Task Planning Framework

Analyzing the task:

1. Identifying the mathematical content and instructional purpose
    - Do the task yourself.
    - What is the mathematics that students are supposed to be working on?
    - What is your instructional purpose for using the task?

2. Anticipating student thinking
    - What knowledge or skills will students need in order to do the task?
    - What methods are students likely to use? What solutions or responses are students likely to generate?
    - What misconceptions are students likely to have? What errors do you anticipate they will make?

Planning its enactment:

1. Setting up the task
    - How will you present the task to students?
    - What materials will you and the students need?
    - If needed, how will you familiarize students with representations used in the task?
    - What should students do if they finish the task?

2. Monitoring student work
    - What will you look for or listen for to determine if students are engaging with the task?
    - What will you do to learn about and keep track of what students do as they engage with the task (e.g. what strategies students are using, errors they are making, etc.) that might inform how you lead the discussion?
    - What questions or variations will you pose if students finish quickly or have trouble getting started?

3. Launching the discussion
    - How will you start the discussion of students' solutions and strategies? (i.e., What specific question, example, or idea will you use?)

4. Orchestrating the discussion
    - *Student strategies:* What are some prompts you will use to elicit, probe, and connect students' solutions and strategies?
    - *Focal mathematical ideas:* What might you ask to support students' reasoning about the important mathematical ideas in the task? *(Include examples of how you will respond to anticipated student errors or incomplete solutions.)*
    - *Interactions:* What will you say or do to encourage students to consider the thinking of others and respond to each other in the discussion?

5. Concluding the discussion
    - What specific statement will you use to begin wrapping up the discussion? *(It is possible that you will need to close the discussion before a natural place to stop presents itself, so consider how you will make this shift near the end of your time.)*
    - What mathematical ideas do you want to summarize at the end of the discussion?

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Example from Teaching "Tool Box": Beginning Repertoire of Teacher Questions [selected examples]

1. **Initial eliciting of students' thinking**
   - *Please raise your hand when you are ready to share your solution.*
   - *What have you found so far?*
   - *Can someone explain the first step they took to solve the problem?*
   - *How did you begin working on this problem?*
   - *Would anyone be willing to explain one of the solutions they found?*

2. **Probing students' answers**
   a. **Trying to figure out what a student means or is thinking when you don't understand what they are saying**
   b. **Checking whether right answers are supported by correct understanding**
   c. **Probing wrong answers to understand student thinking**
      - *Can you repeat that?*
      - *Can you explain how you got [that answer]?*
      - *So what you're saying is _____?*
      - *[Name], can you restate what [name] has said?*
      - *How do you know?*
      - *Could you use [materials] to show us how that works?*
      - *Walk us through your steps. Where did you begin?*

3. **Focusing students to listen and respond to others' ideas**
   - *Do you agree or disagree with [name's] idea/answer/conjecture?*
   - *[Name] said _____. Now what do you think?*
   - *What do other people think?*
   - *Would someone be willing to add on to what [name] said?*
   - *How does what [name] said go along with what you were thinking?*
   - *Can you repeat what [name] just said in your own words?*
   - *Who can explain this using [name's] idea?*
   - *Can anybody see what method [name] might have used to come up with that answer?*

4. **Supporting students to make connections (e.g., between a model and a mathematical idea or a specific notation)**
   - *How is [name's] method similar to (or different from) [name's] method?*
   - *How does [one representation] correspond to [another representation]?*
   - *How does that match what you wrote on the board?*
   - *Can you use the [representation] to explain what you are thinking?*
   - *What part of the problem/solution does this [pointing to a particular part of representation] represent?*

5. **Guiding students to reason mathematically (e.g., make conjectures, state definitions, generalize, prove)**
   - *Can you explain why this is true?*
   - *Does this method always work?*
   - *Why does that work in this case?*
   - *How do you know it works in all cases?*
   - *When do you think that would be true?*
   - *What do these solutions have in common?*
   - *Have we found all the possible answers?*
   - *What about [counterexample]?*

6. **Extending students' current thinking, and assessing how far they can be stretched**
   - *What happens if you plug in different numbers?*
   - *How would you explain that to a ___ grader?*
   - *Can you think of a situation where that wouldn't be true?*
   - *Would it still be true if ____?*
   - *What would happen if the numbers were changed to _____?*
   - *If someone said [wrong answer], how would you respond?*
   - *Can you think of another problem that could be solved with this method?*

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Example from Teaching "Tool Box": The Work of Setting Up a Mathematics Task

