EDC Learning transforms lives.

Professional Development for Implementing the Standards for Mathematical Practice

June Mark, Victor Mateas, Johannah Nikula

Who?

Paul Goldenberg, Al Cuoco, Mark Driscoll, June Mark, Deborah Spencer, Katherine Schwinden, Victor Mateas, Johannah Nikula, Matt McLeod, Jane Kang, Mary Fries

Advisors: *Diane Briars, Dan Chazan, Brad Findell, Bill McCallum, Barbara Reys, Mike Shaugnessy*

The Implementing the Mathematical Practice Standards project is supported by the National Science Foundation under Grant No. DRL 1119163. Any opinions, findings, and conclusions or recommendations expressed are those of the author and do not necessarily reflect the views of the National Science Foundation.

Project Goals

- Increase awareness of the Standards for Mathematical Practice (SMP)
- Support understanding of the SMP connected to content standards
- Cultivate teachers' capacity to identify these SMP in student thinking
- Develop teachers' ability to plan instruction to support these SMP

Plan for Session

- ***Background:*** Learn about resources we are developing to support teacher learning about the standards for mathematical practice

- ***Experience:*** Engage as learners in an abbreviated experience of one geometry task and an excerpt from a lesson planning protocol.

- ***Debrief Supports for Teachers:*** See examples of how teachers are participating in the professional development. Discuss ways to support teachers using these resources in your settings.

Illustrations

- Student dialogues clarify the *meaning* of SMP by showing what a conversation among students engaging in SMP might look like.
  - Embedded in the context of specific mathematical content.
  - Model productive mathematical discourse.
  - Strategically chosen student characters.

- Each dialogue is accompanied by supporting materials:
  - A mathematical problem
  - Teacher discussion/reflection questions
  - A mathematical overview
  - Follow-up activities and discussion questions for students

Implementing the Mathematical Practice Standards

7. Look for and make use of structure.

Login Sign up

Search

Home | About SMP | About Illustrations | Browse Illustrations | Use Illustrations | Links | Contact Us

Need help understanding the mathematical practices?

Explore this site to learn more about the Common Core Standards for Mathematical Practice (SMP) and how they can be connected to the content standards. Use our Illustrations, centered on student dialogues, to see the Standards for Mathematical Practice in action.

See All Illustrations

About Illustrations

Each Illustration of the Standards for Mathematical Practice (SMP) consists of a mathematics task; a student dialogue based on that task; information about grade level, standards, and the context for the dialogue; teacher reflection questions; a mathematical overview; and optional student materials. While the primary use of Illustrations is for teacher learning about the SMP, some components are designed for classroom use with students. Go to "Browse Illustrations" to find Illustrations for particular SMP.

Web Survey

Have you explored this website? If so, please share your experience with us and take a moment to complete this survey.

Spotlight on...

Mathematical Practice 8: Look for and express regularity in repeated reasoning.

About the Illustrations as a Set

- 20 Illustrations developed and reviewed to date
  (mathpractices.edc.org; see bookmark with QR code)
- Additional 10-12 Illustration coming soon.

- Multiple SMP identified in each dialogue
- Several Illustrations that address each SMP

- Grade levels from 5-10
- Number, algebra, geometry, data and statistics

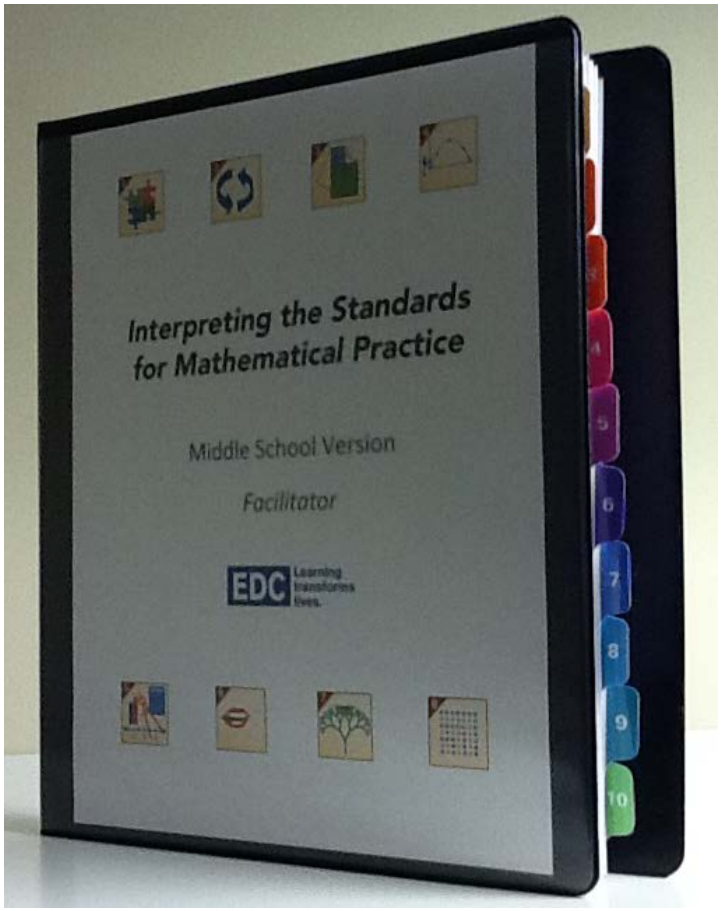
- Range of mathematical tasks, some more open-ended

