

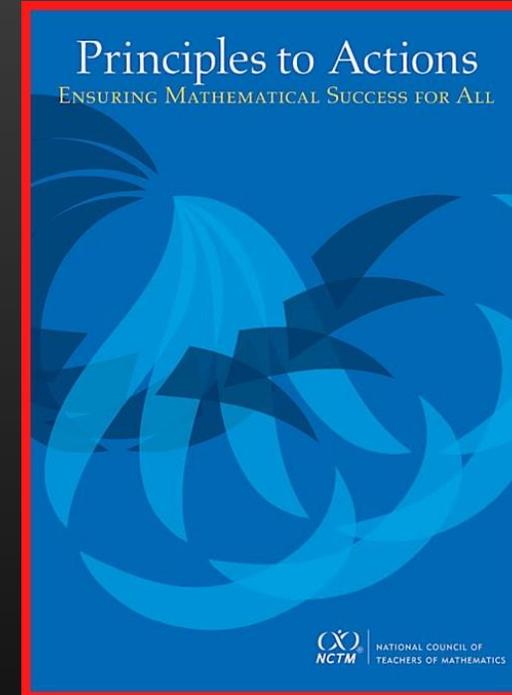
PRINCIPLES TO ACTIONS **IN ACTION**

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PRINCIPLES TO ACTIONS OVERVIEW

- Book Structure:
 - **Effective Teaching and Learning**
 - Mathematics Teaching Practices
 - Discussion
 - Illustration (Classroom examples)
 - Teacher and Student Actions
 - Essential Elements
 - Obstacles
 - Productive and Unproductive Beliefs
 - Overcoming Obstacles
 - Illustration (Classroom examples)
 - Moving to Action
 - Taking Action
 - These words will remain only ideas on paper or screen until they compel us all to action.



MATHEMATICS TEACHING PRACTICES

- Establish mathematics goals to focus learning.
- Implement tasks that promote reasoning and problem solving.
- Use and connect mathematical representations.
- Facilitate meaningful mathematical discourse.
- Pose purposeful questions.
- Build procedural fluency from conceptual understanding.
- Support productive struggle in learning mathematics.
- Elicit and use evidence of student thinking

Eight
research-
informed
teaching
practices
that support
the
mathematics
learning of
all students

While incorporating productive beliefs, this framework provides educators a common lens for moving toward improved instructional practice and for supporting one another in becoming skilled at teaching in ways that matter for ensuring successful mathematics learning for all students.

PRODUCTIVE VS. UNPRODUCTIVE BELIEFS

Beliefs about teaching and learning mathematics	
Unproductive Beliefs	Productive Beliefs
Mathematics learning should focus on practicing procedures and memorizing basic number combinations.	Mathematics learning should focus on developing understanding of concepts and procedures through problem solving, reasoning, and discourse.
Students need only to learn and use the same standard computational algorithms and the same prescribed methods to solve algebraic problems.	All students need to have a range of strategies and approaches from which to choose in solving problems, including, but not limited to, general methods, standard algorithms, and procedures.
Students can learn to apply mathematics only after they have mastered the basic skills.	Students can learn mathematics through exploring and solving contextual and mathematical problems.
The role of the teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematics problems.	The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves students toward shared understanding of mathematics.
The role of the student is to memorize information that is presented and then use it to solve routine problems on homework, quizzes, and tests.	The role of the student is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts and experiences, and considering the reasoning of others.
An effective teacher makes the mathematics easy for students by guiding them step by step through problem solving to ensure that they are not frustrated or confused.	An effective teacher provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.

- Productive vs. Unproductive Beliefs sorting activity
- We cut apart the belief statements and staff sorted the statements into the categories of Productive or Unproductive, based on their current level of understanding.
- We had a group discussion about the belief statements. We included in our discussion the statement that these beliefs should not be viewed as good or bad, instead they should be understood as unproductive when they hinder the implementation of effective instructional practice or limit student access to important mathematics content and practices.