Goal of a Set Up: Get students ready to engage in productive mathematical work with an instructional purpose

Before students arrive:

Set up the classroom & materials
- Gather and organize materials & equipment
- Determine when/how you will display public work (overhead, board, etc.) and who will display it (e.g., teacher record, students come up to board, or give students blank overheads)
- Arrange the room/tables to fit the task
- Remove distractions from room and/or tables
- Determine seating plan
- Determine when/how to distribute materials

When setting up the task with the students:

Establish the work environment
- Make sure students know where to sit
- Do introductions (if needed)
- Give clear, explicit instructions
- Establish expectations for work
    - Explain materials students will use and how they should record their work
    - Establish who students will work with (individually, with partner, in group, etc.)
    - Explain what will be done with the work that is finished (e.g., Tell students they will be asked to explain their thinking.)
    - Establish time frame (e.g., how long students will have to work, that they will be discussing their solutions, etc.)
    - Explain what students should do if they finish
    - How students signal when they need help or want to ask a question

Set the tone
- Enthusiasm and energy, but not over the top
- Attend to your language (positive, mathematically precise, etc.)
- Talk clearly and more slowly than you typically do

Get students into the task without doing the work for them
- Articulate what the task is that they will be working on
- Emphasize the most important parts with repetition
- Make connections to previous work
- Introduce or review any language, tools, and/or representations that students need to understand or be able to use to do the task
- Ask if there are any questions about the task or what students are supposed to do
    - Could ask someone to say what they are supposed to be doing in their own words
    - Could ask if someone has an idea for how they might get started (without saying their answer)
- Have a back up plan if many students don't understand the task (e.g., be ready to explain it again or do an example together (one that is different from their problems)); otherwise, be prepared to scaffold individual students while monitoring
- Use examples that don't give away "too much" of the mathematics; try to ask questions or do examples that leave students with mathematical thinking to do

Distribute materials
- Establish routines/techniques for distribution
- Pass out materials when you want students to start working

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Example Lesson Sketch

Name of task: Which is Larger? (*Marilyn Burns,* p. 135)

Main mathematical point/s of task: Being able to use and explain informal strategies for comparing fractions is an important component of number sense with fractions. Informal comparison strategies typically rely on reasoning about the relative number and size of fractional pieces; benchmarking to 0, ½, or 1; and/or using knowledge of familiar equivalent fractions. Choice of strategy depends on the fractions being compared. The strategies we want to focus on in clinic are drawn from Van de Walle and include:

- More of the same-size parts (i.e., common denominators)
- Same number of parts, but parts of different sizes (i.e., common numerators) (in particular, unit fractions)
- More and less than one-half or one whole
- Distance from one-half or one whole (in particular, fractions that are "missing" one piece from the whole)

This task is not intended to teach or review algorithms for comparing fractions such as finding a common denominator or cross multiplying.

Notes: You will need to select three or four pairs of fractions that can be compared using informal comparison strategies. You will want to choose fractions that elicit different types of strategies and think about how to sequence them in the task.

Additional resources: *Van de Walle*, pp. 304-305; *Math Matters,* pp. 119-121; *Investigations*, pp.52-54

~ 2 min	Setting up the task	Display and pose task: *For each pair of fractions, decide which one is larger. Explain your reasoning.*
~ 5 min	Monitoring student work	As you circulate, ask students to explain their thinking so you can find out what strategies they are using. Students do not need to finish comparing all fraction pairs before you begin the discussion.
~ 1 min	Launching the discussion	Start with one of the pairs that everyone has had a chance to work on and where there is a good degree of consensus on the solution.
~ 6 min	Orchestrating the discussion	Discuss one pair of fractions at a time. The following sequence of questions might be helpful: • Ask for a volunteer to explain which fraction they think is greater. • Ask a student to revoice, or to make a connection with how they were thinking about it. • If students have different answers, discuss until resolved by getting different people to explain their own and other's thinking. If everyone says the same fraction is greater, ask if anyone has a different way of explaining why. • If no one says the incorrect answer, could ask a "what if" question about the pair that gets at a common misconception or unmentioned strategy (e.g., What if a third grader said that 4/4 and 4/8 are equal because they have the same number of pieces?) Continue with as many pairs as you have time to discuss. You don't need to discuss all of the pairs. It is better to discuss multiple strategies for each pair.
~ 1 min	Concluding the discussion	Summarize one of the comparison strategies that was discussed. Conclude with a comment about how they listen to and/or responded to each other's ideas.

