Welcome!

THE IMPORTANCE OF MATH DISCOURSE IN THE ELEMENTARY CLASSROOM

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SOLVE

18X5

What happened when you listened to other people's strategies and shared your own?

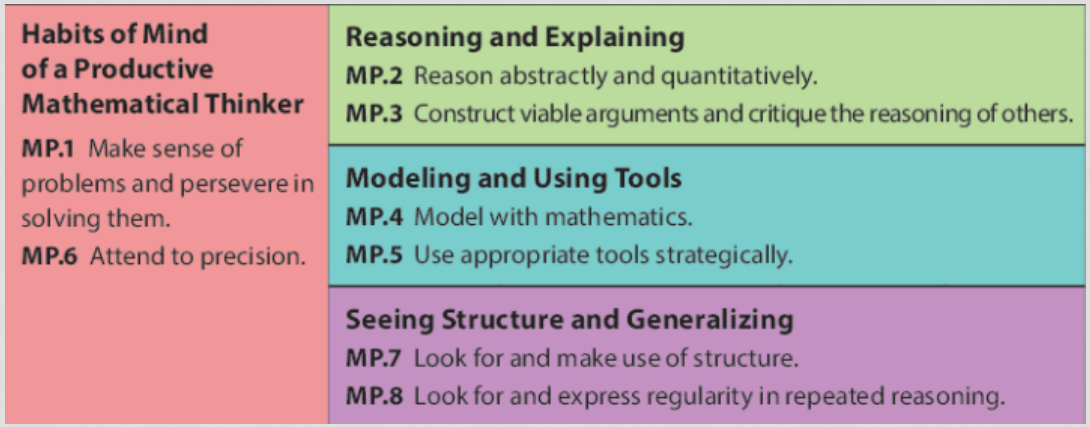
WHY IS MATH DISCOURSE IMPORTANT?

MATH DISCOURSE

- Students are able to:
  - Explain
  - Defend
  - Justify mathematical thinking

SHIFTING TEACHING PRACTICES

- Why is a shift in teaching practices necessary?



- What do we, as teachers, need to do to facilitate the shift?

UNAWARE-STAGE

TEACHER

I can't always tell why my students struggle.

CONSCIOUS-STAGE

TEACHER

I have little control over how some students perform, so I continue to encourage them.

ACTION-STAGE

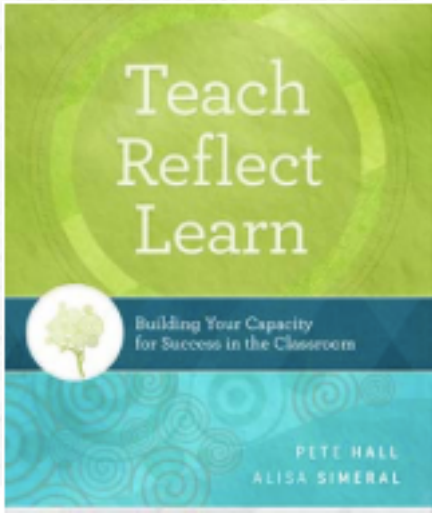
TEACHER

I look at my teaching strategies to see if changing them might have a better effect on those students who are struggling.

REFINEMENT-STAGE

TEACHER

I analyze each student's specific struggles to determine a course of action designed to address them.

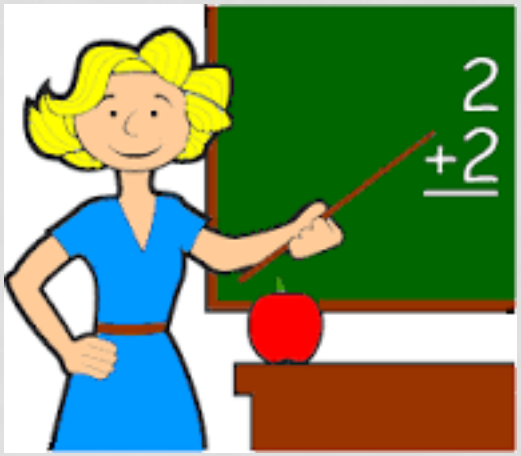


FOUR COMPONENTS OF MATH-TALK

Questioning
Explaining Mathematical Thinking
Source of Mathematical Ideas
Responsibility for Learning

QUESTIONING

Shift from teacher as questioner to students and teacher as questioners.