PRODUCTIVE VS. UNPRODUCTIVE BELIEFS

JCMS
Junction City Middle School
700 Wildcat Lane

The role of the teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematics problems.

Mathematics learning should focus on practicing procedures and memorizing basic number combinations.

Students can learn mathematics through exploring and solving contextual and mathematical problems.

An effective teacher, provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.

The role of the student is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, or making connections to prior knowledge or familiar contexts and experiences, and considering the reasoning of others.

Please sort according to your beliefs on the teaching and learning of mathematics ("we agree" or "we disagree")

Group discussion

Mathematics learning should focus on developing understanding of concepts and procedures through problem solving, reasoning, and discourse.

Students can learn to apply mathematics only after they have mastered the basic skills.

The role of the student is to memorize information that is presented and then use it to solve routine problems on homework, quizzes, and tests.

The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves students toward shared understanding of mathematics.

All students need to have a range of strategies and approaches from which to choose in solving problems, including, but not limited to, general methods, standard algorithms, and procedures.

Students need only to learn and use the same standard computational algorithms and the same prescribed methods to solve algebraic problems.

An effective teacher makes mathematics easy for students by taking step by step through problems to ensure that they are not confused.

OUR INITIAL TIMELINE - MILE WIDE, INCH DEEP



Source: blog.designbynewton.com

- Focus on all 8 Mathematics Teaching Practices
 - Sign up sheet for Math PD - Book Study
- *Goal: To collaborate and have rich discussions focused on specific actions that ensure all students learn to become mathematical thinkers and are prepared for their future academics and professional endeavors.*
- As a grade-level, teachers chose three topics to read, plan for, and present to the math department throughout the school year.

Professional Development – Ensuring Math Success for All
Principles to Actions

Effective Teaching and Learning

- September
 - Establish Mathematics Goals to Focus Learning (p. 12-16) _____
 - Implement Tasks That Promote Reasoning and Problem Solving (p. 17-24) _____
- October
 - Use and Connect Mathematical Representations (p. 24-29) _____
 - Facilitate Meaningful Mathematical Discourse (p. 29-35) _____
- November
 - Pose Purposeful Questions (p. 35-41) _____
 - Build Procedural Fluency from Conceptual Understanding (p. 42-48) _____
- December
 - Support Productive Struggle in Learning Mathematics (p. 48-52) _____
 - Elicit and Use Evidence of Student Thinking (p. 53-57) _____

Essential Elements

- January
 - Access and Equity (p. 59-69) _____
- February
 - Curriculum (p. 70-77) _____
- March
 - Tools and Technology (p. 78-88) _____
- April
 - Assessment (p. 89-98) _____
- May
 - Professionalism (p. 99-108) _____
 - Taking Action (p. 109-117) _____

OUR INITIAL TIMELINE



Planning



Leading learning

ESTABLISH MATHEMATICS GOALS

- Establish Mathematics Goals to Focus Learning: Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.
- Both teachers and students need to be able to answer crucial questions:
 - What mathematics is being learned?
 - Why is it important?
 - How does it relate to what has already been learned?
 - Where are these mathematical ideas going?
- Students will perform at a higher level!

ESTABLISH MATHEMATICS GOALS - FOUR SQUARE

- Teachers presented a summary of *Establishing Mathematics Goals*. Then they go into grade level groups and answered the questions using the standards and progressions documents.

Establish Mathematics Goals to Focus Learning

What important mathematics is being learned?	Why is it important?
How does it relate to what has already been learned?	Where are these mathematical ideas going?

