Powerful, Engaging, and Effective Professional Development

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FOUR PRINCIPLES FOR DESIGNING POWERFUL, ENGAGING, AND EFFECTIVE PROFESSIONAL LEARNING EXPERIENCES

We will engage in them first and then we will name them.

Let's Mingle!

1. **When we say mingle – you will start mingling.**
2. **When we call out a number, find that number of people to be in your group and quickly introduce yourself.**
3. **Then answer the question on the screen.**

3

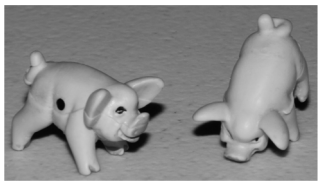
Tell about a mathematics teacher who influenced you.

5

What is your biggest worry about coaching/leading mathematics teachers?

Select the image that best represents your own mathematical teaching journey.

Pass the Pigs!



1. **Toss a pig to find out all the possible ways a pig could land.**
2. **Now, assign a point value for each possible landing position.**
3. **Develop a mathematical argument for deciding which gets the highest point value. Use evidence to support your idea.**

What is Engaged Professional Learning Principle 1?

Engaged Professional Learning Principle 1

"The best Professional Learning gets going right away – No announcements please. We can get that in an email" (Teacher Interview, November, 2015).

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What are our *beliefs* and how might these beliefs influence our work?

How might our Professional Learning Reflect beliefs about our teachers?

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.

National Council of Teachers of Mathematic). (2014). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: Author.

How might our Professional Learning Reflect beliefs about our teachers?

Beliefs about Mathematics Professional Learning (Development)	
Unproductive Beliefs	Productive Beliefs
Professional Learning should be designed around teacher deficits.	Professional learning should be designed around teacher assets.
All teachers need the same professional learning.	All teachers need a range of professional learning opportunities.
One shot, expert, professional learning works to motivate teachers to make changes.	Professional learning must be sustained and teacher driven.
If teachers just knew the mathematics, they would be able to teach better.	Professional learning respects the intellect and experience of teachers.

National Council of Teachers of Mathematic). (2014). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: Author.

Do our practices match our beliefs about Professional Learning?

"We have too many professional development presenters who have come to save the teachers. They have all of the answers for how teachers should be teaching students mathematics, and those still in the classroom have none of the answers."

(Teacher Interview, November, 2015).

"What do you wish your mathematics leader knew?"

"PD that makes me feel good about my teaching. Not bad."

Teacher Interview
November, 2015

"A safe environment where I feel comfortable being a risk-taker while learning, sharing, and questioning"

Teacher Interview, September, 2015

"We need time to talk…process… reflect… We don't need to be saved… Let us save ourselves"

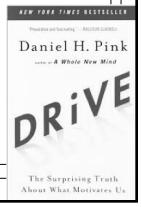
Teacher Interview, October, 2015

Do our practices match our beliefs about Professional Learning?

What kinds of PD Motivates Us?

"Control leads to compliance; autonomy leads to engagement"

"Human beings have an innate inner drive to be autonomous, self-determined, and connected to one another. And when that drive is liberated, people achieve more and live richer lives."