Professional Development

Materials for 20 Hour
Professional Development Course
(MS & HS Versions)

Three Main Activity Types:

- Doing and Discussing Mathematics
- Analyzing Artifacts of
  Student Thinking
- Connecting to Classroom Practice



Project Goals

- Increase awareness of the Standards for Mathematical Practice (SMP)
- Support understanding of the SMP connected to content standards
- Cultivate teachers' capacity to identify these SMP in student thinking
- **Develop teachers' ability to plan instruction to support these SMP**

Exploring an Illustration: Parallelogram Vertices

1) Work on mathematics task (individual then pairs)
2) Sharing/debriefing mathematics of task (full group)

3) (Skipping: Read and discuss student dialogue and mathematical overview – materials available at mathpractices.edc.org)

4) Plan instruction based on mathematics task.

Parallelogram Vertices: Math Task

Given three vertices of a parallelogram at A (1, 2), B (4, 1), and C (5, 3), where can the fourth vertex be located?

- **Work individually for 5 min, then in pairs.**
- **Keep track of thinking, questions, wrong turns, etc.**

Parallelogram Vertices: Discussing Mathematics

What strategies did you use to explore the problem?

How did you start the problem?

How do you know that you've found all the possible fourth vertices that form parallelograms?

Parallelogram Vertices: Reflecting on the SMP

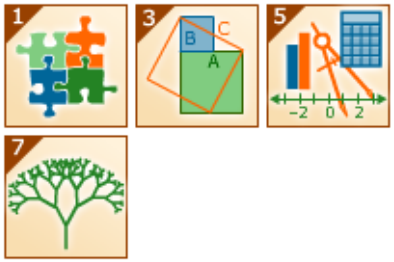
What evidence of the SMP did you see in…

1) Your own work on the task?

2) Colleagues' work on the task?

Finding Parallelogram Vertices

Open Student Dialogue (in its own window)
Jump to Comment section



The mathematics task is intended to be a problem or question that encourages the use of mathematical practices. The dialogue is meant to show how students might engage in the mathematical practices as they work on the task. Before reading the dialogue, work on the mathematics task. Next reflect on the mathematical practices you engaged in while working on the task. Finally read the student dialogue.

Mathematics Task

Given three vertices of a parallelogram at $A(1, 2)$, $B(4, 1)$, and $C(5, 3)$, where can the fourth vertex be located?

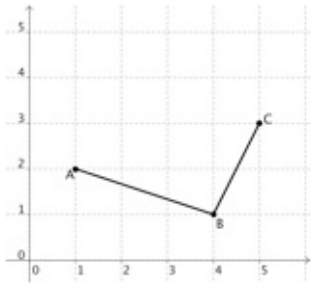
Student Dialogue

Students in this dialogue have just studied the properties and definition of different polygons. They are now working on open-ended problems that require the use of those definitions and properties. Students already have experience plotting points onto the Cartesian plane from previous units.

(1) *Sam* Well, let's use graph paper and plot the three points we know.*[plots on graph paper]* Now all we need to do is find one more point that will make a parallelogram. What do we know about parallelograms?

(2) *Anita* Opposite sides are parallel?

(3) *Dana* So, let's draw some sides and see if we can't find the fourth vertex. We can connect points A and B to get side AB, and we can connect points B and C to get side BC.



Parallelogram Vertices: Planning Protocol

- Identify goals related to SMP and mathematical content
- Anticipate student thinking and strategies to support students to engage in the SMP
- Plan questions to ask students

Planning Instruction to Support SMP

In pairs or small groups, create two lists:

1) Anticipate student thinking on this task.

2) List questions & supports that will create and develop opportunities for students to engage in the SMP.