Unit of Study: _____

	Investigation 5	Extra Notes
Overview What is this investigation about? (Use "Unit Overview" in <u>Teacher's Guide</u>)		
Background What should we know to successfully teach this unit? (Use "Mathematics Background" in <u>Teacher's Guide</u>)		
Standards What Common Core Standards does this investigation align with? (Use "Goals and Standards" in <u>Teacher's Guide</u>)		
Goals What are the goals of this investigation? (Use "Investigation Overview" in <u>Teacher's Guide</u>)		
Connections How does it relate to what has already been learned? (Use "Scope and Sequence")		
Connections Where are these mathematical ideas going? (Use "Scope and Sequence")		
Grain Size Where do the standards for this investigation fall within the grain size of our grade level? (Use "Grain Size Documents")		
Test Questions What are the test questions that correspond to this investigation? (Use "Unit Test Correlations" in the <u>Resource Guide</u> AND the Unit Test)		

ESTABLISH MATHEMATICS GOALS - PLANNING GUIDE

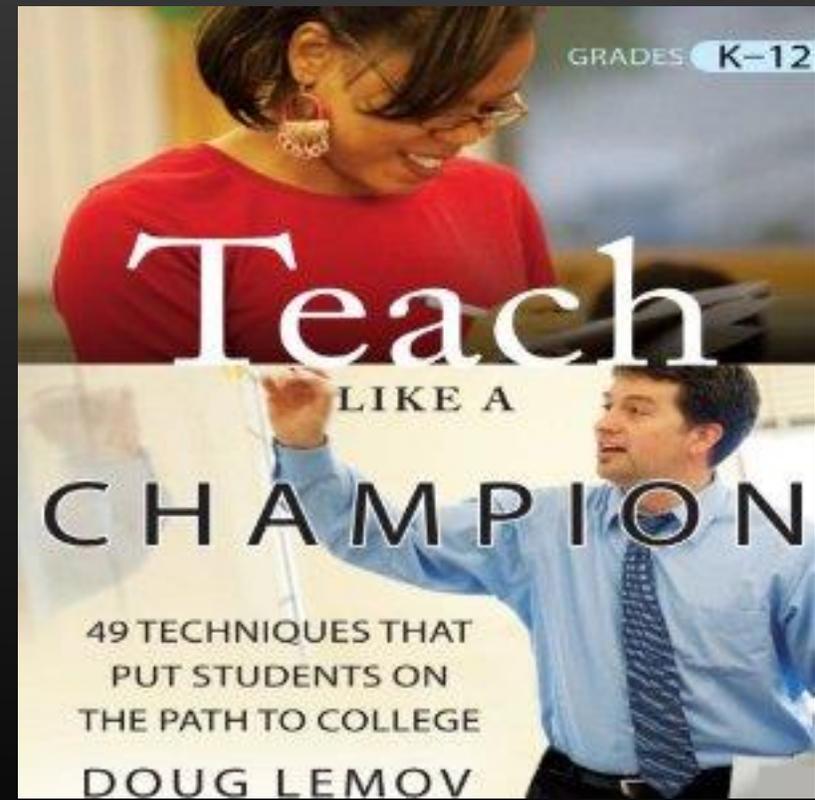
- What mathematics is being learned?
 - Overview, Standards, Goals
- Why is it important?
 - Grain Size
- How does it relate to what has already been learned?
 - Background, Connections
- Where are these mathematical ideas going?
 - Test Questions

ESTABLISH MATHEMATICS GOALS - TEACH LIKE A CHAMPION

Teachers were able to make connections between the work that they did *Establishing Mathematics Goals from Principles to Actions* and writing objectives from Teach Like a Champion.

Effective Objectives are:

- **Made first.** The objective was chosen first and determines what activities the lesson plan includes. It wasn't thought up to justify doing an appealing activity that may or may not advance class learning toward the overall unit goal.
- **Most important.** The objective focuses on what's most important for the class right now on its path to higher education. It describes the next step straight up the mountain.
- **Measurable.** It's possible to measure how fully the objective has been realized. Ideally you have measured that by the time the class period is over.
- **Manageable.** The objective can be reached within the time of the lesson.



"When we know better, we do better."

