rely on context clues and their understanding of syntax to determine the most suitable option.

Cloze reading can help to improve reading accuracy, speed, and comprehension.

When Should Teachers Use the Cloze Reading Strategy?

Teachers should implement the cloze reading strategy to enhance students' reading comprehension and engagement with a text. It is particularly effective in lessons aimed at improving context clue usage, vocabulary development, and understanding of syntax, thus is a strategy often used in upper elementary grades and beyond.

This strategy is also valuable when teachers wish to assess a student's ability to understand a passage as a whole, rather than isolated facts.

Additionally, it can be used as a tool to help students make predictions, draw inferences, and promote critical thinking. Finally, the Cloze reading strategy is a potent tool to improve reading fluency, as it encourages students to read smoothly and with understanding.

A Cloze Reading Teaching Strategy Suggestion

One way to use a Cloze reading passage is to provide students with a paragraph or passage with blank spaces. Do not provide the words that you would include in the blanks.

Have individual students spend time filling out the blanks with what they think best fits the reading passage. Then have students get together with a partner or small group to discuss their responses. Students will likely have different responses.

Students can correct or modify their responses, but encourage them to discuss why they chose a particular word for the space. What about that word makes it a good fit? Or if they chose to change the word, why did they change it?

After students have shared their work with a small group, have small groups share out with the whole class. Choose to discuss responses that vary widely. Why did students choose a particular word for the blank? What part of speech would go in that space? What other words might fit?

The art of Cloze reading passages is the ability to dig deeper with vocabulary and syntax usage. This benefit grows stronger during class discussions about shades of meaning and grammatical features of the words chosen. Use these as teachable moments to dig deeper into syntax and word meaning.

How do Teachers Create Cloze Reading Passages?

Cloze reading passages are best created by the classroom teacher for a specific purpose to use with a specific group of students. It is an exercise to develop deeper levels of comprehension, use of context clues, and facilitate discussions on syntax.

Given these objectives, it is best to take a piece of text that you're already using and strategically remove some of the tier 2 vocabulary. Students should be familiar with the vocabulary that is removed but may lack a depth of understanding of the use of those words in a variety of contexts.

Sentence Frames Strategy

Sentence frames are an excellent strategy for fostering language development. They provide a scaffold that helps learners construct sentences. They're particularly helpful for English language learners as they provide a structure for academic language that learners can use to convey their ideas.

Sentence frames give structure to academic language by providing a structure for using comprehension skills and strategies or writing genres orally or in writing. Sentence frames are used for expressive language requirements. With sentence frames, there is often more than one possible correct answer. They can also be used to share or explain ideas.

When should teachers use Sentence Frames?

Teachers should employ sentence frames when they aim to enhance student expression, particularly in discussions and writing tasks. This strategy is particularly effective for students learning English as a second language, or those struggling with sentence structure and clarity in their communication.

Utilizing sentence frames can help students articulate complex thoughts, draw comparisons, express opinions, or make predictions more confidently.

Furthermore, sentence frames can be a great tool to scaffold learning in content areas like science or social studies, where students need to use academic language to explain processes or concepts. They act as a springboard, setting students up for successful communication while gradually building their linguistic independence.

Academic Sentence Stems

To support the ELL's academic language development, the teacher could provide sentence stems, such as the examples below:

- We were able to solve the problem by...
- _____ tells me...
- _____ helps me...
- Another example might be...
- This relationship can be used to determine...
- This can also be applied to___
- We can use __ when...
- The strategy I used to find the solution is ___ because...
- An increase/decrease in __ results in...
- We can check our answer by...
- Another way to solve this problem is...
- A better way to determine __ is...
- Changing __ in this pattern would result in...
- This equation can be used to determine...
- This equation...

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Math Talk Sentence Starters

- I think _____ because _____.
- My first step is _____.
- I still have a question about _____.
- I learned _____ when _____.
- _____ is important because _____.
- If _____ then _____.
- The answer is _____ because _____.
- A better strategy would be _____ because _____.
- The factors that are most important are _____ because _____.
- I predict that _____ .
- I believe that _____ will happen because _____.
- _____ and _____ are similar because _____.
- _____ and _____ are different because _____.
- Another way to look at _____ is _____.
- Another example is _____.
- This reminds me of _____ because _____.
- I believe this is true because _____.
- I agree with _____ because _____.
- I disagree with _____ because _____.
- _____'s idea reminds me of _____.
- I solved the problem by _____.
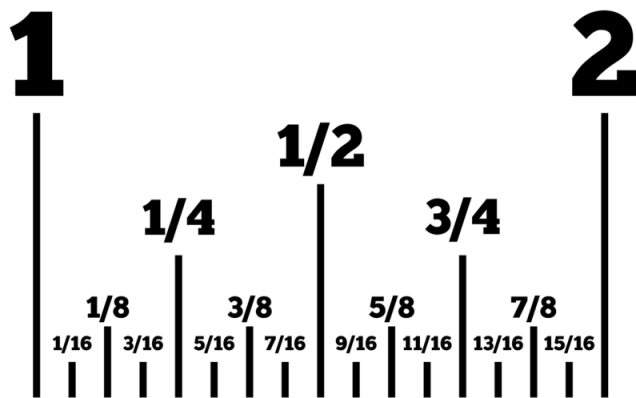- I proved my thinking by _____.

General Sentence Stems

Here are some examples of general sentence stems:

- I feel/think/believe...
- In my opinion...
- The way I would...
- I can use the word...
- This ___ is similar to...
- ____ is important because....
- This makes sense to me because...
- What interests me...
- From the pictures, I can see that...

TEXT FEATURES
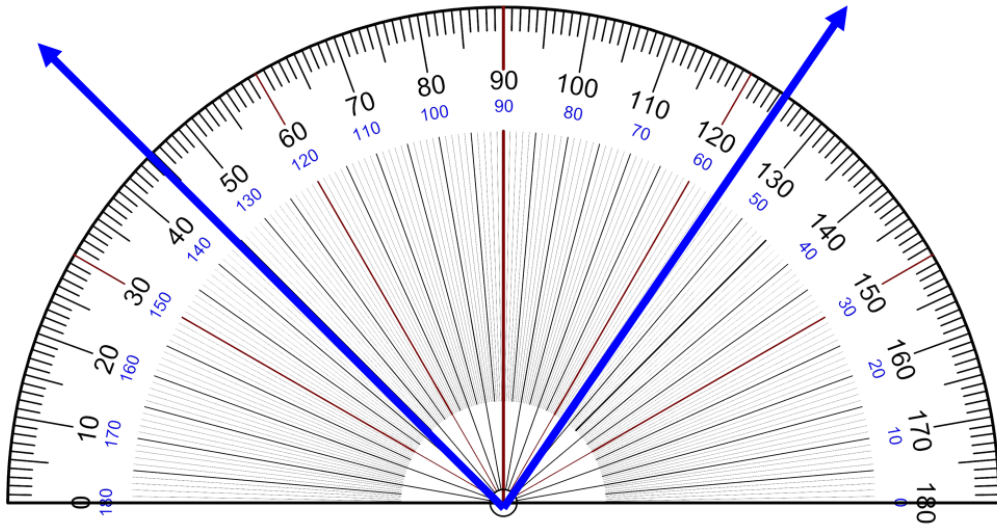
READING A CUSTOMARY RULER

DIRECTIONALITY OF READING

Left to right

Right to left

Top to bottom

Clockwise

Counter clockwise

Combination