Investigations in Number, Data, and Space®

The Teacher's Role in *Investigations*

For many, using *Investigations* involves revising one's idea of what it means to be a mathematics teacher. Instead of lecturing from the front of the room, demonstrating the one right way to solve a problem, and providing feedback as students practice, the teacher's role is to pose problems, ask questions, facilitate discussions, and rephrase, model, compare and contrast students' ideas and strategies. This new role presents challenges for teachers, who want to know:

- Do students have to "discover" everything? Do I ever tell them something?
- How do I best interact with my students? When I'm working with them one-on-one? in small groups? in whole class discussions?
- How do I know when a student is ready to move to a more efficient strategy or a new level of thinking? How do I help them to do so with understanding?

The *Investigations* curriculum helps teachers answer such questions in several ways – through the suggested teacher talk in each session, in Dialogue Boxes, and in Teacher Notes. For example, some teachers wonder, "How should I handle the formal names of geometric shapes[1] with young students?" One place for teachers to look for support is the text of the unit, which suggests ways to introduce and discuss these activities with children. In addition, there are Teacher Notes about introducing geometric vocabulary to (and using it with) students, and about what to expect of students' use of those terms. There are also Dialogue Boxes that provide sample classroom conversations, which give a glimpse of what actual students said during this session, and how the teacher responded. Finally, the benchmarks included in each unit specify when fluency with such knowledge is expected.

While the curriculum works hard to support teachers in this work, it cannot on its own answer the myriad of questions about when and what to tell, and how to move children toward more efficient strategies based on what they do and do not understand. The challenge teachers face is meeting their students where they are in their understanding and still nudging them towards ever more efficient strategies. What follows are descriptions of several approaches – built into the 2nd edition of the curriculum – that can be used when interacting with the whole-class, a small group, or an individual student.

Choosing Particular Strategies to Discuss

Many teachers take notes as they walk around the room, keeping track of where students are, but also getting a sense of the range of the strategies in the room. Armed with this information, they can be sure that a particular strategy gets significant "air time" or that a misconception that many students are grappling with gets discussed. For example,

> "Roveen and Marilyn were working to inventory this bag of pencils. Roveen said there were 12 and Marilyn said there were 13. What do you think about that? Can they both be correct?"

Or,

> "I noticed that Lucy started with 29 x 10 to solve 29 x 12. Lucy, can you explain how you thought about this problem?"

In fact, the curriculum often suggests that, as teachers observe students at work, they look for particular strategies or misconceptions, to be raised in the upcoming discussion.

Sample Games

Whole class discussions are often grounded in a sample game. For example, to stimulate a discussion about counting strategies, the curriculum suggests playing a game of *Collect 20* with students, and (laboriously) counting from one each time. Mrs. L. did just that, adding the number of pennies rolled to a growing pile, and then counting the whole pile from 1. After several turns Jose told her, "Mrs. L, you don't have to start over every time!" If a student doesn't make such a comment, she asks, "I'm getting tired of counting these pennies from one every time I add more. Is there something I can do so that I won't have to?"

Purposeful Mistakes

Sometimes the curriculum suggests that teachers make purposeful mistakes, ones that they are seeing as they observe students at work. For example, Ms. M. had been noticing that, as they counted sets of objects, many students were not keeping track of what they had already counted and what remained to be counted. Students were skipping some objects, double counting others, and were not bothered when their partner found a different total than they did. In the class discussion, she purposefully counted a set of objects incorrectly, using those same errors, to stimulate a discussion about counting strategies. Many students noticed -- "But Ms. M, you counted that one twice and you skipped that one altogether!" -- and a useful discussion of strategies for counting accurately ensued.

Asking Questions

Successful teachers tell us that, instead of telling, their goal is asking a question that might help a child see an error, or view something differently. For example, "Your paper says that 57 times 4 is 288. How did you figure that out? ... Would it help if we thought about how much 50 x 4 would be?" (Russell, 2000.) Or, "A lot of kids counted back by 1's to subtract 12. What would happen if we started by subtracting 10?"

Rephrasing and Modeling

Some students are more likely to understand a strategy if they hear it described in more than one way, or if they have to explain it aloud, or if they see someone model it in a way that makes sense to them, or if they are asked to model it themselves. Therefore teachers tell us they often call on one student to demonstrate his/her method, but then ask another to explain what the first student did. These teachers use, and encourage their students to use, words/contexts, numbers, pictures, and/or tools (e.g. cubes, the 100 Chart or number line, stickers, arrays) to illustrate what's happening in a particular strategy.

> "Juan said he put the counters into rows of 5. Let's try that. We have 8 counters so far. Jean, can you put the pennies into rows of 5? I just rolled a 3. Nick, can you add 3 counters? How many counters do we have now? How do you know?"

> "To solve 29 x 12, Lucy thought about 29 teams with 12 people on each team. It was easy for her to think about 10 people on each team. Then she knew that each team still needed 2 more people. How could we use an array to show Lucy's strategy?"

When facilitated purposefully, conversations -- whether whole-class, small group or one-on-one -- can provide the opportunity for all students to see and hear about, consider, and even try out particular strategies.

Notes

1 It is important to note that, in mathematics, there are some things that can *only* be told. Social conventions such as the name of a six-sided shape, which numerals represent which quantities (5 is the symbol for this many: *****), or what the plus (+) and equals (=) sign stand for, cannot be "discovered." We as a society agree upon these conventions. In order for students to learn that there are 12 inches in a foot, or the fact that a quarter equals 25¢, someone must tell them. It is also important to note that knowing the name of, say, a quarter, does not mean that one understands that it is worth 25¢; that is equivalent to 25 pennies (or 2 dimes and a nickel, or a dime and 3 nickels); that 4 of them make a dollar, etc.

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