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Materials and Supplies:
5 sets of *Task Cards* on cardstock (tasks A-R)
Chart Paper
Markers
11 x 17 paper
Bookmarks *Questions for the mathematics classroom* (one for each participant)

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Handouts:
Characteristics of Mathematical Tasks
General Descriptions of NAEP Levels of Complexity
LIST OF MATH TASK RESOURCES FOR TEACHERS

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<tr><th>Slide</th><th>Tasks/Activity</th><th>Personal Notes</th></tr>
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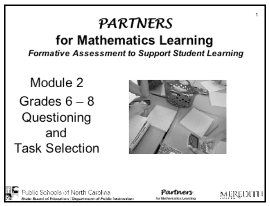

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(Slide 1) Title Slide
Module 2 – Questioning and Task Selection
Welcome back, handout materials, etc.

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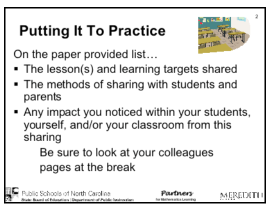

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(Slide 2) Putting It To Practice
In the time between modules 1 and 2 participants were asked to share learning targets for their next unit or lessons with students and parents and then report back to the group.

Provide the participants with 11x17 paper and ask them to write up their learning targets, method of sharing, and any impact they noticed. Post the pages in the room for everyone to look through at a break.

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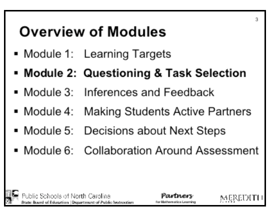

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(Slide 3) Overview of Modules
This module addresses topics within the second stage of the Teaching – Learning Cycle.

Once teachers have determined the learning targets to address; the next step is to choose worthwhile tasks and develop appropriate questions towards achieving the learning targets and for formative assessment.

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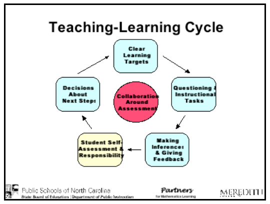
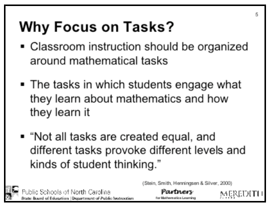


(Slide 4) Teaching – Learning Cycle
Briefly go over assessment cycle and its components.

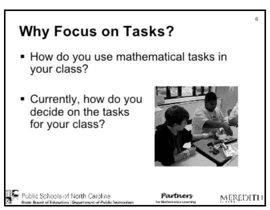
Point out to participants that during this module we will be focusing on choosing good tasks and questioning to fit our instructional and assessment needs



(Slide 5) Why Focus on Tasks?

- *Classroom instruction should be organized around mathematical tasks*
- *The tasks in which students engage what they learn about mathematics and how they learn it*
- *"Not all tasks are created equal, and different tasks provoke different levels and kinds of student thinking."*

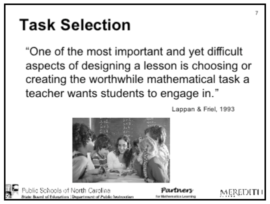
Read the points above or have selected participants read them aloud. Take a second to have participants to record in their journals, questions they have about mathematical tasks that they hope to have answered in this module. Tell participants we will revisit questions later in the module so hold off on sharing for now.



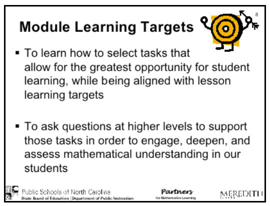
(Slide 6) Why Focus on Tasks?
Give participants several minutes to respond in their journals.
How do you use mathematical tasks in your class?

The question, *How do you decide on the tasks for your class?* is more of a starter question for their journal response.

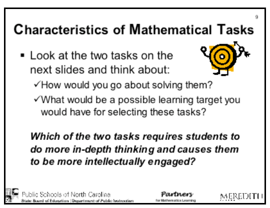
It does not need to be discussed unless someone wants to answer. If so, don't allow much discussion at this point. It should be brief if discussed at all.