	Teacher role	Questioning	Explaining mathematical thinking	Mathematical representations	Building student responsibility within the community
Level 0	Teacher is at the front of the room and dominates conversation.	Teacher is only questioner. Questions serve to keep students listening to teacher. Students give short answers and respond to teacher only.	Teacher questions focus on correctness. Students provide short answer-focused responses. Teacher may give answers.	Representations are missing, or teacher shows them to students.	Culture supports students keeping ideas to themselves or just providing answers when asked.
Level 1	Teacher encourages the sharing of math ideas and directs speaker to talk to the class, not to the teacher only.	Teacher questions begin to focus on student thinking and less on answers. Only teacher asks questions.	Teacher probes student thinking somewhat. One or two strategies may be elicited. Teacher may fill in an explanation. Students provide brief descriptions of their thinking in response to teacher probing.	Students learn to create math drawings to depict their mathematical thinking.	Students believe that their ideas are accepted by the classroom community. They begin to listen to one another supportively and to restate in their own words what another student has said.
Level 2	Teacher facilitates conversation between students, and encourages students to ask questions of one another.	Teacher asks probing questions and facilitates some student-to-student talk. Students ask questions of one another with prompting from teacher.	Teacher probes more deeply to learn about student thinking. Teacher elicits multiple strategies. Students respond to teacher probing and volunteer their thinking. Students begin to defend their answers.	Students label their math drawings so that others are able to follow their mathematical thinking.	Students believe that they are math learners and that their ideas and the ideas of their classmates are important. They listen actively so that they can contribute significantly.
Level 3	Students carry the conversation themselves. Teacher only guides from the periphery of the conversation. Teacher waits for students to clarify thinking of others.	Student-to-student talk is student initiated. Students ask questions and listen to responses. Many questions ask "why" and call for justification. Teacher questions may still guide discourse.	Teacher follows student explanations closely. Teacher asks students to contrast strategies. Students defend and justify their answers with little prompting from the teacher.	Students follow and help shape the descriptions of others' math thinking through math drawings and may suggest edits in others' math drawings.	Students believe that they are math leaders and can help shape the thinking of others. They help shape others' math thinking in supportive, collegial ways and accept the same support from others.

Fig. 11. Levels of classroom discourse. From Hufford-Ackles, Fuson, and Sherin (2014), table 1.

National Council of Teachers of Mathematic). (2014). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: Author.

	Leader role	Questioning	Explaining mathematical thinking	Mathematical representations	Building participant responsibility within the community
Level 0	**Leader** is at the front of the room and dominates conversation.	**Leader** is only questioner. Questions serve to keep **participants** listening to **Leader**. **Participants** give short answers and respond to **leader** only.	**Leader** questions focus on correctness. **Participants** provide short answer-focused responses. **Leader** may give answers.	Representations are missing, or **leader** shows them to **participants**.	Culture supports **participants** keeping ideas to themselves or just providing answers when asked.
Level 1	**Leader** encourages the sharing of math ideas and directs speaker to talk to the class, not to the **leader** only.	**Leader** questions begin to focus on **participant** thinking and less on answers. Only **leader** asks questions.	**Leader** probes **participant** thinking somewhat. One or two strategies may be elicited. **Leader** may fill in an explanation. **Participants** provide brief descriptions of their thinking in response to **leader** probing.	**Participants** learn to create math drawings to depict their mathematical thinking.	**Participants** believe that their ideas are accepted by the classroom community. They begin to listen to one another supportively and to restate in their own words what another **participant** has said.
Level 2	**Leader** facilitates conversation between **participants** and encourages **participants** to ask questions of one another.	**Leader** asks probing questions and facilitates some **participant**-to-**participant** talk. **Participants** ask questions of one another with prompting from **leader**.	**Leader** probes more deeply to learn about **participant** thinking. **Leader** elicits multiple strategies. **Participants** respond to **leader** probing and volunteer their thinking. **participants** begin to defend their answers.	**Participants** label their math drawings so that others are able to follow their mathematical thinking.	**Participants** believe that they are math learners and that their ideas and the ideas of their **colleagues** are important. They listen actively so that they can contribute significantly.
Level 3	**Participants** carry the conversation themselves. **Leader** only guides from the periphery of the conversation. **Leader** waits for **participants** to clarify thinking of others.	**Participant**-to-**participant** talk is **participant** initiated. **Participants** ask questions and listen to responses. Many questions ask "why" and call for justification. **Leader** questions may still guide discourse.	**Leader** follows **participant** explanations closely. **Leader** asks **participants** to contrast strategies. **Participants** defend and justify their answers with little prompting from the **leader**.	**Participants** follow and help shape the descriptions of others' math thinking through math drawings and may suggest edits in others' math drawings.	**Participants** believe that they are math leaders and can help shape the thinking of others. They help shape others' math thinking in supportive, collegial ways and accept the same support from others.

