The Art of Asking Thought Provoking Questions in a Problem Solving Mathematics Classroom

Math Teacher Leader Meeting
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Presenters:

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Purpose

To understand the importance of asking good questions in the problem solving mathematics classroom in order to promote deep discussion about the relative efficiency of the solution.
In the session, we will...

• What are good questions?

• How are good questions created?

• What are the teacher’s responsibility in presenting good questions?

• Complete a math task

• Group discussion about learning experience


Developed by the Milwaukee Mathematics Partnership (MMP) with support by the National Science Foundation under Grant No. 0314898.
What are good questions?
Good Questions…

• They help students *make sense* of the mathematics.

• They are *open-ended*, whether in answer or approach. There may be multiple answers or multiple approaches.

• They empower students to *unravel their misconceptions*.

• They not only *require the application of facts and procedures* but encourage students to *make connections and generalizations*.

• They are *accessible to all students* in their language and offer an entry point for all students.

• Their answers *lead students to wonder more about a topic* and to perhaps construct new questions themselves as they investigate this newly found interest.

How are good questions created?

- The mathematical goals of the lesson
- The misconceptions students may have
- The connections we’d like students to make between lessons goals and previously covered concepts and/or procedures
- Assessment of understanding

When presenting good questions, it is essential for teachers to:

♦ Understand the mathematics embedded in the question

♦ Present the question clearly using accessible mathematical language

♦ Set clear and reasonable expectations for the student work

♦ Allow for individual approaches, methods, and/or answers

♦ Add variety or more data to a question to ensure accessibility for all students

♦ Make good use of concrete materials

♦ Allow ample time for discovery and consolidation of answers, strategies, and the discovered mathematics

Bags of Marbles

To play this game at a math carnival, a player picks one marble from each bag. Bag 1 contains equal amounts of red, blue, and yellow marbles. Bag 2 contains equal amounts of red and blue marbles. If the colors of the marbles match, the player wins a prize.

What are the possible outcomes of the game? What are the chances that a player will win a prize? Is this a fair game? If not, how could you change the rules or the game so that it would be a fair game? Explain your thinking. What are the possible outcomes of your new game in support of your adjustment(s)?

Generic set of questions that may help guide and facilitate discussions of students’ answers:

• Why do you think that?

• How did you know to try that strategy?

• How do you know you have an answer?

• Will this work with every number? Every similar situation?

• When will this strategy not work? Can you give a counterexample?

• Who has a different strategy?

• How is your answer like or different from another student’s?

• Can you repeat your classmate’s ideas in your own words?

• Do you agree or disagree with your classmate’s idea? Why?


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Posing questions while completing the math task

Format: Peer Partners
Teacher role
Student role

Getting Started: Teacher and student read the math task independently.

- **Teacher**: Pose some questions to get the student to think critically about how to approach the math task. Keep track of the questions asked.

- **Student**: State your answers to the questions that were asked. Think about which question(s) helped you to foster clarity of the math task.

Analyzing Student Understanding: Student completes the math task independently.

- **Student**: Explain your work of the math task to the teacher.
- **Teacher**: Generate “new” questions for the student based on what you see in the student work and hear from the student to justify understanding and/or address misconceptions.
- **Student**: Answer the questions posed by the teacher and make edits to the student work if needed.

Reflecting on the Process: A conversation about the teaching and learning process.

- **Student**: Identify the question(s) that moved your thinking the most.
- **Teacher/Student**: Share insights and/or lessons learned from this learning experience.
What are some “new” questions you generated from working through the math task?
“The power of questioning is in the answering. As teachers, we not only need to ask good questions to get good answers but need to ask good questions to promote the thinking required to give good answers.”

# Outline of Session

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<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>12:15-12:20</td>
<td>Purpose/forecast of learning</td>
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<tr>
<td>12:20-12:30</td>
<td><strong>What are good questions?</strong> Chart/Share important points on transparency</td>
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<tr>
<td>12:30-12:35</td>
<td><strong>How are good questions created?</strong> Share transparency</td>
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<tr>
<td>12:35-12:37</td>
<td>When presenting good questions, it is essential for teachers to…(share transparency)</td>
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<tr>
<td>12:37-12:40</td>
<td>Introduce the math task</td>
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<td>12:40-12:45</td>
<td>What are some generic set of questions to help guide and facilitate discussion of students’ answers? <strong>Chart/Share</strong> transparency</td>
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<td>12:45-12:50</td>
<td>Review format of working with peer partner</td>
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<td>12:50-1:10</td>
<td>Working with peer partner</td>
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<td>1:10-1:18</td>
<td>Whole group discussion: What are some “new” questions you generated from working through the math task? <strong>Chart</strong></td>
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<td>1:18-1:20</td>
<td>Closing quote</td>
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