(Slide 7) Task Selection
Task Selection is difficult, but it is one of the most important aspects of teaching. Here is where we make or break learning for students. If we don't choose carefully, we can kill student interests or hamper their intellectual development; rather than challenging their curiosity by setting up problems with stimulating questions that help drive independent thinking. (…paraphrased from George Polya 1973/1945)



(Slide 8) Module Learning Targets
Be sure to impress the point that our purpose is not to learn how to create or design tasks, when we have thousands at our fingertips. Our purpose will be to understand the tasks we choose more completely and to know when we should use those tasks. We will not be learning how to create rich, mathematical tasks during this module, but how to identify them and support their implementation.



(Slide 9) Characteristics of Mathematical Tasks
Participants will look (in small groups) at the two tasks on the following slides to compare them and determine characteristics of each task. (See handouts, *Identifying Characteristics of Mathematical Tasks* for the tasks and workspace to analyze these tasks). Ask the participants NOT to think about grade level appropriateness or background experiences of the students. We need them to compare these tasks based on what they ask the students to do and understand, not on the difficulty of the task. What is difficult for a fourth grade student may be easy for a seventh grade student even though the mathematics remains the same.

Presenter Note: Task 2 requires students to be more intellectually engaged and to give more in-depth thinking around the same learning target as task 1. See notes for each individual task on the next slides for further delineation between the two tasks.

The next two slides show the tasks, so that participants may read and think about them before comparing them.

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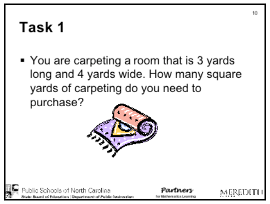

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(Slide 10) Task 1
Presenter background knowledge: This task requires limited intellectual engagement in order for it to be completed. There is little ambiguity about what needs to be done and how to do it. Students are basically asked to recognize an area problem and apply an algorithm. The way a student solves this task may be procedural or conceptual. If a student just completes the algorithm, there may be limited opportunity to see the depth of the student's understanding. The teacher may have to make high inferences about what the student understands whereas in task 2, there is greater opportunity to see depth of student understanding since this task requires students to go beyond simply applying a procedure. (Inferences will be discussed in detail in a later module.)

Possible Learning Target: Calculate the area of a rectangle.
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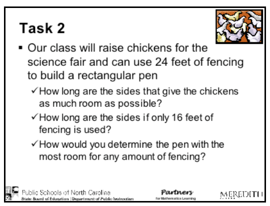

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(Slide 11) Task 2
Presenter background knowledge: This is an intellectually engaging task. It requires complex, non-algorithmic thinking. Students need to explore the concept of area and perimeter and the relationships of the two. Students will have to activate prior knowledge to help work through this task. It may be an opportunity for students to collaborate as they work through the problem to discover possible solutions. The students will be using and extending the knowledge they have already developed on area and perimeter. It is not a simple exercise like Task 1 that is focused on producing a single answer though students should identify and justify appropriate solutions.

Note: That even if only the first question on this slide were given to the students, it is still requires students to do more in-depth thinking than the other task. Do not let participants get caught up in the fact that this task has multiple questions. The remaining questions are there to get students to generalize for any given number of feet used.

Possible Learning Targets:
Describe the possible dimensions of a rectangle given a perimeter.
Calculate the possible areas of a rectangle given a perimeter.
Experiment with lengths and widths of a given perimeter to maximize the area.
Generalize a technique for maximizing area given any perimeter.
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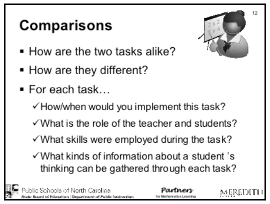

(Slide 12) Comparisons
Allow participants time to work in groups and compare these two tasks.
How are the tasks alike? Both involve calculating area
How are the tasks different? The first has the single learning target, the second addresses multiple learning targets and encourages more depth of thinking

After the group has had some time to discuss these points, start a chart listing characteristics of intellectually engaging tasks. (Possible points to be mentioned by the group – engaging, challenging, cooperative learning, multiple solutions or solution paths, etc.) Leave the chart up throughout the training so you'll be able to refer to it or add to it during later modules.