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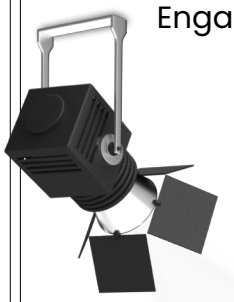
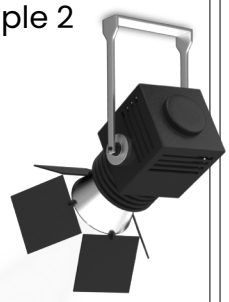
What is Engaged Professional Learning Principle 2?

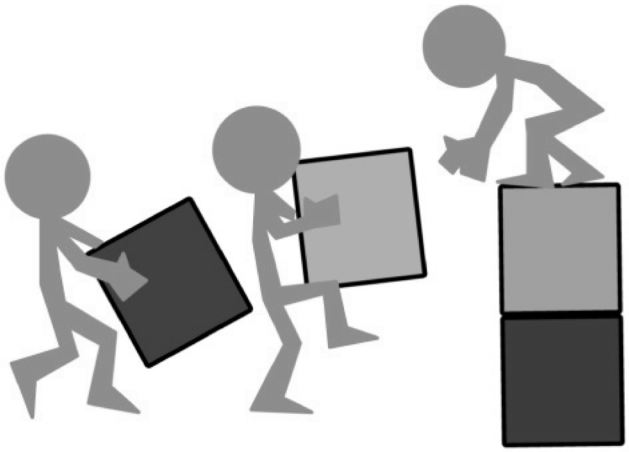
Engaged Professional Learning Principle 2





Our *beliefs* are reflected in what we choose to do.

Let's Solve a Task Together!



