Questioning Strategies to Deepen Mathematical Understandings

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Agenda

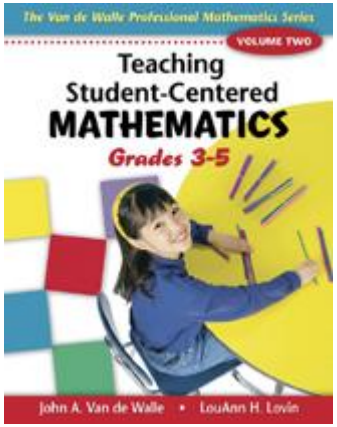
- Teaching math through problem solving.
- Why ask questions?
- Types of questions.
- The teacher's role during the lesson.
- What questioning might look like in the mathematics classroom.

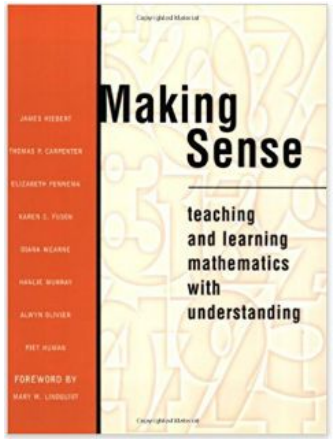
Teaching Math Through Problem Solving

John Van de Walle's book Teaching Student-Centered Mathematics tells us:

> The single most important principle for improving the teaching of mathematics is to *allow the subject of mathematics to be problematic for students* (Hiebert et al., 1996).

Teaching Math Through Problem Solving





A problem is defined as any task or activity for which the students have no prescribed or memorized rules or methods, nor is there a perception by students that there is a specific correct solution method (Hiebert et al., 1997).

Why Ask Questions?

Why Ask Questions?

Reminders:

1. Never say anything a kid can say.
2. Ask good questions
3. Use more process questions than product questions.
4. Replace lectures with sets of questions.
5. Be patient.

Why Ask Questions?

More tips:

1. Use think-pair-share to give students time to think independently before working together.
2. Require students to ask a question when they need help.
3. Require several responses to the same question - and be non-judgemental.
4. Avoid answering my own questions.
5. Never carry a pencil!

Types of Questions

Open Questions vs. Closed Questions

Process vs. Product Questions

Just ask them WHY

Developing Mathematical Thinking With Effective Questions

Types of Questions

To promote problem solving, ask…

- How would you describe the problem in your own words?
- What facts do you have?
- What do you know that is not stated in the problem?
- How did you tackle similar problems?
- Could you try it with simpler numbers? Fewer numbers? Using a number line? What about putting things in order?
- Would it help to create a diagram? Make a table? Draw a picture?
- Can you guess and check?
- If you compared your work with anyone else's, what did they try?

Types of Questions

To help students build confidence and rely on their own understanding, ask…

- Why is that true? How did you reach that conclusion?
- Does that make sense?
- Can you make a model to show that?

To help students learn to reason mathematically, ask…

- Is that true for all cases? Explain.
- Can you think of a counterexample?
- How would you prove that?
- What assumptions are you making?

Types of Questions

While students are solving problems:

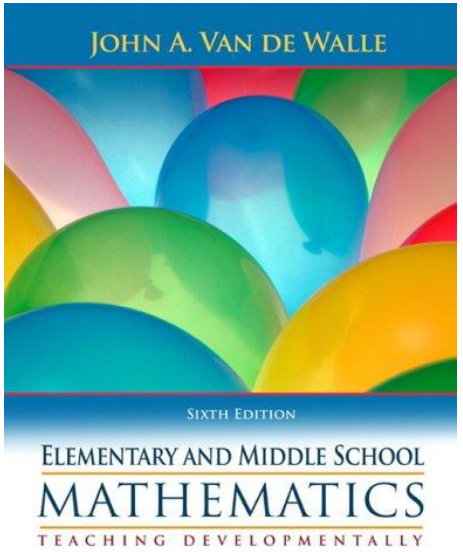
- What are you doing?
- Why are you doing it?
- How does it help you?