How would you implement this task? The first could be used after an introduction of area as could the second, but the second involves exploration of the relationship between area and perimeter and maximizing area.It could be done in groups or pairs as well as individually.

What is the role of the teacher and the students? In task one the teacher asks, then the student responds, then a "right" or "wrong" is all that's needed. In task two the students are investigators and the teacher's role includes making sure all of the student's ideas and strategies are shared.

What skills were employed during the task? In the first, recognizing an area calculation and multiplying. In the second, recognizing an area calculation, relating areas to a given perimeter, testing various examples, and generalizing results.

What kinds of information about a student's thinking can be gathered through each task? In task one, a student's ability to calculate area. In task two, a student's ability/willingness to explore, to conjecture, and justify, as well as the student's understanding of area, perimeter, and how they relate.

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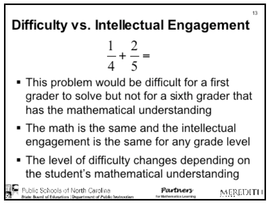

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(Slide 13) Difficulty vs. Intellectual Engagement
Further clarification between difficulty versus intellectual engagement: this task is only applying procedural knowledge and does not require in-depth thinking or intellectual engagement. Make sure the information on the slide (that this problem applies procedural knowledge regardless if the procedure is known) is understood before moving on to the next slide.
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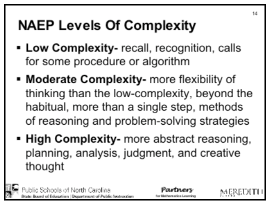

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(Slide 14) NAEP Levels of Complexity
Direct participants to the handouts (General Descriptions of NAEP Levels of Complexity). Ask them to read for themselves the NAEP definitions of problems with low, moderate, and high levels of complexity. Have participants count off in threes- so that the ones will read about the NAEP low level, the twos will read about the NAEP moderate level, and the threes will read about the NAEP high level. Then have participants move to form 1-2-3 groups, in order to share the definitions and descriptions they read.

Note that NAEP's "demands on thinking" is equivalent to the phrase "intellectual engagement". Once participants finish reading and sharing, move to the next slide for the task sort.
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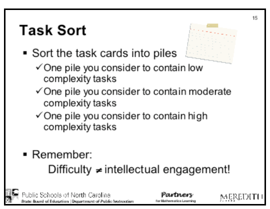

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(Slide 15) Task Sort
Give each group of participants a set of Task Cards (there is a copy in the handouts) to sort into three piles according to the directions on the slide. Each group needs to reach consensus on the categories for each of these tasks. The tasks were selected from a variety of textbooks, resources from DPI, NAEP, NCTM and other readily available resources for teachers.

After the groups have their tasks sorted, instruct them to list the task sort in their journals indicating which tasks they placed in the low, medium, and high complexity categories. They can make notes about the ones they were unsure of which category it fell into noting what confused them.
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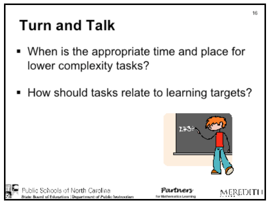


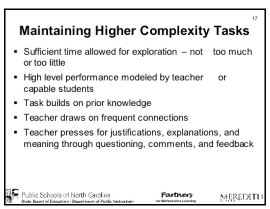
(Slide 16) Turn and Talk
Ask participants if there is a time for students to complete low complexity tasks? When would that be?

Make sure participants understand that skill and practice (procedures without connections) are important to help develop automaticity and autonomy. Like everything, a good balance is critical!

Be sure to connect the task to the learning target – what is the opportunity for student learning and what assessment information can be gained from using this task.

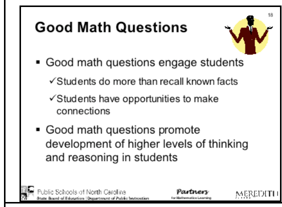
Have participants select one of the low complexity tasks from the task sort and reword it to be a high complexity level task. Discuss what information can be gleaned from each task and the purpose for using each one.