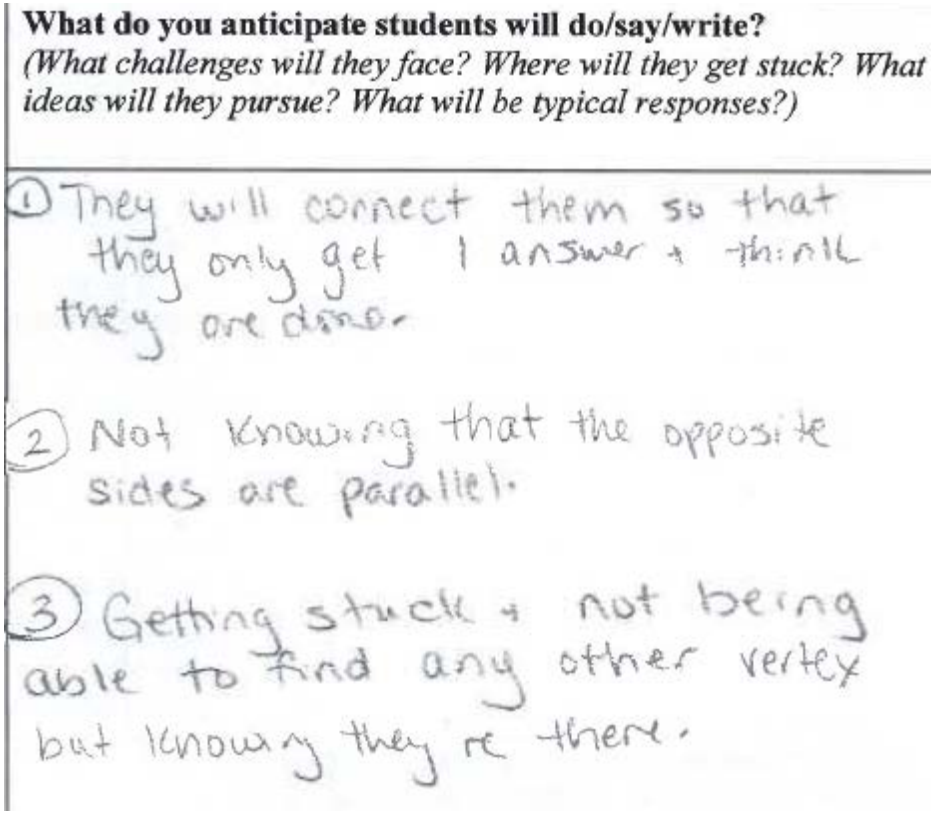
Planning Instruction to Support SMP

Full Group:

1) Share one key idea from your planning.

2) What do you notice in the planned questions and supports?

Example protocols



What do you anticipate students will do/say/write?
(What challenges will they face? Where will they get stuck? What ideas will they pursue? What will be typical responses?)