SHIFT FROM TEACHER AS QUESTIONER TO

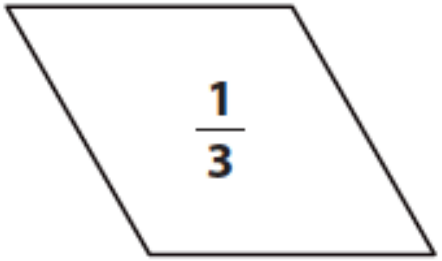
STUDENTS AND TEACHER AS QUESTIONERS.

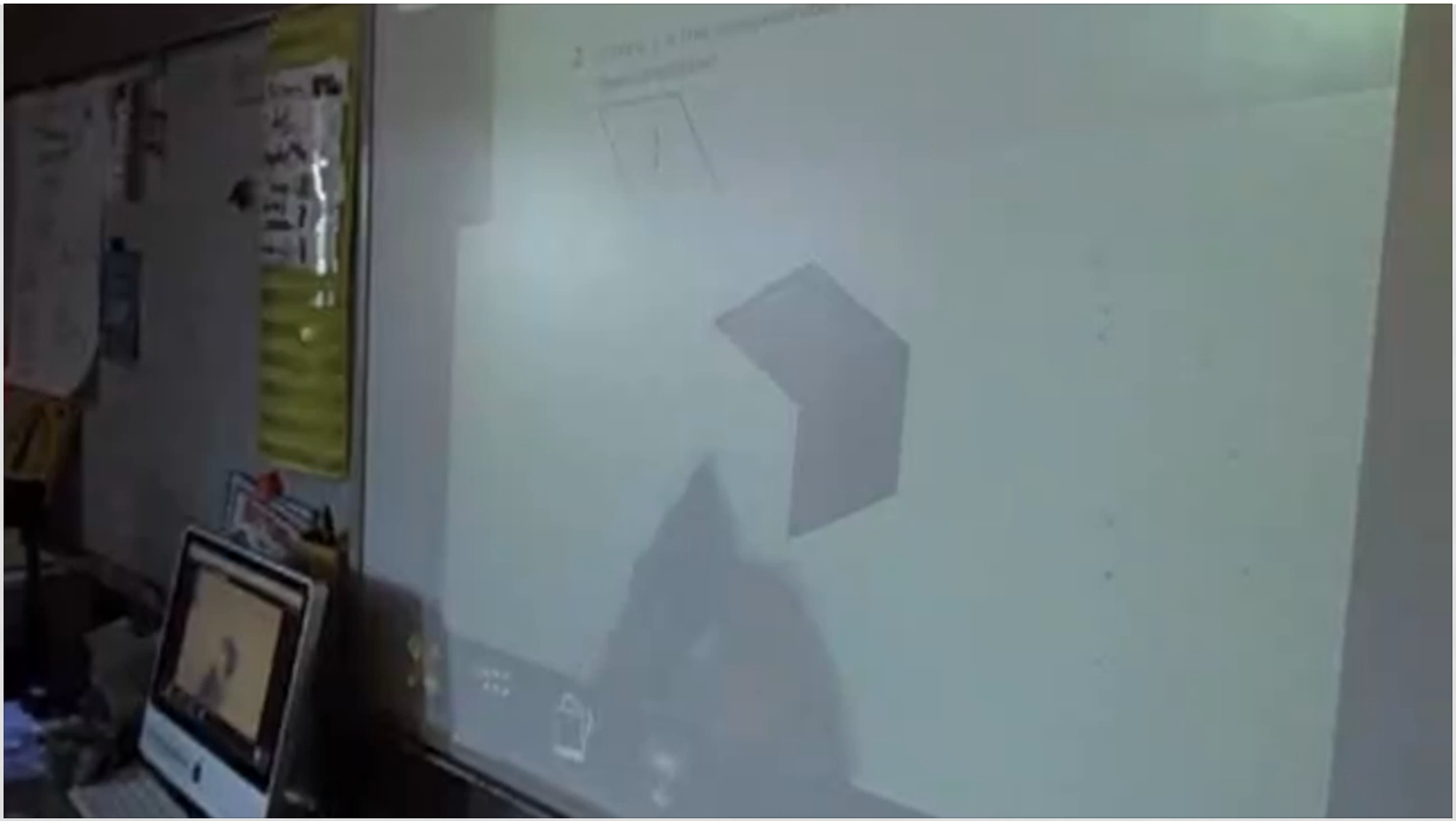
Traditional teacher directed classroom with brief answer responses from students.	***Teacher beginning to pursue mathematical thinking. Teacher plays a central role in the math-talk community.***	***Teacher modeling and helping students build new roles. Some co-teaching and co-learning begins as student-to-student talk increases. Teacher physically begins to move to the side or back of the room.***	***Teacher as co-teacher and co-learner. Teacher monitors all that occurs, still fully engaged. Teacher is ready to assist, but now in more peripheral and monitoring role (coach and assister).***
Teacher is the only questioner. Short, frequent questions function to keep students listening and paying attention to the teacher.	***Teacher questions begin to focus on student thinking and focus less on answers. Teacher begins to ask follow-up questions about student methods and answers. Teacher is still the only questioner.***	***Teacher continues to ask probing questions and also asks more open questions. She also facilitates student-to-student talk, e.g., by asking students to be prepared to ask questions about other students' work.***	***Teacher expects students to ask one another questions about their work. The teacher's questions still may guide the discourse.***
Students give short answers and respond to the teacher only. No student-to-student math talk.	**As a student answers a question, other students listen passively or wait for their turn.**	**Students ask questions of one another's work on the board, often at the prompting of the teacher. Students listen to one another so they do not repeat questions.**	**Student-to-student talk is student initiated, not dependent on the teacher. Students ask questions and listen to responses. Many questions are "Why?" questions that require justification from the person answering. Students repeat their questions until satisfied with answers.**

