Differentiating Instruction Through Questioning

One of the most effective means to address the variety of student needs is through the questions teachers pose in instruction and assessment. Good questions should focus on important mathematics, engage every learner, and offer possibilities for each learner to participate in a rich mathematical conversation, no matter what their stage of learning. The questions teachers ask further the mathematical development of students by exposing student thinking and, through the ensuing dialogue, provide teachers with information needed to adjust their intended instructional trajectory. For good questions to work, students must be provided with the appropriate scaffolding and challenge in an environment that allows them to speak and listen fearlessly. Good questions provide opportunities for rich mathematical conversations thus promoting math talk learning communities.

By providing choice, teachers allow students to work at their readiness level while working on a common learning goal. Open questions and parallel tasks are two core questioning strategies that allow for choice.

Open Questions

Open questions allow for a variety of responses or approaches. Students choose the numbers or mathematical models they are comfortable with, thus promoting confidence.

For example:
Question A: A pair of shoes regularly sells for $60. They are on sale for 25% off. What is the sale price?
Question B: A pair of shoes is on sale for 25% off. What could the original and sale price be?

Question B is open because students can choose the numbers with which they would like to work. This choice makes it more inclusive and accessible to a larger range of student abilities. This choice also allows students to demonstrate what they do know about working with percents and not be hampered by values with which they are not comfortable.

Open questions can be used in the beginning of a lesson, **Minds On…**, to engage students in new learning, build on students prior knowledge, or serve as assessment **for** learning opportunities. They could be used in the middle part of the lesson, **Action!,** for students to explore new ideas at their readiness level, or in the third part of the lesson, **Consolidate**, focusing on assessing student understanding of the goal for the lesson.

Strategies for Opening a Question

- Begin with the answer. Ask for the question.
  Example: You saved $6 on a pair of jeans. What could the original price and the percent off have been?
- Ask for similarities and differences.
  Example: How are $y = 3x$ and $y = 2x$ alike? How are they different?
- Leave certain information out of the problem, e.g., omit numbers.
  Example: Two right triangles are similar. One has two side lengths of 4 and 6. The other has one side length of 12. What lengths could the other three sides be?
- Provide several numbers and math words; the student creates a sentence using all the numbers and words.
  Example: Create a sentence that uses the numbers and words: 40, 5, ratio, and scale.
- Use “soft” language.
  Example: Two ratios are “almost but not quite” equivalent. What might they be?

Scaffolding Questions

Meaningful learning occurs during problem solving, when students do not know the answer or what to do and have to investigate for some period of time. All students should be encouraged to explore for a bit, but some students do not even know how to start. Teachers need to be prepared to scaffold the learning for these students with question prompts, when they are clearly needed. The following scaffolding questions are designed to preserve the cognitive demand of the original question rather than break the original question into a multi-step procedure.

Examples

Open Question	Scaffolding Questions
One number is 2.5 times as much as another. What might the numbers be?	• Which number is bigger? How do you know? • If the first number is less than 10, what do you know about the second number? • Does either number have to be a decimal?
An item costs more than $60. You saved $35. What might the percent discount have been?	• Suppose you had saved 50%. What do you know about the original price? • Suppose you had saved 25%. What do you know about the original price? • For what price would be easy for you to figure out the percent discount?
What situations could this graph describe? 	• Suppose you use two variables. If one increases, what should the other do? How do you know? If one doubles, what should the other do? How do you know? • How would it help to put numbers on the axes?

Parallel Questions

Another strategy that builds student confidence is to offer choice in two or three parallel tasks that are mathematically equivalent in terms of the learning concept but not in terms of skill details. All students can succeed relatively independently since obstacles are removed in the varied tasks to provide an entry point for all students. The context of the tasks are relatively similar so that the same follow-up questions can be asked and answered by students no matter which task they did. This differentiation technique allows all students to be part of the discussions and encourages a math talk learning community.

Steps for Creating Parallel Questions

1. Select the initial task.
2. Anticipate student difficulties with the task (or anticipate what makes the task too simple for some students).
3. Create the parallel task, ensuring that the Big Idea is not compromised, and that enough context remains similar so that common consolidation questions can be asked.
4. Create at least three or four common questions that are pertinent to both tasks. These should provide insight into the solution and not just extend the original tasks. You might use processes and Big Ideas to help.
5. Call upon students from both groups to respond.