If participants are struggling with this refer to the low/high pairs of problems from the task sort. (ex. M/N, G/P)

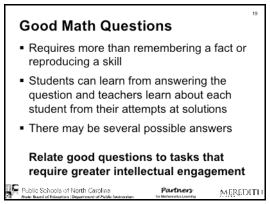


(Slide 17) Maintaining High Complexity Tasks
This slide lists ways for teachers to be sure that they keep the high complexity tasks at a high level. Unfortunately, any high complexity task can be turned into a low complexity task if teachers aren't careful. When teachers lead students through tasks or have leading questions that reduce the complexity of the task by taking over student thinking or leading students through the steps, the task is no longer of a high complexity level. Other factors can also reduce the complexity of the task; for example, if the task expectation is not clear or the students don't have the prior knowledge needed to perform the task or there is poor classroom management or unmotivated students.

Teachers have the responsibility to keep their tasks at a high level of complexity!

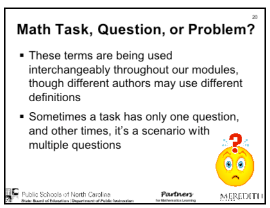


(Slide 18) Good Math Questions
Have a participant read the bullets. Relating back to the first module, remind participants that Bloom’s Revised Taxonomy can be useful in developing mathematics questions that fit these characteristics (and that are at a high complexity level).



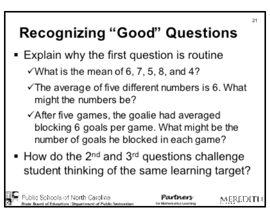
(Slide 19) Good Math Questions
Connect back to Task 1 and Task 2 – the area and perimeter problems. Which one of those fits the criteria of a good math question? (Answer: Task 2.)

Ask how is a good question like a task that requires greater intellectual engagement? (Be sure the discussion hits on the point that tasks are merely questions for students to solve. There is a purpose for higher and lower complexity questions and tasks. The teacher should know the purpose for each question being asked and to be sure to include many opportunities for students to solve questions that require higher levels of thinking skills.)



(Slide 20) Math Task, Question, or Problem?
The next several slides deal with routine and non-routine questions and how these questions are also considered tasks. A task does not have to be an activity that is found in a book…questions can also be tasks that are higher or lower complexity level, depending on the thinking skill and the intellectual engagement elicited from the question.

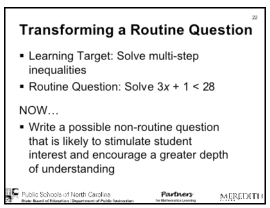
These math questions (tasks) are not the questions that teachers also ask to support tasks (such as probing or clarifying questions). These questions that teachers asked during instruction will be discussed later in this module.



(Slide 21) Recognizing “Good” Questions
Ask the participants to read the math questions on the slide. Then ask for participants to name the learning target that these questions might be used to address. One statement of the learning target might be, “Students will be able to calculate a mean.”
Then ask participants-
Explain why the first question is routine (It is the most common approach to calculating a mean, that is calculate the mean of a given set of numbers.)

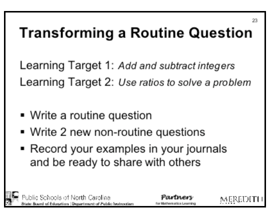
How do the 2nd and 3rd questions challenge student thinking of the same learning target? (Students are <u>still asked to calculate a mean</u>, but these questions are reversed, in the sense that the mean is given and the students must find a set of numers. Students are still being asked to do the same calculation, but there may need to be some experimentation, some trial and error. And in the third question, there is the additional constraint of finding 5 vaules that are possible numbers of blocks. That is, in the third question -2 or ½ would not be numbers that would be appropriate.)

Note to participants how low complexity level tasks can be turned in high complexity level tasks by tweaking the question or task.



