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).

Membership

NCTM Individual Membership Options

<table>
<thead>
<tr>
<th>Membership Options</th>
<th>Essential Membership</th>
<th>Premium Membership</th>
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<tr>
<td>Grade-Rank Journal</td>
<td>$68/year</td>
<td>$139/year</td>
</tr>
<tr>
<td>Mathematics Teaching in the Middle School</td>
<td></td>
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<td>Mathematics Teaching in High School</td>
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<tr>
<td>Archive Access</td>
<td>To the one subscribed journal</td>
<td>To all three grade band journals</td>
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<tr>
<td>Discount for Meeting Registration</td>
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<td>30% discount</td>
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<td>Discount for Online Bookstore</td>
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<td>Illuminations</td>
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<td>MYNCTM</td>
<td>✔</td>
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<tr>
<td>Journal for Research in Mathematics Education and Its Archives</td>
<td>Print and digital or digital only</td>
<td>*Students get digital only</td>
</tr>
<tr>
<td>Free ebook Annually After Renewal</td>
<td>✔</td>
<td>✔</td>
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Discount Code

BOARD18

This code will provide a $20 discount for everyone in this room who:
- Joins NCTM as a Premium Member
- or -
- Renews

What are our beliefs and how might these beliefs influence our work?
How might our Professional Learning Reflect beliefs about our teachers?

<table>
<thead>
<tr>
<th>Beliefs about teaching and learning mathematics</th>
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<tbody>
<tr>
<td>Unproductive beliefs</td>
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<tr>
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</tr>
<tr>
<td>Mathematics learning should focus on</td>
</tr>
<tr>
<td>practicing procedures and memorizing</td>
</tr>
<tr>
<td>basic number combinations.</td>
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<tr>
<td>Students need only to learn and use</td>
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<tr>
<td>the same standard computational algorithms</td>
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<tr>
<td>and the same prescribed methods to solve</td>
</tr>
<tr>
<td>algebraic problems.</td>
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<tr>
<td>Students can learn to apply mathematics</td>
</tr>
<tr>
<td>only after they have mastered the basic</td>
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<tr>
<td>skills.</td>
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<tr>
<td>The role of the teacher is to tell students</td>
</tr>
<tr>
<td>exactly what definitions, formulae, and</td>
</tr>
<tr>
<td>rules they should know and demonstrate</td>
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<tr>
<td>how to use this information to solve</td>
</tr>
<tr>
<td>mathematics problems.</td>
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<tr>
<td>The role of the student is to memorize</td>
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<tr>
<td>information that is presented and then use it</td>
</tr>
<tr>
<td>to solve routine problems on homework,</td>
</tr>
<tr>
<td>work, quizzes, and tests.</td>
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<tr>
<td>An effective teacher makes the math-</td>
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<tr>
<td>ematics easy for students by guiding them</td>
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<tr>
<td>step-by-step through problem solving, to</td>
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<tr>
<td>ensure that they are not frustrated or</td>
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<tr>
<td>confused.</td>
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</tbody>
</table>

How might our Professional Learning Reflect beliefs about our teachers?