During class discussions:

- How did you solve the problem?
- Why did you solve it this way?
- Why do you think your solution is correct?

The Teacher's Role During the Lesson

After preparing students for the problem, they should work alone or in small groups to find a solution.



- ***Let go!***
- ***Listen actively to your students.***
- ***Cautiously provide appropriate hints.***

What Questioning Might Look Like in the Classroom

Look at the student work samples from www.exemplars.com (K-2, 3-5).

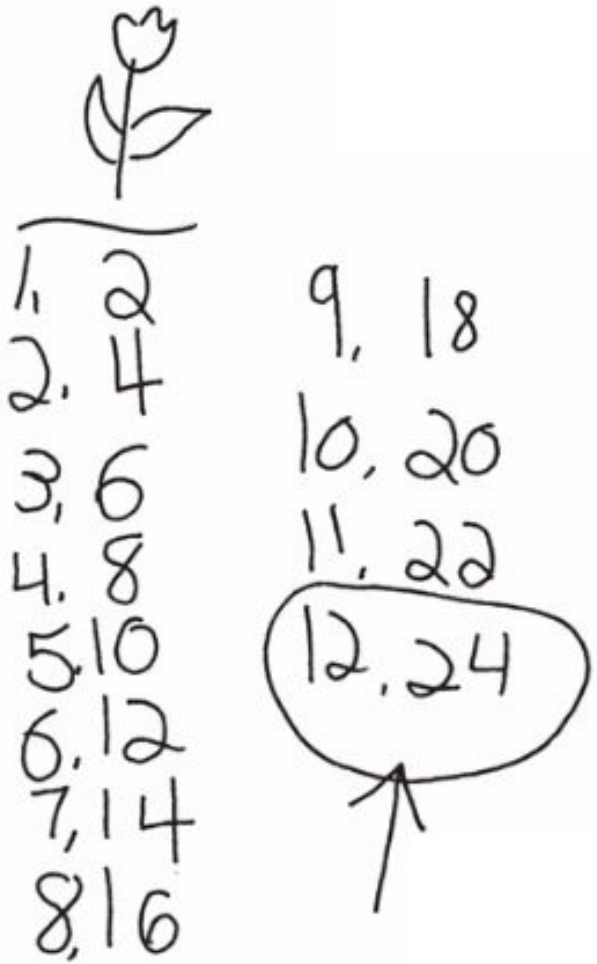
Using the information you have learned, think of questions to ask each student about their work.

What Questioning Might Look Like in the Classroom

Measuring a Tulip

Last fall, Mr. Park's class planted tulip bulbs in the school flower garden. In the spring, when the tulips poked through the soil, the students chose 1 tulip to measure every week. The 1st week, the tulip they chose to measure was 2 inches tall. The 2nd week, the tulip was 4 inches tall. The 3rd week, the tulip was 6 inches tall. When was the tulip 12 inches tall?

