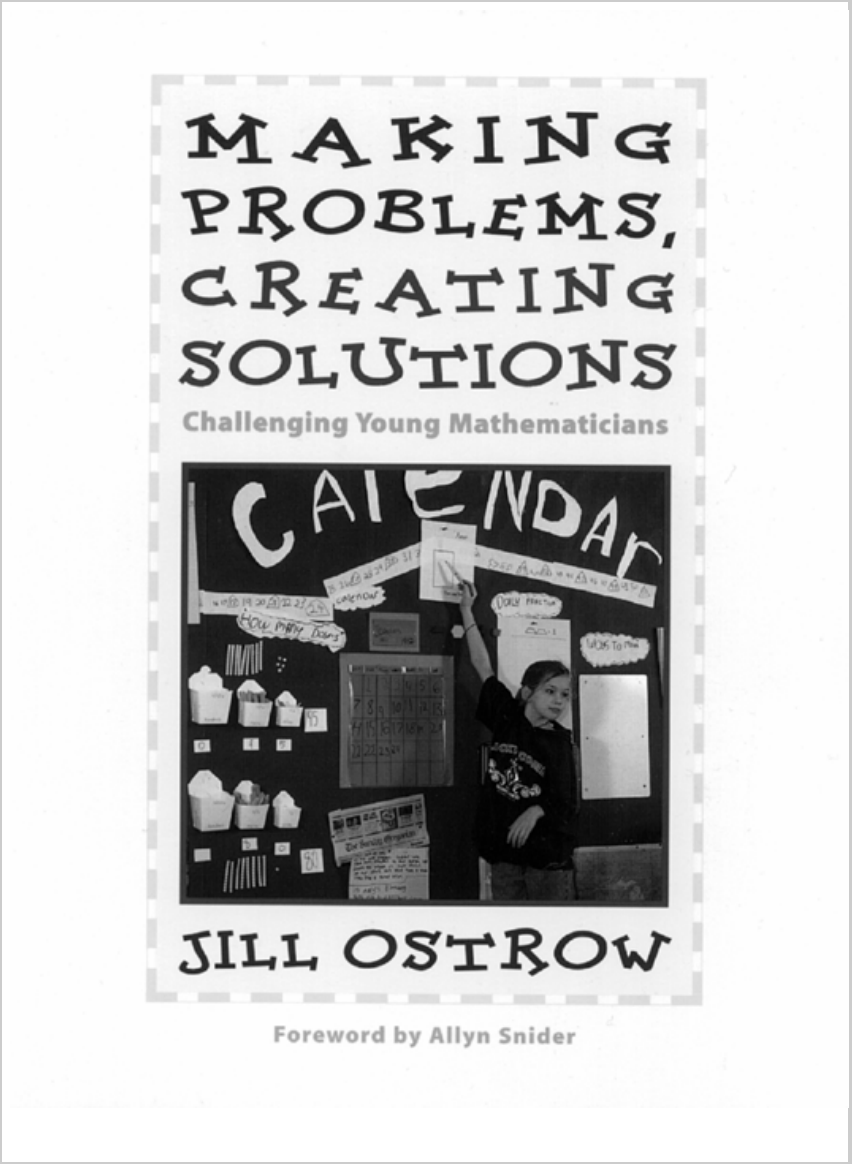
STUDY GUIDE



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STUDY GUIDE

Making Problems, Creating Solutions

Challenging Young Mathematicians

Jill Ostrow

This study guide is designed to help teachers discuss concepts from *Making Problems, Creating Solutions* by Jill Ostrow. The discussion questions and workshops place an emphasis on linking the book's ideas to NCTM and local standards. Workshops demonstrate how to connect quality children's literature, comprehension strategies, and math skill development. The guide includes a sample math problem, a bibliography of children's literature that is linked to math, and comprehension constructors.

Helpful Hints for All Group Discussions and Activities

1. If discussion stalls or digresses into a local issue or school problem unrelated to the book, you can refocus the group by introducing a key question or by having everyone consider one of the Quotes to Ponder.
2. You may want to rotate responsibility for leading whole-group or small-group discussions to ensure that everyone has a turn leading and invests equally in the group.

Part 1: Mathematicians in the Making

Key Questions for Group Discussion

How do you solve problems in your head? Think about your own thought process and contrast it with that of other teachers in your group.

How might you encourage your students to create their own ways to solve raw algorithms?

Workshop: Linking Math Problems and Standards

Distribute copies of Figure 1: Sample Math Problem. Have small groups work together to solve the problem. Designate one member of each group to serve as a recorder, noting how the group discussed and divided the work to complete the problem. Distribute copies of your state's math standards and/or the NCTM standards available at http://standards.nctm.org/ for each participant's grade level. Have everyone think about what standards are being practiced or met as they work collaboratively to solve the sample math problem.