GOOD QUESTIONS…

- …require more than a fact or reproducing a skill
- …have more than one correct answer OR approach
- …allow students to learn by answering them
- …help teachers learn about students
- …have a universal entry point and use accessible language
- …encourage students to construct new questions

If this is $\frac{1}{3}$ of the shape, what does the whole shape look like? Can you find more than one solution?





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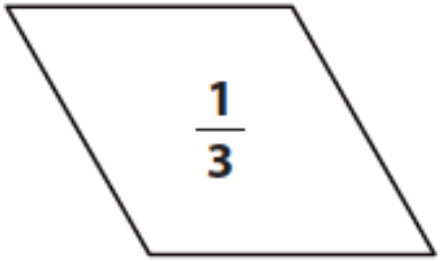


KEY QUESTIONS

- What equation might we use to represent this story problem? Does anyone have a different idea?
- What answer did you get for this problem? How did you figure it out?
- Does anyone have a different solution?
- Does anyone have a different strategy, a different way to solve the problem?
- We have seen three different strategies for solving the problem.
- How are they alike? How are they different?
- Can you convince us? Can you find another way to prove that?
- Did anyone try a method that didn't work? Why didn't it work?
- Do you think It would ever work? Why or why not?

EXPLAINING MATHEMATICAL THINKING

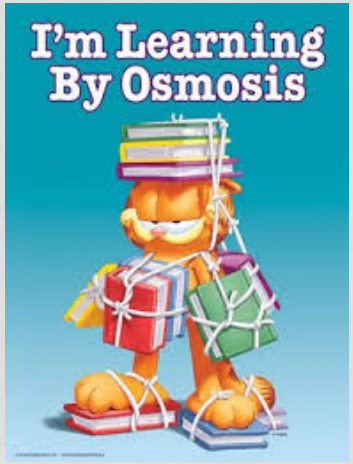
Students increasingly explain and articulate their mathematical ideas.

SOURCE OF MATHEMATICAL IDEAS

- Shift from teacher as the source of all math ideas to students' ideas also influencing the direction of the lesson.

RESPONSIBILITY FOR LEARNING

- Students increasingly take responsibility for learning and evaluation of others and self. Math sense becomes the criterion for evaluation.



How can we facilitate math discourse?

