Department of Education
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STANDARDS FOR MATHEMATICAL PRACTICE AND TEACHER INQUIRY (110 MINUTES)

Who Should Use this Module?	Guiding Question:
This module is for educators who have initial experience with the Common Core State Standards who are interested in engaging in inquiry as an entry point for CCSS implementation and the pedagogical changes it will require.	• How can we utilize the inquiry team process to deepen the teacher and student understanding of mathematical concepts?

Prerequisites:

Educators should be familiar with the Common Core State Standards before engaging in this activity. Click here to unwrap the CCSS.

Context:

Collaborative inquiry is a structured professional collaboration whereby educators engage in systematic analysis of student assessment data, student work, and teacher work, resulting in adjustments to curriculum, instruction, assessments and resource allocation to improve learning outcomes for students. Effective inquiry process can be a vehicle for examining and transitioning to the CCSS.

Outcome:

Participants will be able to articulate how inquiry teams can be used as an entry point for implementing the CCSS in a school and as a leverage point for the pedagogical changes required by the CCSS.

Suggested Materials:

- Copy of Standards Protocol
- Copies of task
- Copies of student work
- Task Analysis Guide

Overview of Activity

Using a protocol, participants will experience a fourth-grade teacher team simulation with the purpose of analyzing a math task and resulting student work. Teachers will use a task analysis guide to determine how cognitively demanding the task is and if the task is in alignment with the *CCSS Standards for Mathematical Practice*. After determining the level of

task demand, they will discuss ways to improve the task. Finally, participants will discuss ways to use this type of activity with teacher teams as an entry point into the CCSS.

Agenda:

1. Introduction: This activity is a collaborative inquiry team simulation. Facilitator reviews collaborative inquiry cycle and then makes key points about the team:
- 4th grade teacher team in a K-5 school
- Has analyzed student level data from last year's state math test, and used those data to create student groups
- Last year, this team's goal was to deepen complexity of math tasks assigned to students, and it used the Task Analysis Guide, a tool to analyze math tasks, to stimulate dialogue around the idea of "doing mathematics."
- In the first meeting of the year, the team reviewed the CCSS for Mathematical Practice and discussed their relationship to the "doing mathematics" quadrant of the Task Analysis Guide
- The team has agreed on a five-step protocol for this meeting, the purpose of which is to review a teacher-created task and student work in order to make recommendations for improving the task so that student work involves "doing mathematics."

(10 minutes)

2. Simulation: Table facilitator serves as presenting teacher and previews steps of agreed-upon protocol. They are:

i. Experiencing the math task
ii. Looking at student work
iii. Analyzing the task with CCSS
iv. Determining level of task demand
v. Revising the task (5 minutes)

Step 1: Experiencing the math task.
Participants to complete the student task in pairs and reflect on the problem-solving strategy they used. (15 minutes)

Step 2: Looking at student work from the task.
Presenting teacher shares sample student work and asks:
- What low-inference observations can you make about the student work? *(Reminder: Low-inference observations are descriptions of observable facts free of inference, interpretation, or judgment.)*
- What does this student work tell us about student learning?
- What do students know and what are they able to do? (10 minutes)

Step 3: Analyzing the task with the standards.
Participants revisit the task, the student work and the fourth grade standards to answer the following questions:

- Which standards for mathematical practice does the student work exhibit?

(*Note to facilitator*: In this task, students MODEL WITH MATHEMATICS - practice standard #4 - in that they apply the math they know "to solve problems arising in everyday life, society, and the workplace.")

- Given the relevant content standards, what actionable feedback do the task and student work provide?

(*Note to facilitator*: The relevant content standards fall under the domain of OPERATIONS AND ALGEBRAIC THINKING, with #3 being the most relevant because the students are solving a "multistep word problems posed with whole numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted.")

- How well does this task demonstrate progress towards both the content and practice standards?

(15 minutes)

Step 4: Determining level (low, high) of task demand.
Pairs consider the demands of the task based on the Task Analysis Guide, and locate the task within the appropriate quadrant, explaining their thinking.
(*Note to facilitator:* The task mostly contains elements of Pw/oC and PwC, yet it does approach Doing Mathematics.) (10 minutes)

Step 5: Taking action: Revising the teacher task

- Participants revise the task in order to more closely approximate "doing mathematics" and share their suggested revisions with the rest of the team. (15 minutes*)*

Simulation ends.