- **Carol Arjona**, Director of Secondary Education, Geary County Schools



REFOCUSING OUR EFFORTS

- Objectives
 - Teachers will make connections between all of our major math resources
 - Teachers will recognize evidence of the teaching practices of **Posing Purposeful Questions** and **Facilitating Meaningful Math Discourse** in instruction
 - Teachers will implement the teaching practices of Posing Purposeful Questions and Facilitating Meaningful Math Discourse with fidelity in the classroom

APPLICATION

- Principles to Actions
 - Mathematics Teaching Practices
 - Facilitate Meaningful Mathematical Discourse
 - Pose Purposeful Questions
- Standards for Mathematical Practice
 - Construct viable arguments and critique the reasoning of others
- Connected Mathematics 3
 - Student and Teacher Observation
 - Students participate in discourse
 - Teacher engages in behaviors that promote student engagement and critical thinking

Observation Protocol for Math

WHAT DOES EACH RESOURCE LOOK FOR?

6-12 District Math Expectations	Standards for Mathematical Practice	Principles to Actions
Students are engaged in important mathematical tasks	Make sense of problems and persevere in solving them	*Establish mathematics goals to focus learning
Students communicate using mathematical language	Reason abstractly and quantitatively	Implement tasks that promote reasoning and problem solving
Students make connections related to the goals of the lesson	Construct viable arguments and critique the reasoning of others	Use and connect mathematical representations
Students summarize	Model with mathematics	*Facilitate meaningful mathematical discourse
Students use elements of abstraction (symbolic representation, generalizations), if appropriate	Use appropriate tools strategically	*Pose purposeful questions
Students keep records	Attend to precision	Build procedural fluency from conceptual understanding
Students reflect on their learning	Look for and make use of structure	*Support productive struggle in learning mathematics
Students participate in discourse	Look for and express regularity in repeated reasoning	Elicit and use evidence of student thinking
Teacher supports students' initial engagement with the mathematics task		
Teacher supports students' exploration of the mathematics task		
Teacher supports students' summarizing		
Teacher engages in behaviors that promote student engagement and critical thinking		
Students use technology (when appropriate)		
Teacher uses technology (when appropriate)		

APPLICATION

Read the “Facilitate Meaningful Math Discourse” section from Principles to Actions (pg. 29-35) and discuss the following:

- Simply having students talk does not necessarily advance the mathematical goals of a lesson. How can the five practices identified on page 30, as described by Smith and Stein (2011), support and facilitate the purposeful exchange of ideas in the mathematics classroom?
- Review the Candy Jar task in figure 12 (p. 31) and the conversation from Mr. Donnelly’s implementation of the Candy Jar task, shown in figure 13 (pp. 33-34). What do the authors mean when they say, “Mr. Donnelly facilitates rather than directs” this discussion (p. 34)? Give specific examples.

APPLICATION

Facilitate Meaningful Mathematical Discourse

A LESSON IN ACTION

Task

Focus on a category of symbol strings (expression, equation, inequality), separate them, and discuss how you know how to categorize them.

$$X + Y = Y + X$$

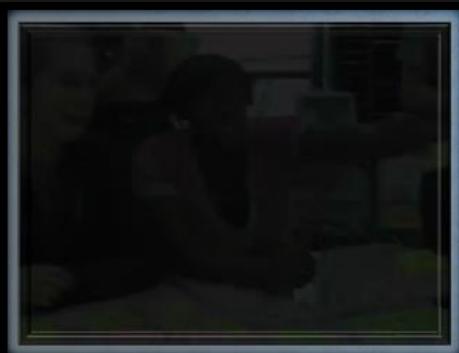
$$4p + 3p - 2p$$

$$a + (b + c) = (a + b) + c$$

$$3x + 2y + 4z$$

$$3x + 2x = 5x$$

$$5x - 1 > 34$$



Classroom Visits – Student Actions for *Facilitate Meaningful Mathematical Discourse*

School: _____ Grade or Course: _____ Date: _____

Students are:	Evidence
Presenting and explaining ideas, reasoning, and representation to one another in pair, small-group, and whole-class discourse.	
Listening carefully to and critiquing the reasoning of peers, using examples to support or counterexamples to refute arguments.	
Seeking to understand the approaches used by peers by asking clarifying questions, trying out others' strategies, and describing the approaches used by others.	
Identifying how different approaches to solving a task are the same and how they are different.	
Initiating problems and posing new questions.	
Encouraging the use of mathematics vocabulary.	