<table>
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<th>Beliefs about Mathematics Professional Learning (Development)</th>
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<tr>
<td>Unproductive Beliefs</td>
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<tr>
<td>Professional Learning should be designed around teacher</td>
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<tr>
<td>deficits.</td>
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<tr>
<td>All teachers need the same professional learning.</td>
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<td></td>
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<tr>
<td>One shot, expert, professional learning works to motivate</td>
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<tr>
<td>teachers to make changes.</td>
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<tr>
<td>If teachers just knew the mathematics, they would be able</td>
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<tr>
<td>to teach better.</td>
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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.”
<table>
<thead>
<tr>
<th>Level 0</th>
<th>Teacher role</th>
<th>Questioning</th>
<th>Explaining mathematical thinking</th>
<th>Mathematical representations</th>
<th>Building student responsibility within the community</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 0</td>
<td>Teacher is at the front of the room and dominates conversation.</td>
<td>Teacher is only questions. Questions serve to keep students listening to teacher. Students give short answers and respond to teacher only.</td>
<td>Teacher questions focus on correctness. Students provide short answer focused responses. Teacher may give answers.</td>
<td>Representations are missing, or teacher shows them to students.</td>
<td>Teacher provides students with ideas and their own words when asked.</td>
</tr>
<tr>
<td>Level 1</td>
<td>Teacher encourages the sharing of math ideas and directs students to talk to the class, not to the teacher only.</td>
<td>Teacher questions begin to focus on student thinking and less on answers. Only teacher asks questions.</td>
<td>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.</td>
<td>Students learn to create math drawings to depict their mathematical thinking.</td>
<td>Students believe that their ideas are accepted by the classroom community. They begin to listen to one another supportively and to respond in their own words what another student has said.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Teacher facilitates conversation between students, and encourages students to ask questions of one another.</td>
<td>Teacher asks probing questions and facilitates some student-student talk. Students ask questions of one another with prompting from teacher.</td>
<td>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.</td>
<td>Students label their math drawings so that others are able to follow their mathematical thinking.</td>
<td>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.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Students carry the conversation themselves. Teacher only guides them through the dialogue of the conversation. Teacher waits for students to clarify thinking of others.</td>
<td>Student to student talk: a student initiates. Students ask questions and listen to responses. Many questions ask “why” and call for justification. Teacher questions may still guide discussion.</td>
<td>Students follow and help shape the descriptions of others’ math thinking through math drawings and may suggest edits in others’ math drawings.</td>
<td>Students believe that they are math learners and can help shape the thinking of others. They help to shape others’ math thinking in support of one another. They learn to give and accept the same support from one another.</td>
<td></td>
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</tbody>
</table>

Fig. 11. Levels of classroom discourse. From Huford-Ackles, Fuson, and Sherin (2016), table 1.

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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leader is at the front of the room and dominates conversation.</td>
<td>Leader is only questioner. Questions serve to keep participants listening to Leader. Participants give short answers and respond to leader only.</td>
<td>Leader questions focus on correctness. Participants provide short answer-focused responses. Leader may give answers.</td>
<td>Representations are missing, or leader shows them to participants.</td>
<td>Culture supports participants keeping ideas to themselves or just providing answers when asked.</td>
</tr>
<tr>
<td>Level 1</td>
<td>Leader encourages the sharing of math ideas and directs speaker to talk to the class, not to the leader only.</td>
<td>Leader questions begin to focus on participant thinking and less on answers. Only leader asks questions.</td>
<td>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.</td>
<td>Participants learn to create math drawings to depict their mathematical thinking.</td>
<td>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.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Leader facilitates conversation between participants and encourages participants to ask questions of one another.</td>
<td>Leader asks probing questions and facilitates some participant-to-participant talk. Participants ask questions of one another with prompting from leader.</td>
<td>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.</td>
<td>Participants label their math drawings so that others are able to follow their mathematical thinking.</td>
<td>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.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Participants carry the conversation themselves. Leader only guides from the periphery of the conversation. Leader waits for participants to clarify thinking of others.</td>
<td>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.</td>
<td>Leader follows participant explanations closely. Leader asks participants to contrast strategies. Participants defend and justify their answers with little prompting from the leader.</td>
<td>Participants follow and help shape the descriptions of others’ math thinking through math drawings and may suggest edits in others’ math drawings.</td>
<td>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.</td>
</tr>
</tbody>
</table>

Fig. 11. Levels of classroom discourse. From Hufford-Ackles, Fuson, and Sherin (2014), table 1.
What is 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.
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
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 you see as strengths for the teacher?
Which ones would 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.

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

2. Implement tasks that promote reasoning and problem solving.

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’”

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 one challenge in your mathematics classroom.

PtA Mathematics Teaching Practices

1. Establish mathematics goals to focus learning.
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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.

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.”

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?
Leverage *Strengths* to work on Challenges

Thank you!

We wish you the best!

Questions?

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References


Learning Intentions
and
Success Criteria

Task Selection

Content and
Practice/Process
Standards

Launching
the
Lesson

Facilitating
the
Lesson

Closing
the
Lesson

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

Lesson Purpose

Reflecting on the Lesson

Formative Assessment

Lesson Formats

Anticipating Student Thinking

Knowing Your Students

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

Lesson Purpose

- What is the purpose of this lesson?
  - Conceptual
  - Procedural fluency
  - Transfer

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?

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?

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?