Effective Math Teaching Practices: A Guide for Families and Out-of-School Time Professionals

Mindset and Philosophy for Math Support

When helping a student with math, it is important to focus on their thinking, questioning, and understanding rather than just getting the right answer. Here are some key tips to keep in mind:

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Ask Thoughtful Questions

Engage your student with questions that explore their thought process and understanding. Instead of providing answers, ask them to explain what they know and where they got stuck.

Understand Their Thinking

Even if you are not familiar with the math they are working on, asking questions can help you understand their level of comprehension. This helps you guide them more effectively and allows them to express their thought process.

Encourage Detailed Explanations

When students can articulate where they got stuck and what they tried to do, it makes it easier for teachers to help them. Encourage your student to be specific about their difficulties.

View It as a Learning Journey

Think of your role as an opportunity to explore your student's mind and help them develop better learning and understanding skills. It is a collaborative and exciting process.

Here are some prompting questions you can use to support your student:

- What part of the problem do you understand?
- Can you explain the strategies you have tried so far?
- What is the problem asking you to find or do?
- Can you think of a different way to approach this problem?
- What resources or tools could help you solve this?
- How did you arrive at your answer?
- What do you think the next step should be?
- Why do you think this method works or does not work?
- Can you relate this problem to something you already know?

By asking these questions, you will help your student build a deeper understanding of math and develop strong problem-solving skills. Remember, the goal is to make math a fun and engaging experience where your student feels supported and encouraged to explore and learn.

Principles to Actions (2014) by the National Council of Teachers of Mathematics (NCTM) is a helpful book for improving math instruction. It offers practical tips and teaching practices to improve math instruction. This guide is for people who help students outside of the classroom including tutors, family members, and out-of-school time professionals and volunteers. Math is everywhere, and using these practices can help children see math in their world, especially when they are not in math class. The information below is based on the book and helps make math fun and effective, with easy explanations and real-life examples. It is all about making math a positive experience for everyone.

If you are a teacher, or if you want to learn more, the Colorado Department of Education has more information about these teaching practices on its website at **https://www.cde.state.co.us/comath/effectivemathteachingpractices**. Here you will find links to NCTM's books that describe the practices in detail, links to a Spanish edition of Principles to Actions, and tools for use in teacher professional development.

CONTENT

Establish mathematics goals to focus learning

EXPLANATION

Have clear ideas of what needs to be learned, how it connects to prior learning, and why it is important.

PRACTICE IN ACTION

Talk with students about what they are understanding as well as how to arrive at an answer, pointing out opportunities to connect to related ideas.

WHAT IT IS NOT

This practice is not about setting goals that sound like, “Do a subtraction worksheet” or “Get 80% correct.”

CRITICAL ACTIONS

- Plan a clear learning goal for the session (what students are learning, not how students are learning).
- Understand what is being taught and why.
- Note how the math goals connect to past and future learning.
- Discuss learning goals with students.
- Plan and reflect on learning goals.

PROMPTING QUESTIONS

- How is this like something else you know?
- Why is this important to learn?
- Where did this come from?

CONTENT

Implement tasks that promote reasoning and problem solving

EXPLANATION

Do learning activities focused on making sense and solving problems.

PRACTICE IN ACTION

Ask students what happens during a specific scenario in a problem and allow their curiosity to move their thinking forward.

WHAT IT IS NOT

This practice is not about practicing rote memorized facts and procedures. It is also not about telling students how to solve the problem step-by-step.

CRITICAL ACTIONS

- Select diverse math tasks with various representations and tools that allow students to approach the problem with a range of strategies (**example task**).
- Offer challenges that require deep thinking.
- Support student thinking by asking questions.

PROMPTING QUESTIONS

- How is (this strategy) similar to (that strategy)?
- What are some different ways to represent this problem?
- What is going on with this problem?

CONTENT

Use and connect mathematical representations

EXPLANATION

Use and make connections between contextual/situational, visual, verbal, physical, and symbolic (e.g., equations) representations of math problems.

PRACTICE IN ACTION

Understand what is happening (situation) in a word problem before trying to solve it.

WHAT IT IS NOT

This practice is not about removing all context and units from a problem while using different representations. It is also not about requiring all students to use the same representations at the same time.

CRITICAL ACTIONS

- Ask students to make math drawings or use other visual supports to explain and justify their reasoning.
- Encourage purposeful use of representations.
- Make clear connections between representations.
- When changing between representations, switch directions (e.g., table to graph, and then graph to table).