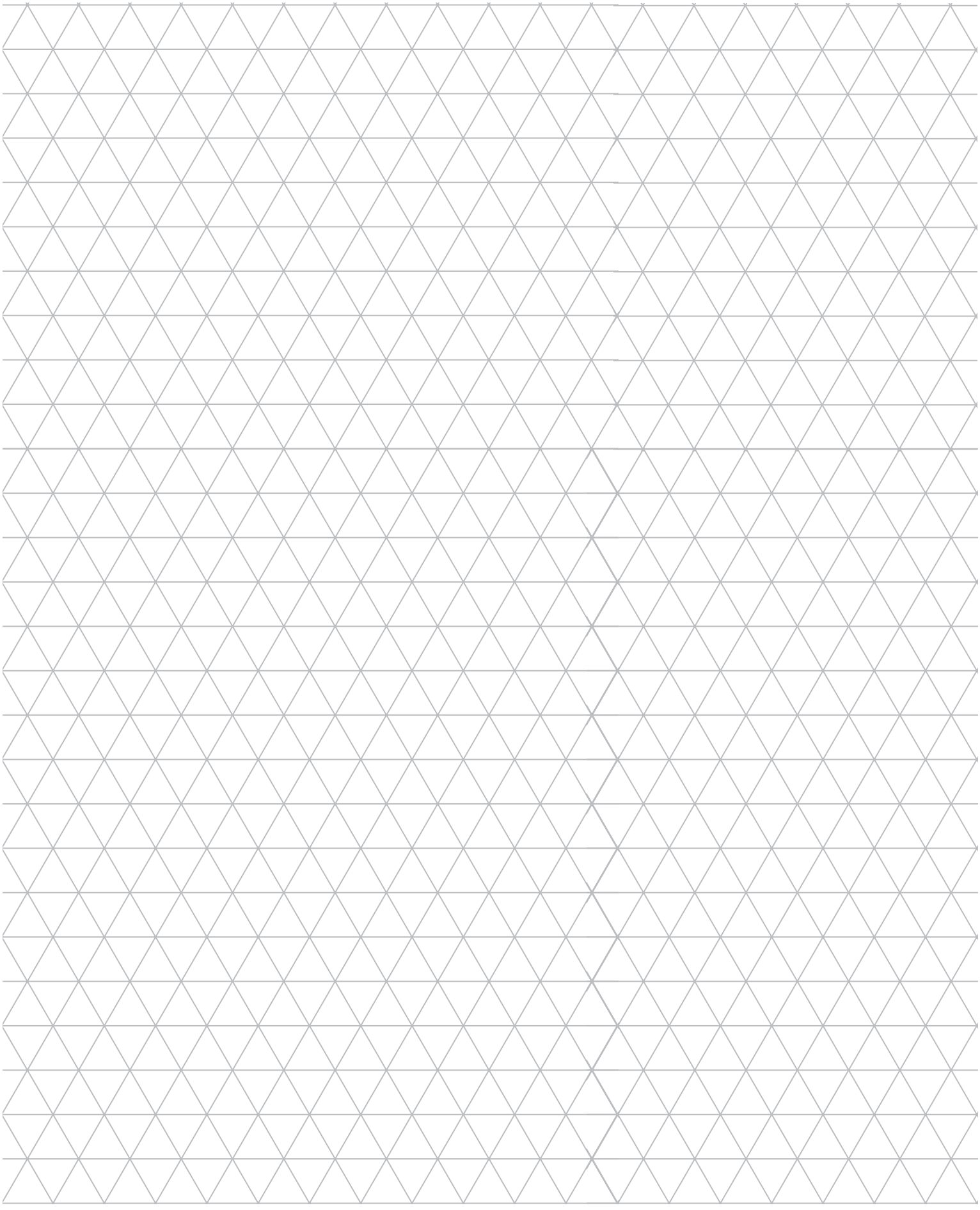
Partitioning a Hexagon

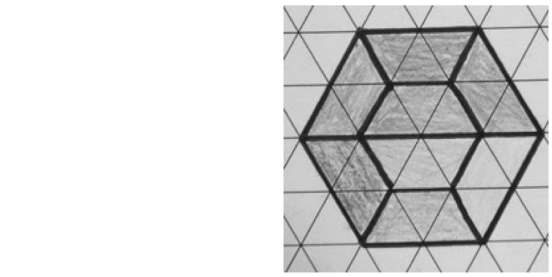
c. **Find a way to partition a regular hexagon into 4 congruent figures. Explain how you know the 4 figures are congruent.**

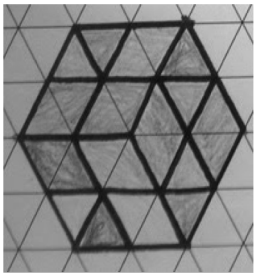
d. **Find a way to partition a regular hexagon into 8 congruent figures. Explain how you know the 8 figures are congruent.**

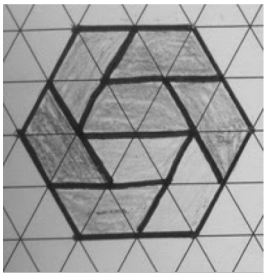
Bonus: Find a different way to partition a regular hexagon into 8 congruent figures.

Illustrative Mathematics









What was different between engaging in the task and reading about it?

How might you use this process in your own work?

How can you build your own task talk

?

- **Do what we ask students to do…**
  - **Take risks**
  - **Collaborate**
  - **Question**
- **Look for other people who like to talk about their lessons!**

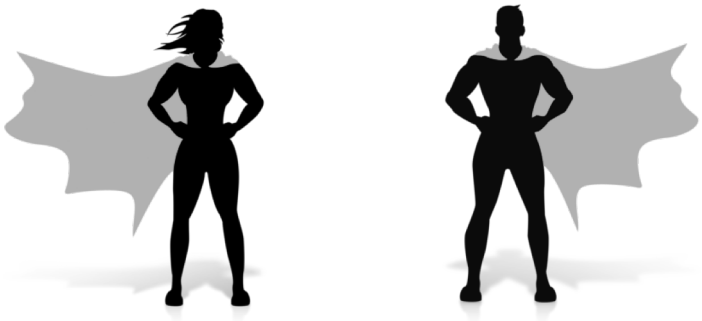
What is Engaged Professional Learning Principle 3?