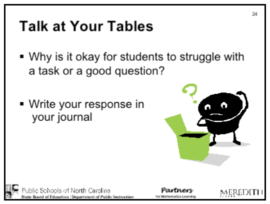
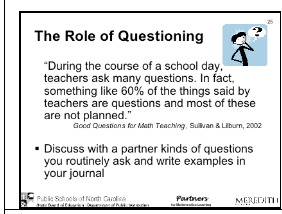
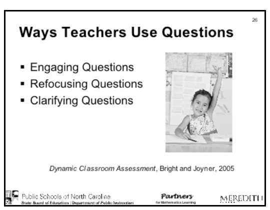
(Slide 22) Transforming a Routine Question
The goal of this module is not to discuss creating tasks or questions; however, a quick activity is shared here to show how easy it can be to turn a routine question into a non-routine one. Ask participants to come up with ideas at their tables.

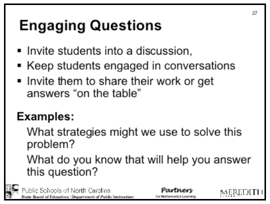
Have groups share possible non-routine questions. Here's a few examples:
For the given inequality, $3x + 1 < 28$, find the prime number solutions.
Given the inequalities $3x + 1 < 28$ and $3x +1 < 31$, find a solution for the second inequality that is not a solution to the first inequality.
Given $3x + 1 < 28$, write a different two-step inequality with the same solution. (Note to participants how the new questions still address the same learning target- solving multi-step inequalities!)



(Slide 23) Transforming a Routine Question
Group participants in small groups of 4 people. This time ask participants to begin by writing a "routine" question addressing each learning target on the slide and then writing two new "non-routine" questions that could be used to address the same targets. Give the groups 11x17 paper on which to write their 3 problems.

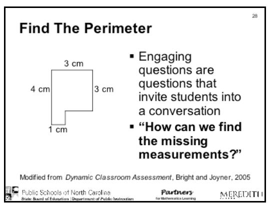
Once this is complete, regroup participants to share ideas. Have the participants number off from 1 to 4 within their groups. Then ask all the ones, twos, threes, and fours to meet

	together in four places in the room in order to share ideas, while the presenter hangs the papers in a place for people to view at the break. Learning Target 1: *Add and subtract integers* Learning Target 2: *Use ratios to solve a problem*	
	**(Slide 24) Talk at Your Tables** Allow groups to discuss this briefly, making notes in their journals. Research supports that some frustration/struggle is good (disequilibrium). Students aren't learning if everything is too easy for them! It becomes the teacher's responsibility to monitor this struggle and provide appropriate support to students that need it. Consider Vygotski's Zone of Proximal Learning: If students aren't stretched in their thinking, their zone of learning is not expanded. Teachers need to know their students well in order to do this. You may want to also point out that discussing tasks with the class will allow students to hear others thinking and often resolves their own questions, rather than the teacher always telling them the answers.	
	**(Slide 25) The Role of Questioning** Briefly discuss with a partner some kinds of questions you ask students and write examples of these in your journals. *What are some advantages of planning questions when planning lessons? Difficulties?*	
	**(Slide 26) Ways Teachers Use Questions** We have been talking about tasks at different levels of complexity and routine/non-routine questions up to now. These next slides remind us that we need to think about why we are asking questions, and if a question is worth asking, we need to wait for an answer and listen carefully to students' responses.	



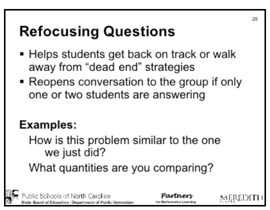
(Slide 27) Engaging Questions
Ask if participants have examples of engaging questions on their lists of questions they generated that they ask in their own classrooms. Why are engaging questions important to ask students? Discussion should include that they allow for ALL students to enter the discussion. At this point you aren't looking for right or wrong answers, but to elicit student thoughts and opinions.

If time allows, ask participants to generate some more generic questions to put in their notes.
Examples: How did you begin to solve this problem? What information did you find most useful? Can you say in your own words what you are trying to find out?