Quotes to Ponder

> *Children work on editing and revising in order to get their writing ready to be read by an audience. Math is no different. If children don't have the opportunity to practice, make mistakes, create strategies, ask questions, and share, they are missing a huge part of becoming competent mathematicians. (p. 12)*

> *Even though I challenge my students, I don't rush them through understanding. If we try to rush mathematical understanding, we just end up confusing children. Why, then, are we still cramming the memorization of math facts down our young students' throats and asking them to know these before they understand what they are memorizing? (p. 14)*

Part 2: Active Practice

Key Questions for Group Discussion

What math activities could add to your daily calendar?

How could you incorporate a math workshop into your day?

Workshop: Evaluating Math-Related Children's Literature

Bring in an assortment of children's books that incorporate mathematical concepts. Or you could distribute copies of Figure 2: Bibliography of Children's Math Literature and have participants use it as a guide for bringing in books from their own classroom libraries. Distribute copies of Figure 3: Criteria for Evaluating Math-Related Literature. Have everyone evaluate the

books brought to the workshop using the criteria on this sheet. Afterward, have each participant share a book that meets the criteria and a book that does not.

Quotes to Ponder

I assume my classroom will be filled with busy workers who are free to move about the room. My learning workshops are not neat, quiet times; they are most often messy, and they are always filled with discussion and movement. (p. 60)

I don't track my students by putting them into ability groups. All the children work on the same problems and activities and do them at their own levels of understanding. (p. 87)

Part 3: Integrating It All

Key Questions for Group Discussion

Look at your district and state math curriculum guidelines. How can topics and ideas be integrated into other curricular areas?

Workshop: Designing Math Comprehension Think-Alouds

Provide copies of quality children's math literature (either books you bring in or books selected by participants from their classroom libraries using Figure 2: Bibliography of Children's Math Literature as a guide). Distribute copies of Figure 4: Designing a Math Comprehension Think-Aloud and some sticky notes. Have individuals read a math literature book silently, marking points they might make when sharing the book with their students. In small groups, have participants share their think-aloud notes.

Quotes to Ponder

Projects come from our classroom community: what we are studying and learning at that point in time. But, more important, they are ever-changing even as we work on them. (p. 111)

One of my favorite parts of all of these projects is watching the kids play . . . Having fun with what they are learning is an important part of a successful project experience. (p. 115)

Part 4: Show Me What You Know

Key Questions for Group Discussion

Bring in samples of student work. Look at the problems students have solved. What do their solutions tell you about them as mathematicians?

Workshop: Marking Thinking in Mathematical Text

Provide copies of quality children's math literature (either books you bring in or books selected by participants from their classroom libraries using Figure 2: Bibliography of Children's Math Literature as a guide). Distribute copies of Figure 5: How to Mark Text for Mathematical Comprehension and some sticky notes. Have each participant read a math literature book silently, marking the text using the "MC," "MS," and "TS" codes. In small groups, talk about what went well with the activity and how they might adapt it to the needs of their students.

Quotes to Ponder:

How do I know what my kids know and have learned if I don't give them math tests? I let them show me what they know and what they have learned. (p. 123)

The assessments I care about and share with parents is the progress my students are making over time, what they know, and how they know it. Parents view their children's work during conferences led by the child. I make it a point to educate the parents on authentic assessments we do in class. Then they too begin to know what to look for and how to take standardized tests with a grain of salt. (p. 135)

Figure 1

Sample Math Problem

1. Sam and Lisa each bought 16 sports cards.
2. One-fourth (1/4) of Sam's and Lisa's cards were football cards. One-fourth (1/4) were basketball cards. And one-half (2/4) were baseball cards.
3. Sam traded 1/2 of his football cards and three of his baseball cards. Lisa traded 1/4 of her basketball cards and five baseball cards.
4. Sam and Lisa put their remaining cards together. They decided to separate them by type in a box. They had football, basketball, and baseball cards in a box.
5. They looked in the book and discovered that their football cards were worth $4.75, their basketball cards were worth $3.05, and their baseball cards were worth $12.35.
6. They read that if they kept their baseball cards for 10 years the value of the cards would double. They figured out how much they would be worth in 20 years and in 30 years.
7. Now, they did get money for the cards they traded. Sam got $9.25. He used that money to get more cards, but he only wanted to spend 1/3 of that money.
8. He wanted to buy packs of cards. Each pack had seven new cards, and each pack cost $1.75.
9. The change, and the rest of the money from the $9.25, he put in the bank. He already had $47.96 in his account.
10. At his bank, for a savings account he gets 10 percent in interest every month. He kept the money in the bank for six months.

Now go back to step 7 and write problems about what Lisa did with her money.