Engaged Professional Learning Principle 3

Incorporate Opportunities to Collaborate Around Mathematics Tasks

Do the Math!

Examining our Teaching Strengths



The Mathematics Lesson-Planning Handbook

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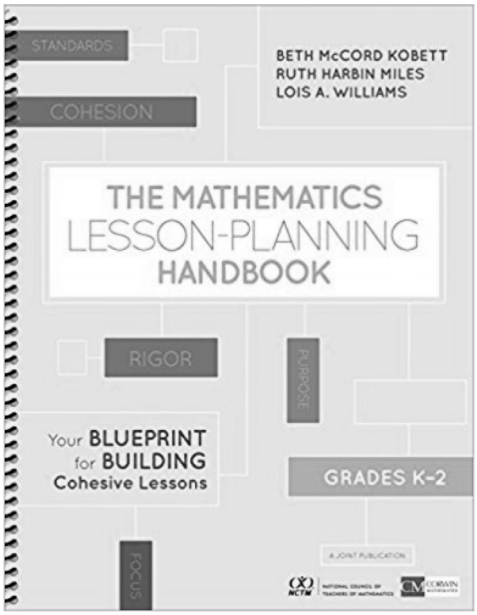


Think of a teacher you work with.

Sort the cards into two categories from that teacher's point of view.

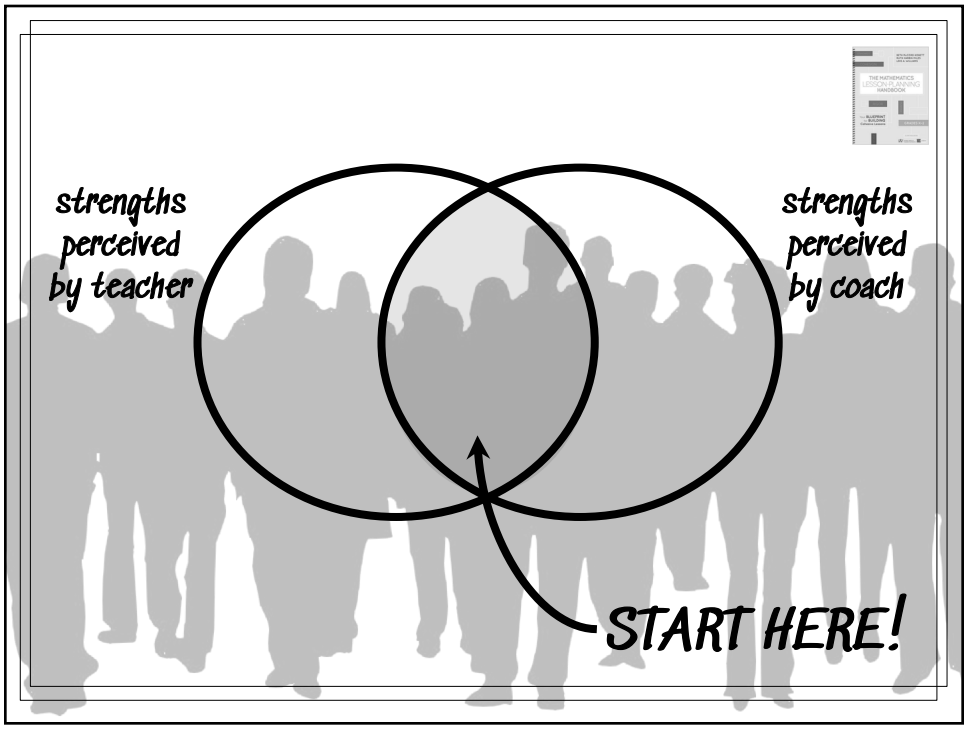
Which ones would the teacher consider to be their strengths?