3. Reflection. Participants discuss, using the "Bridge to Practice" questions as a guide (below)

- (15 minutes)

Bridge to Practice:

What is the value of using a protocol like this one in teacher teams? What challenges do you foresee in implementing such a protocol? What changes might you have to make for this protocol to work for schools that you work with? What are other ways teacher teams can connect their current practice to the Common Core State Standards?

Additional Resources:

Resources posted in the Children First Intensive and Inquiry section of the Common Core Library can help you learn more about the process of transitioning to the CCSS.

Mathematical Standards and Teacher Inquiry Team Protocol

Step 1: Establishing norms and reviewing the protocol.

- Review the norms, select a timekeeper and recorder for the group and introduce the six-step protocol:
    - Establishing norms and reviewing the protocol
    - Experiencing the math task
    - Looking at student work
    - Analyzing the task with CCSS
    - Determining level of task demand
    - Revising the task **(5 minutes)**

Step 2: Experiencing the math task.

- Divide participants in pairs to complete the mathematics task handout.
- Pass out one piece of student work to each pair and inform them they will need the fourth grade content standards, mathematics standards for practice, and the Task Analysis Guide for the activity.
- Ask participants to complete the student task in pairs and reflect on the problem-solving strategy they use and be ready to discuss. **(10 minutes)**
- Participants return to the whole table discussion. Table facilitators ask each pair to share how they solved the problem**. (5 minutes)**

Step 3: Looking at student work from the task.

As they look at student work, table facilitators ask participant pairs to respond to the following questions:

- What low-inference observation can you make about the student work? ***(Reminder: Low-inference observations are descriptions of observable facts free of inference, interpretation, or judgment.)***
- What does this student work tell us about student learning?
- What do students know and what are they able to do? **(10 minutes)**

Step 4: Analyzing the task with the standards.

Table facilitators ask pairs to revisit the task, the student work and the fourth grade standards to answer the following questions: Which standards for mathematical practice does the student work exhibit?

- Given the relevant content standards, what actionable feedback do the task and student work provide?
- How well does this task demonstrate progress towards both the content and practice standards? **(15 minutes)**

Step 5: Determining level (Low, High) of task demand.

Table facilitators ask pairs to consider the demands of the task based on the Task Analysis Guide.

- Ask the participant pairs to locate the task within a quadrant on the Task Analysis Guide. The table facilitators ask, "Where does this task belong and why?"

Step 6: Taking action: Revising the teacher task

- Ask, "With the goal of *understanding* the problem situation and *exploring* mathematical concepts rather than *getting answers*, how could this task be revised to move students closer to *doing* mathematics and the standards for mathematical practice?"
- Refer participants to Examples of Higher and Lower Level Cognitive Demands Task to highlight the differences between lower-level and higher-level tasks.
- Share revisions. **(15 minutes)**

THE TASK ANALYSIS GUIDE

Lower-Level Demands	*Higher-Level Demands*
1. **Memorization Tasks** • involve either reproducing previously learned facts, rules, formulas, or definitions OR committing facts, rules, formulas, or definitions to memory. • cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure. • are not ambiguous—such tasks involve exact reproduction of previously seen material and what is to be reproduced is clearly and directly stated. • have no connection to the concepts or meaning that underlie the facts, rules, formulas, or definition being learned or reproduced.	3. **Procedures with Connections Tasks** • focus students' attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts. • suggest pathways to follow (explicitly or implicitly) that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts. • usually are represented in multiple ways (e.g., visual diagrams, manipulatives, symbols, problem situations). Making connections among multiple representations helps to develop meaning. • require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with the conceptual ideas that underlie the procedures in order to successfully complete the task and develop understanding.
2. **Procedures Without Connections Tasks** • are algorithmic. Use of the procedure is either specifically called for or its use is evident based on prior instruction, experience, or placement of the task. • require limited cognitive demand for successful completion. There is little ambiguity about what needs to be done and how to do it. • have no connection to the concepts or meaning that underlie the procedure being used. • are focused on producing correct answers rather than developing mathematical understanding. • require no explanations, or require explanations that focus solely on describing the procedure that was used.	4. **Doing Mathematics Tasks** • require complex and nonalgorithmic thinking (i.e., there is not a predictable, well-rehearsed approach or pathway explicitly suggested by the task, task instructions, or a worked-out example). • require students to explore and understand the nature of mathematical concepts, processes, or relationships. • demand self-monitoring or self-regulation of one's own cognitive processes. • require students to access relevant knowledge and experiences and make appropriate use of them in working through the task. • require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solution. • require considerable cognitive effort and may involve some level of anxiety for the student due to the unpredictable nature of the solution process required.

Stein and Smith, 1998