- Consider the physical arrangement of the classroom
- Establish the expectation that all students are participants
- Ask students to restate one another's ideas
- Provide equitable opportunities to share (consider names on craft
- sticks, random name generator, etc.)
- Provide adequate wait time
- Use key questions
- Provide multiple opportunities for Student to Student talk (Think-Pair-Share)

Attention to All Aspects of Culturally Responsive Instruction

- Important Mathematics
- Relevant Experiences
- Students' Mathematical Identities
- Shared Power

MATH PRACTICES AND MATH DISCOURSE

Habits of Mind of a Productive Mathematical Thinker

MP.1 Make sense of problems and persevere in solving them.

MP.6 Attend to precision.

Reasoning and Explaining

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

Modeling and Using Tools

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

Seeing Structure and Generalizing

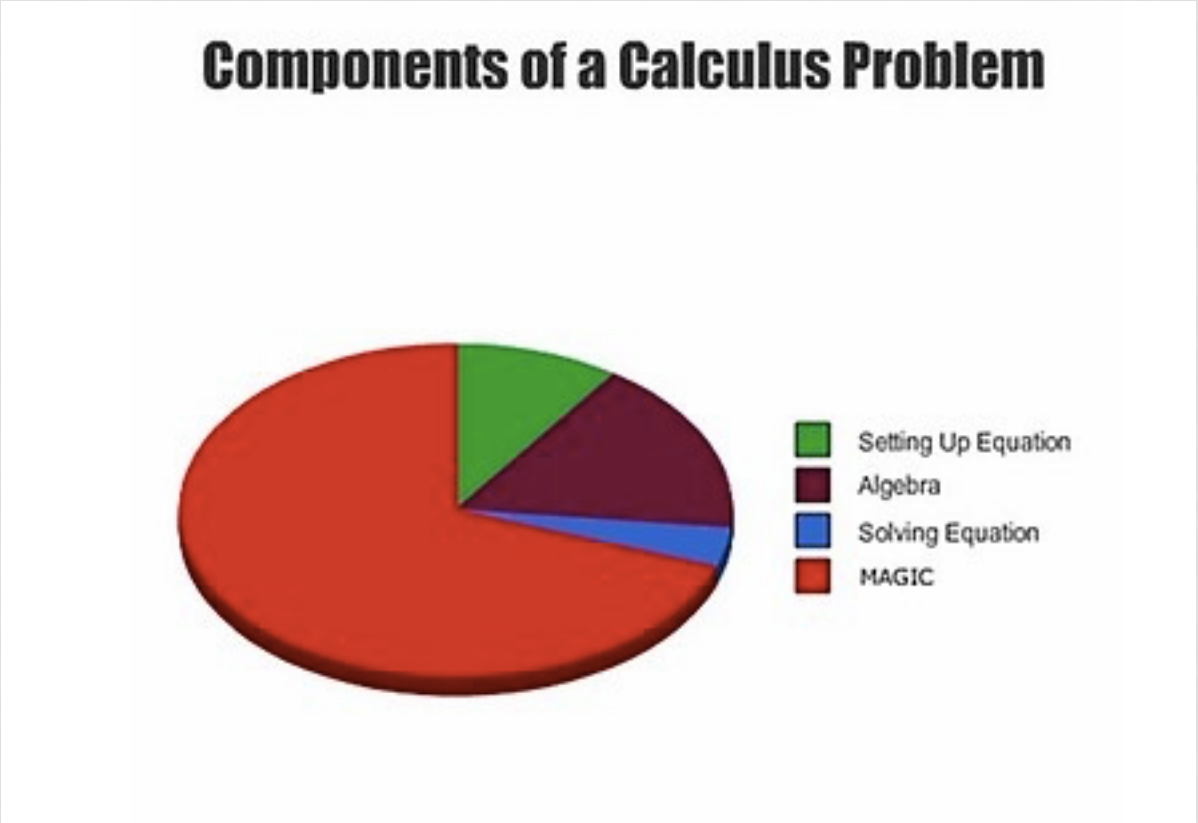
MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Choose one component from the rubric where you have room to grow.

Note one or two steps you can make in your teaching practice to make a shift in your practice.

"Be the change you want to see in the world."
-Gandhi


Components of a Calculus Problem
Setting Up Equation
Algebra
Solving Equation
MAGIC

Purr-pendicular

MOVING FORWARD

- https://www.illustrativemathematics.org
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