Which ones would the teacher consider to be their challenges?

Re-sort the cards from *your* point of view.

Which ones would do *you* see as strengths for the teacher?

Which ones would do *you* see as challenges for the teacher?



What are your top three strengths?

PtA Mathematics Teaching Practices

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

National Council of Teachers of Mathematic). (2014). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: Author.

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National Council of Teachers of Mathematic). (2014). *Principles to actions: Ensuring mathematical success for all.* Reston, VA: Author.

<u>Choose one</u> Mathematics Teaching Practice Teaching Strength and and describe how you know. What is your evidence?

Joe

2. Implement tasks that promote reasoning and problem solving.

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Joe **How do you know? What is your evidence?**

"Students say, 'hey, this is really cool how we end up learning math. All of sudden we are learning and we didn't realize it"

Joe

How do you know? What is your evidence?

"It is the flow, you know when you look around the room and students are talking to each other, working on the task, and getting excited and proud of themselves."

"I see all the connections the students make. I planned for one or two and they are going crazy making connections in the task."

Now identify <u>one challenge</u> in your mathematics classroom.

PtA Mathematics Teaching Practices

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

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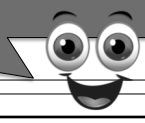
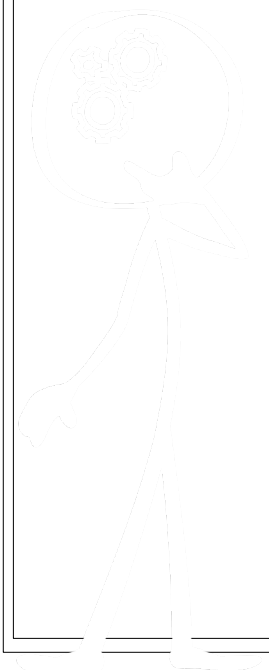
How could Joe use his strength to solve his challenge? What should he do next?

"Hmmmm. I want to use a variety of assessments more. I could do this by posing the questions I usually ask as whole class discussions as individual questions. I think I could then collect data from that and get a better idea of how individuals understand the content."



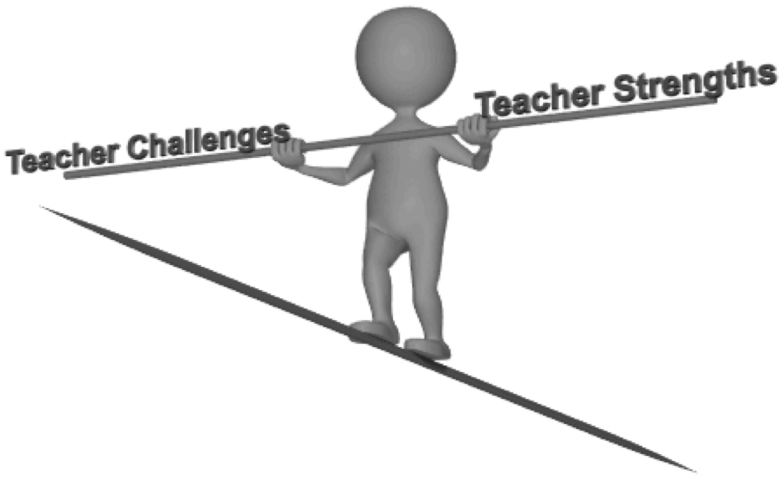
Joe



Reflect on your challenge.

How can you use your *strength* to solve your challenge? What should you do next (think about the teaching practices)?

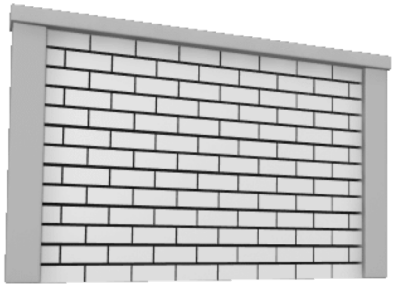
The Power of Yet



What is Engaged Professional Learning Principle 4?