What Questioning Might Look Like in the Classroom

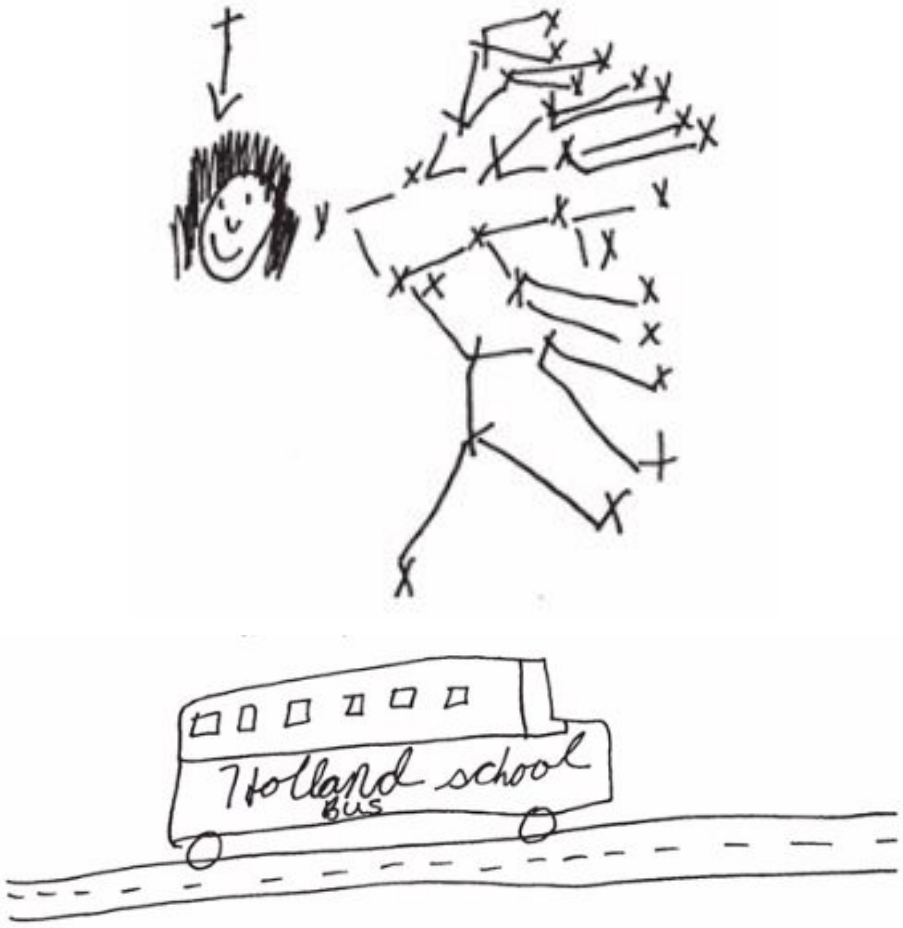


What Questioning Might Look Like in the Classroom

Calling All Students

Mrs. Forest wanted to plan how to contact her students by phone in case the field trip they were going on the next day needed to be canceled. She decided to call one student who would then call 2 other students. Each of these students would then call 2 other students. This would continue until all students had been called. Mrs. Forest has 31 students. How many students will need to make phone calls if Mrs. Forest calls the first student?

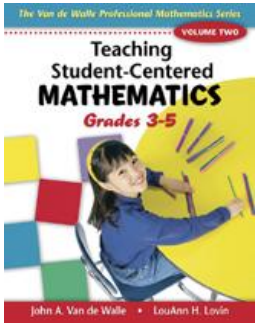
What Questioning Might Look Like in the Classroom

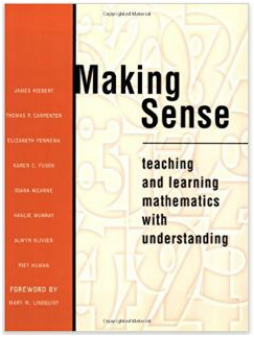


What Questioning Might Look Like in the Classroom

What can I tell them?

Should I tell them anything?





A good rule of thumb is that you should feel free to share relevant information as long as the mathematics in the task remains problematic for the students (Hiebert et al., 1997).

Thank you!

Thank you for participating today!

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References

Developing Mathematical Thinking with Effective Questioning

http://teacherline.nylearns.org/resources/documents/MathTipsCard.pdf

Exemplars

http://www.exemplars.com

Hiebert, James. *Making Sense: teaching and learning mathematics with understanding*. Portsmouth, New Hampshire: Heinemann, 1998. Print.

Reinhart, Steven C. "Never Say Anything a Kid Can Say!" *Mathematics Teaching in the Middle School* 5.8 (2000): 478-83. Print.

Van De Walle, John A., and LouAnn H. Lovin. *Teaching Student-Centered Mathematics*. Boston: Pearson Education, 2006. Print.

Van De Walle, John A. *Elementary and Middle School Mathematics: Teaching Developmentally*. Toronto: Pearson Allyn & Bacon, 2007. Print.