TEACHER LEARNING AND REFLECTION

After watching the lesson, what things did you notice or wonder about in regards to:

- How the teacher facilitated discourse?
- The students' role in the class discussion?

Share Your Learning

- What are some key points from our reading in P to A or that you saw in the lesson that would help make our professional practice better as teachers?
- Any personal testimonies? What have you already tried that has proven to make a positive impact in regards to these ideas?
- What is something you can do tomorrow?

KEY POINTS

- We want students to LEARN, not be TAUGHT
 - The depth of learning is so much greater if we use it for discourse
- Get students talking more!
 - Students should be talking to each other rather than teacher
 - Who is seen with the knowledge?
- The importance of helping students listen to each other
- The importance of purposefully sequencing and selecting student strategies to share (progressive ideas) - Follow 5 Step process to be intentional with planning and sharing of ideas
- Teacher = Question Master, BUT allow time for students to think about their thinking
- Truly listen to students to seek understanding, without thinking of next steps
 - Help them make connections
- Teacher Q's to ask:
 - Why?
 - How do you know?
 - What do you mean?



TEACHER LEARNING AND REFLECTION

With a different lens, reflect on your second observation and answer the following:

- What patterns of questioning did you notice?
- How would you compare the question types posed in the lesson to the ones outlined in Figure 14 (pg. 36-37)?

Share Your Learning

- What are some key points from our reading in P to A or that you saw in the lesson that would help make our professional practice better as teachers?
- Any personal testimonies? What have you already tried that has proven to make a positive impact in regards to these ideas?
- What is something you can do tomorrow?

KEY POINTS

- Be mindful of the questions you ask
- Critical things to consider when questioning are:
 - Types of questions
 - Patterning of questions
- Wait time! Should be close to 15 seconds
 - Explain to students why you wait and allow them to check if peers' responses are correct/incorrect and why?
 - Build student confidence in their math ability
- Allow students to share and explain their thinking; process "how" and "why"
- "EMS" --> Explain/Reflect, Make Connections, Support students in sharing their thinking



Challenge: Record the questions you ask in a lesson and look to see if your questions remain open-ended without asking a follow-up *funneling question*.

ACTION STEP

Action Steps: All Teachers

- Invite a coach or administrator to observe your class and use either the FMMD or PPQ checklist. Then meet with them later to discuss.
- After one of your lessons, reflect using either the FMMD or PPQ checklist and discuss it with a coach or administrator.
- Observe another math teacher with a coach or administrator, using either the FMMD or PPQ checklist and debrief with a coach or administrator.

Please complete by April 2nd.

WHAT NEXT?

- Timeline for future
 - Continue focusing on FMMD and PPQ by having teachers:
 - observe video clips of other teachers unknown to them
 - observe video clips of themselves teaching
 - volunteer to have other teachers observe them
 - conduct systematic observations of one another
 - Continue focusing our professional development on the Mathematical Teaching Practices
 - Continue to evaluate the comfort and implementation levels of our teachers to design meaningful professional development to dig deeper into additional practices



START SMALL, BUT GET STARTED

"Your present circumstances don't determine where you can go; they merely determine where you start."

- Nido Qubien



EXIT TICKET

- **A**djective
 - A word or two that describes what you saw or heard
- **E**motion
 - Describe how a particular part of what you saw or heard made you feel
- **I**nteresting
 - Write about something you found interesting in the information
- **O**h!
 - Something you heard or saw that made you say, "Oh!"
- **U**mm?
 - Questions you have from the information you saw or heard

THANK YOU FOR COMING!

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