Engaged Professional Learning Principle 4

Leverage *Strengths* to work on Challenges



Thank you!

We wish you the best!

Questions?

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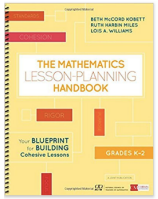
Learning Intentions and Success Criteria



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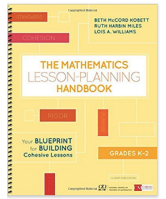
Content and Practice/Process Standards



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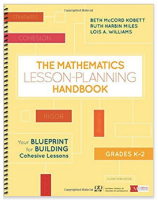
Task Selection



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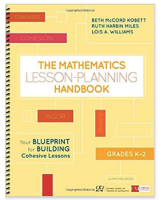
Launching the Lesson



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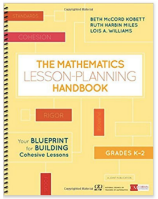
Facilitating the Lesson



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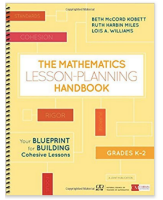
Closing the Lesson



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Content and Practice/Process Standards

- What does this standard mean?
- What prior knowledge do my students need for this standard?
- What future standard does this standard support?

Learning Intentions and Success Criteria

- Why are they important for students to know?
- How and when will students find out about them?
- How will students know when they are successful?
- When might students self-evaluate their success?

Launching the Lesson

- What are different ways the lesson be launched?
- What do you anticipate students will do?
- How does my lesson launch provide equitable access to the task?

Task Selection

- Is the task worthwhile? How do you know?
- How might I adapt the task for my learners' needs?
- How does this task connect to the Standards for Mathematical Practice and Process Standards?

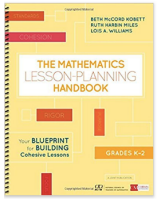
Closing the Lesson

- What are some different closure activities?
- How will I make the mathematics visible?

Facilitating the Lesson

- How will you faciliate meaningful mathematics discourse?
- How do you plan for and pose purposeful questions?
- How do you faciliate productive struggle?
- How do you make sure students engage in the the Standards for Mathematical Practice and Process Standards?

Knowing Your Students



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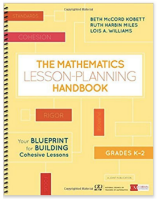
Formative Assessment



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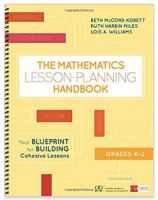
Lesson Purpose



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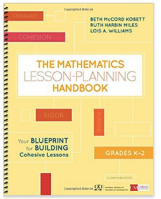
Lesson Formats



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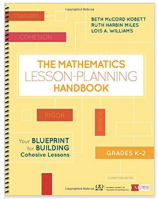
Reflecting on the Lesson



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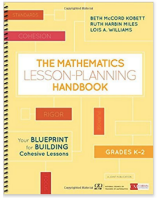
Anticipating Student Thinking



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Formative Assessment

- What formative assessment techniques will I use?
- When and how will I use formative assessment?
- How will I adjust instruction and provide feedback to students?

Knowing Your Students

- What do my students need?
- What does access and equity mean?
- What do culturally and linguistically diverse students need?

Lesson Formats

- What lesson format best matches the lesson purpose, students' needs, task, and standard?
- What are different kinds of lesson formats for my grade level?

Lesson Purpose

- What is the purpose of this lesson?
- Conceptual
- procedural fluency
- transfer

Anticipating Student Thinking

- What kinds of student thinking do you anticipate?
- How can you minimize misconceptions?
- How can ensure that there are opportunities for students to reveal their thinking?

Reflecting on the Lesson

- What worked well?
- What challenges did you experience?
- How can you leverage your strength to address the challenges?