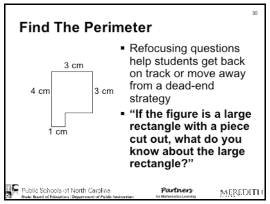
(Slide 28) Find The Perimeter
Engaging questions are often used to start a discussion or bring the class back together into a discussion. After 3 or 4 exchanges with one student, it may be important to re-engage the class.

The engaging question on the slide is designed to get the conversation started since there are a number of ways students might respond. The question, "What is the answer?" wouldn't be very engaging since it has only one correct response.



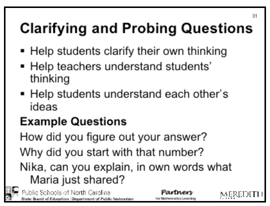
(Slide 29) Refocusing Questions
Ask if participants have examples of refocusing questions on their lists (refer back to slide 25- lists created in journals).
Why are refocusing questions important to ask students? Point out that while engaging questions can be generic, refocusing questions tend to be more specific.

Teachers must be careful not to scaffold their questions to lead students to the answer – rather just get them on the right track.

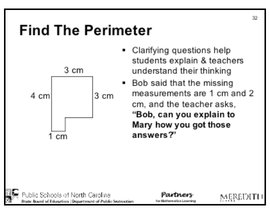


(Slide 30) Find The Perimeter
Refocusing questions are usually used when you feel that students are working in unproductive ways. Sometimes students get bogged down in one way of thinking and need some alternative ways of thinking about the problem. While we do not want to do the thinking for the students, it is important to help students think productively without leading them too much.

You want to help point students in a productive way with a refocusing question. Be careful NOT to ask step-by-step questions that lead students to the correct answer without understanding what the answer means or thinking for themselves. The question from the slide wasn't leading, it was designed to help students rethink the visual image.

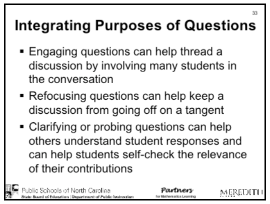


(Slide 31) Clarifying and Probing Questions
Ask if participants have examples of clarifying questions on their lists. Why are clarifying questions important to ask students? (Answers will vary but may include, to make clear what the student means for the teacher, other students, and the student himself, or to verify the student's understanding of the question or problem.)



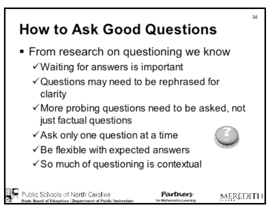
(Slide 32) Find The Perimeter
Teachers ask clarifying questions in response to what students have written or said. They help students make clear what is meant, both for themselves and for other students.

Probing questions are types of clarifying questions. They help teachers uncover student's thinking when it is unusual or unclear. "What do you mean when you said that?" is a good generic clarifying question. But generic questions alone are not enough, teachers should follow-up with questions that get at the mathematical concepts specific to the task. In the example question on the slide, the teacher may have felt that the student was thinking correctly, but wanted the class to also understand that student's thinking.



(Slide 33) Integrating Purposes of Questions
Divide the group into three smaller groups. Have group one come up with engaging questions related to Task 2 in the first handout page, ask group two to write refocusing questions for Task 2, and then ask group three to write clarifying questions for Task 2. Allow groups to share their ideas.

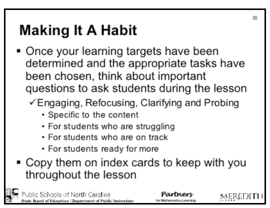
It is important for teachers to integrate purposes for their questions. All classroom discussions should have a main thread and teachers need to keep the discussion and tasks focused around that main idea. It is easy for discussions to lose the sense of direction and the students will likely not remember the key mathematical ideas of the learning targets. All questions teachers ask should illicit information that helps determine student understanding. That is the critical link between instruction and assessment.