PROMPTING QUESTIONS

- Can you use tools/draw a picture to represent this question?
- How are these representations the same? How are they different?
- How does this (representation) show (the problem)?

Facilitate meaningful mathematical discourse

EXPLANATION

Encourage students to share ideas through class discussion and other forms of communication.

PRACTICE IN ACTION

When solving a problem, students work in teams to share ideas and clarify each other's thinking, constructing convincing explanations about why and how things work, using mathematical language, and learning about the perspectives of their peers.

WHAT IT IS NOT

This practice is not about the teacher asking questions, and the students answering them with no student-to-student interaction.

CRITICAL ACTIONS

- Anticipate student responses before doing the lesson.
- Allow time and space for students to discuss/debate strategies and not be dependent on the teacher for the answers.
- Connect different students' responses, and connect those to the main idea of the lesson.

PROMPTING QUESTIONS

- What did you do? Why?
- Can anyone restate what they just said?
- Do you agree or disagree with that idea? Why?
- Does anyone see it differently?

CONTENT

Pose purposeful questions

EXPLANATION

Ask questions that encourage students to explain and reflect on their thinking.

PRACTICE IN ACTION

Ask questions that gather information, probe understanding, make the mathematics visible, and ask students to reflect on and justify their reasoning.

WHAT IT IS NOT

This practice is not about the teacher asking questions to get students to use one strategy. It is also not about the teacher asking simple questions that require one-word responses.

CRITICAL ACTIONS

- Ask open-ended questions.
- Allows students time to process and form their answers.
- Ask questions that address the learning goal.

PROMPTING QUESTIONS

- What do you notice or wonder about...?
- What do you mean by...?
- How is your equation connected to the situation/problem?
- How do you know your answer is correct?

Build procedural fluency from conceptual understanding

EXPLANATION

Start by teaching the reasoning behind mathematical ideas and then transition to teaching procedures by connecting the steps to the reasoning.

PRACTICE IN ACTION

Introduce equations to represent visual information and make the connection between visual and symbolic representations clear.

WHAT IT IS NOT

This practice is not about memorizing multiplication facts or algorithms. It is also not about completing pages of practice problems or getting answers as fast as you can.

CRITICAL ACTIONS

- Start by understanding the concept.
- Encourage students to draw, write, make up stories, or use objects to explain how the math is making sense to them.
- Disperse opportunities for practice.
- Connect student strategies to more efficient procedures as appropriate.

PROMPTING QUESTIONS

- Why does your strategy work?
- Will this method always work?

CONTENT

Support productive struggle in learning mathematics

EXPLANATION

Support students to stick with it when things are tough so they can improve their understanding.

PRACTICE IN ACTION

Students persevere through tasks, trying alternate approaches and seeking help when needed.

WHAT IT IS NOT

This practice is not about students making no progress on tasks and becoming emotionally overwhelmed (e.g., crying, screaming, disengaging). It is also not about students doing many easy tasks that do not challenge their thinking.

CRITICAL ACTIONS

- Encourage students to make sense of the problem, including context.
- Allow the use of tools and multiple representations to make sense of problems.
- Value thinking over a right answer.
- Give feedback and praise based on effort, perseverance, willingness to ask questions, and attempts at using mathematical language and precise explanations.

PROMPTING QUESTIONS

- How much did that problem challenge you?
- What strategies can you use when you get stuck?
- What would be an extension to the problem?

CONTENT

Elicit and use evidence of student thinking

EXPLANATION

Gather clues about how students are thinking and use them to plan next steps.

PRACTICE IN ACTION

Intentionally collect data every day and use it to plan lessons and support for the next day.

WHAT IT IS NOT

This practice is not about giving a weekly quiz for a grade. It is also not about moving ahead without knowing what the student(s) is/are thinking.

CRITICAL ACTIONS

- Identify what counts as evidence of student thinking by matching evidence with learning goals.
- Plan for daily collection of evidence to track students' progress towards goals.
- Interpret student thinking to assess mathematical understanding, reasoning, and methods.
- Respond to student thinking with prompts and tools to extend and apply thinking.
- Reflect on gathered evidence to plan next steps.

PROMPTING QUESTIONS

- What do you think you know about _____?
- What do you notice? What do you wonder?
- How has your thinking changed?

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