Problem deals with NCTM Standards: 1, 2, 3, 4, 6, 7, 8, 11, 12

NCTM Standards:

1. Mathematics as Problem Solving
2. Mathematics as Communication
3. Mathematics as Reasoning
4. Mathematical Connections
5. Estimation
6. Number Sense and Numeration
7. Concepts of Whole Number Operations
8. Whole Number Computation
9. Geometry and Spatial Sense
10. Measurement
11. Statistics and Probability
12. Fractions and Decimals
13. Patterns and Relationships

Figure 2

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Figure 2 *(cont.)*

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Figure 3

Criteria for Evaluating Math-Related Literature

Invites Asking Questions

- ❑ Doesn't simply ask questions, but encourages curiosity and discovery.
- ❑ Has multiple layers of information.
- ❑ Has room for open-ended ideas.
- ❑ Encourages discussion.

Invites Making Connections

- ❑ Encourages reader to make connections with prior knowledge.
- ❑ Encourages reader to make mathematical connections.
- ❑ Encourages text, self, and world connections about more than just mathematical ideas.

Invites Making Inferences

- ❑ Gives room for prediction based on already read information.
- ❑ Is written in authentic mathematical language.

Invites the Reader to Learn Something New

- ❑ The book is not biased toward any culture, gender, or race.
- ❑ The book is natural and not contrived.
- ❑ The illustrations and text go together well.
- ❑ The book has a logical structure.
- ❑ The book demonstrates that math is authentic.

Figure 4

Designing a Math Comprehension Think-Aloud

Skim through the children's books provided. Select one that might be good to use as a think-aloud. Think about what parts of the text would be good stopping points, jot your thinking down on sticky notes, and place them next to the points they refer to in the text. Be explicit about the thought process you used to get the meaning you do.

Some words to use to share thinking are:

When I read _____ (read the words from the text), I am reminded of _____ (share the connection).

Good readers connect new knowledge to known information.

When I read _____ (words from text), I wonder _____ (share question)?

Good readers ask questions when they read in order to help themselves make inferences.

I am confused when I read _____ (share the words that cause confusion). I am going to _____ (share the fix-up strategy you will use to clear confusion) to get unstuck.

Good readers recognize confusion and know how to repair meaning when confusion sets in.

I notice when I read this piece it is organized _____ (share what you notice about the organization). I am going to use _____ (point out text structure that facilitates the reader) to help me understand the text.

Good readers look for organizational patterns in the text. It helps them to predict.

Adapted from *I Read It, but I Don't Get It* by Cris Tovani

Figure 5

How to Mark Text for Mathematical Comprehension

1. Before students begin to read, assign a code to the type of thinking in which you would like students to engage. As they read, their purpose is to consciously mark the text with the assigned thinking strategy. For example, if teachers want students to make connections between the text and their existing background knowledge they could assign the code MC to stand for Mathematical Concept. Next to the code, the student records what his connection is, starting with the words, "This reminds me of . . ."

2. It is important that teachers model the thinking strategy they'd like to see students use. This is easily done through a Think-Aloud. I recommend marking on a transparency and thinking out loud the mental process I want students to use. If I am teaching students how to use the code BK, I model my connection between the text and my background knowledge. Precise explanation of the connection will help students see how meaning is enhanced through the use of background knowledge.

   At first students may claim they don't have any connections. Awareness of the different strategies makes it easier to apply them when meaning is breaking down. Help readers first become aware of their thinking before asking them to actually do it. Many times students are not interacting with the text because they need to be taught how to do it. Continue modeling. With practice, students quickly learn how to make connections, ask questions and highlight confusions. Marking text encourages awareness so readers can become more responsible for making their own meaning.

3. Provide opportunities to mark text with accessible pieces. Select something that is within reach. If the text is too hard, students won't be able to practice the strategy. As students read, they code the material and record their thoughts. Make sure students mark the text with not only the code but also words that describe their thinking. Encourage all serious attempts. This is an excellent opportunity for assessment as teachers can observe the invisible mental processes taking place inside their students' heads.

Codes you might try with mathematical text include:

MC Math Concept. Denotes connections the reader makes between a math concept and the text. Written responses can begin with, "I make the connection . . ."

MS Math Strategy. Denotes connections the reader makes between their own problem-solving skills and the way a problem is solved in the text.

Figure 5 *(cont.)*

Written responses can begin with, "If I was trying to solve this problem, I would . . ."

TS Text-to-Self. Denotes connections the reader makes between personal experience and the text. Written responses can begin with, "This reminds me of . . ."

I Inference. Denotes an inference or a conclusion the reader draws from the text. Written responses can begin with, "I think . . ."

? Question. Denotes questions the reader has about the text. Written responses can begin with, "I wonder . . ."

Adapted from *I Read It, but I Don't Get It* by Cris Tovani