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Excerpt from Protocol for Discussing a Math Problem (page 1 of 3: Setting Up, Monitoring, and Launching)

	Questions, prompts, or points to try	Commentary on situation or rationale
Setting Up the Problem	• What is happening in this problem? • Can someone try saying that in her own words? • What is this story about?	Use questions like these to build common understanding of the problem. If you believe that students do not have a clear enough understanding of the problem after you have tried these questions, you may need to explain a bit more about whatever aspect of the problem would prevent students from starting on the problem. As you talk it is critical to be careful not to diminish the work you are hoping the students will do by "giving away" what students are supposed to be figuring out.
	• What sorts of tools might be helpful when working on this problem? • I am going to have you work on your own at first and then share your method with a partner. • Lets be ready to share with the group in 5 minutes.	Use questions and comments like these to establish the work environment for solving the problem. Students need to know information about materials, time, social arrangement, and expectations
Monitoring Student Responses	• I am just listening/looking to find out how you are working on the problem. • This helps me think about what we will do later	You may need to use comments like these if the students seem distracted to see you watching and listening to them as they work. It is important to circulate around the room in order to learn about what strategies, solutions, errors, comments, and questions are arising as the students work. It is likely that you will need to record what you are noticing to help you remember and organize your thinking about what might be shared in the discussion.
	• What are you trying here? • Can you tell me a little about this? • What does that picture show? • What are you finding troubling? • Are there other ways to work on the same thing?	Often you may see or hear something that you do not understand at first or you may see that a student looks "stuck". You can use questions like these to find out what the student is thinking and to clarify what is being done.
	• Why are you interested in more information about that? • Tell me what you have thought about so far. • Let me say just a little about that part.	As they work, students may want to ask questions. You can use statements and questions like these to find out more about what students want to know and why they want to know it. You will need to judge the extent to which answering specific questions helps students to learn.
Launching the Discussion	• Will someone start us off by sharing on way of working on this problem? • Lets see what the class came up with for this part. J'La would you be willing to start us off? • What did you do first when working on this problem?	These prompts may be useful in starting a discussion in the larger group. You will want a prompt that points the discussion in a productive direction and that you believe students will understand and respond to.
	• Lets start by clearing up a few things about the problem. • What are some key parts in this problem? • What was unclear in the problem?	Sometimes you will need to start the discussion by establishing shared understanding of some pieces of the problem that could otherwise hinder the discussion of the larger group. Prompts like these can be used to launch the discussion in this way.

Drawing in part on selected elements in: Math Methods Planning Group, 2007; Smith et al., in press; Chapin, O' Connor, & Anderson, 2003; Lampert, 2001; and Learning Teaching Practice Project, 2008

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Example Grading Tool

<table>
<tr><th>Aspects of
Enacting Instruction</th><th colspan="2">Performance Description and Comments</th></tr>
<tr><td rowspan="4">Setting up an instructional task</td><td colspan="2">The set up:
• supports students access to the task (all students, maintains mathematical demands)
• establishes the work environment (work format, time, materials, expectations)
• is accomplished in a suitable time span (corresponds with student familiarity with mathematics, task structure, representations)
• effectively distributes materials</td></tr>
<tr><td colspan="2">Comments on Performance</td></tr>
<tr><td>Strengths:</td><td>Site(s) for further improvement:</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Launching a discussion</td><td colspan="2">The launch:
• reestablishes whole-group work format
• points work in the direction of the instructional purpose and content of the task
• elicits responses
• is understood by respondents</td></tr>
<tr><td colspan="2">Comments on Performance</td></tr>
<tr><td>Strengths:</td><td>Site(s) for further improvement:</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Orchestrating the discussion</td><td colspan="2">The discussion:
• engages every student (student contributions and attention)
• takes up and uses student contributions
• engages students in mathematical content and practices
• includes appropriate use of representations
• includes clear and accurate contributions from the teacher</td></tr>
<tr><td colspan="2">Comments on Performance</td></tr>
<tr><td>Strengths:</td><td>Site(s) for further improvement:</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Concluding engagement with the task</td><td colspan="2">The conclusion:
• is clear and succinct
• accurately reflects classroom interactions about the task
• attends to mathematical and/or social nature of interactions
• ends in a way that supports transition to the next activity</td></tr>
<tr><td colspan="2">Comments on Performance</td></tr>
<tr><td>Strengths:</td><td>Site(s) for further improvement:</td></tr>
<tr><td colspan="2"></td></tr>
</table>

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