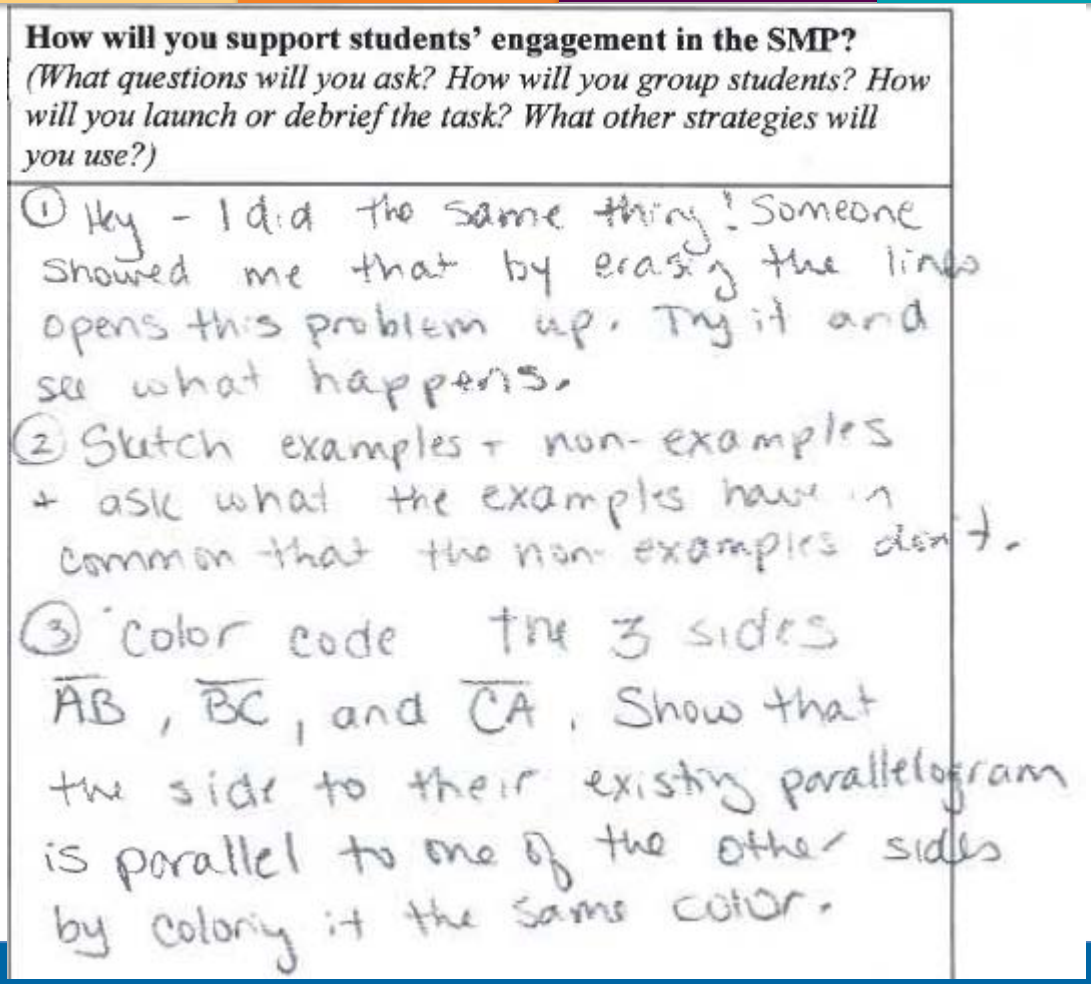
1. They will connect them so that they only get 1 answer & think they are done.

2. Not knowing that the opposite sides are parallel.

3. Getting stuck & not being able to find any other vertex but knowing they're there.

Example protocols

How will you support students' engagement in the SMP?
(What questions will you ask? How will you group students? How will you launch or debrief the task? What other strategies will you use?)



Example protocols

What do you anticipate students will do/say/write?
(What challenges will they face? Where will they get stuck? What ideas will they pursue? What will be typical responses?)

- worried about them measuring and not using points on the coordinate grid
- concerned about using parallel lines that just look parallel but aren't

How will you support students' engagement in the SMP?
(What questions will you ask? How will you group students? How will you launch or debrief the task? What other strategies will you use?)

- will instruct them to only use coordinate points or will we? Is it good, like in dialogue to use random point
- prove parallel or show
- do we preview parallel lines?
  or
- do we use this as parallel lines & slope

What other questions might you ask while students work on the task to *understand what they are thinking*, to *support their work on the task*, or to *extend their thinking*?

Is there more than one answer? How do you know? If so, how many other answers?
Why are there many answers?

PD Facilitators

I don't think, as a school, that they had really ever embraced the idea of really lesson planning around a task. […] I ***think that was a shift for them. They struggled with anticipating student responses.. And they, I don't think, had thought about their lessons in that way before***.

I think it was huge for them to be able to plan a task around the Standards for Math Practice […] I think, oftentimes, we give teachers a lot of theory in our courses, and then they don't exactly know how to go back. But the protocol was really helpful, in terms of just being able to, maybe put something kind of skill-based down, but really think about what they'd done in our sessions, and ***change those traditional kinds [of tasks…] and change them to be a much more rich experience***, based on what they'd already gone through in our courses.

Supporting Teacher Learning

What do you want to keep in mind as you support teachers in planning instruction that supports student engagement in the SMP?

Professional Development Main Components

- **Doing and Discussing Mathematics**
  - Exploring IMPS mathematics tasks as mathematical learners
  - Discussing own use of standards for mathematical practice (MPs)
- **Analyzing Artifacts of Student Thinking**
  - Dialogues that are part of the Illustrations
  - Video or written work from participants' students based on IMPS tasks
  - Video or written work from sample students (provided with PD materials)
- **Connecting to Classroom Practice**
  - Anticipating and planning for student engagement in MPs
  - Planning around IMPS tasks
  - Adapting tasks from teachers' own curricula

Implementing the Mathematical Practice Standards

Questions?

mathpractices.edc.org
(QR code on bookmark)

Thank you!

(If interested in having a group in the 2014-2015 fieldtest of the PD curriculum, talk to one of us or email kschwinden@edc.org)