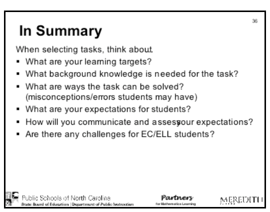
(Slide 34) How to Ask Good Questions
Make the following points:

Waiting for answers is important
Teachers tend to wait less than 3 seconds for an answer – not long enough for many students to even process the question. Without waiting for an answer, we will never find out what that child knows and understands.
Questions may need to be rephrased for clarity
If student seems not to understand a question, it may not be because he/she doesn't know what you are getting at, but because the student does not understand the question in the way it was asked.
More probing questions need to be asked, not just factual questions
This gets at Blooms Taxonomy and the need to lead children to higher order thinking skills. We will learn more about what the child understands beyond facts he/she may have memorized without understanding.
Ask only one question at a time
Allow students to process and think about one question rather than bombarding them with several, unless a series of questions is meant to be motivational rather than information gathering. Again, we are giving children time to think about their response.
Be flexible with expected answers

<table>
<tr><td></td><td>Children may give correct answers with appropriate mathematical thinking that are not the ones we expect. We must understand the math enough to recognize good mathematical thinking when we see and hear it.
So much of questioning is contextual
Children will understand questions only in the context in which they are asked. Take time to think about the context in which you are asking questions so that you are getting the answers that will give you the information you need.

It is also important to reiterate that being able to use good questions and learn from them is largely a function of a classroom environment which is safe enough for the children to give honest answers. Also crucially important is the mathematical knowledge of the teacher. We need to be willing to find out more about the math we are teaching and not just rely on the math we were taught in school.</td><td></td></tr>
<tr><td>
</td><td>**(Slide 35) Making It A Habit**
One suggestion is to list important questions for students during the lesson planning stage. The questions asked by the teacher should be helping students towards the lesson's learning targets.

Keep a copy of these questions close to refer to during the lesson.

Give participants the bookmarks of "Questions for the mathematics classroom".</td><td>Note: have bookmarks for participants</td></tr>
<tr><td>
</td><td>**(Slide 36) In Summary**
These are all of the things that need to be thought about and carefully planned before giving tasks to students to do. Understanding the learning target and what experiences students need before completing the task is imperative to consider during planning. If teachers also think through the misconceptions and errors students may make as well as possible methods they will use, then questions can be planed so you are not thinking "on the fly" or caught off guard and having to think "on your feet".</td><td></td></tr>
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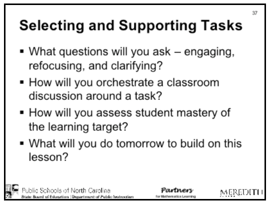
<td>
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<td>(Slide 37) Selecting and Supporting Tasks
Questions need to be planned and thought through before tasks are given to students (Note: "Clarifying" and "Probing" questions are the same). Teachers should monitor and search for solution paths to be shared during the discussion and understand how the order of sharing these solutions can help build students' understanding of the learning targets. Students should make connections between the strategies being shared and strategies/content learned previously.</td>
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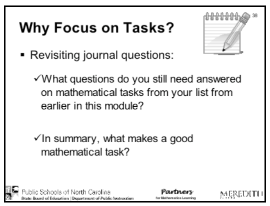
<td>
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<td>(Slide 38) Why Focus on Tasks?
Answer questions participants may have about mathematical tasks that were not addressed in the module. Hopefully, most everything was answered. If anything comes up that you are unsure how to best answer, write it down and address it at the beginning of the next module. That will allow you time to prepare a answer.

Have participants summarize what makes a good mathematical task. We hope they will refer back to the poster and add things like: addressing important mathematical concepts, interesting and engaging to students, requires students to make connections, may have multiple solutions or solution paths, etc.</td>
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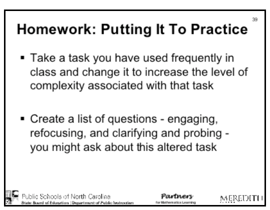
<td>
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<td>(Slide 39) Homework: Putting It To Practice
Ask participants to prepare for the next meeting by completing the assignments on the slide. Also point them to the last page in their handouts where they will find a list of resources for mathematical tasks.</td>
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<td>(Slides 40-43) Credits and Closing Slides</td>
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