Three Reads Using a Problem Stem

Focusing on The 8 Standards for Mathematical Practice

Definitions:

***Problem Stem*:** the situation for a math word problem without the question.

Three Reads: reading the situation/problem three times, each time with a particular focus

Student-to-Student Discourse:

- ✓ Comprehending the text (context)
- ✓ Comprehending the mathematical structure of the situation
- ✓ Listing all the possible mathematical questions

Background Information:

Receptive Language Functions:

What we know about receptive language functions when teaching mathematics:

Receptive language is the understanding of language "input." This includes the understanding of both words and gestures. Receptive language goes beyond just vocabulary skills, but also the ability to interpret a question as a question, the understanding of concepts like "on," or accurately interpreting complex grammatical forms (i.e. understanding that the phrase "The boy was kicked by the girl" means that a girl did the kicking).

Word Problem Misconceptions:

What we know about students' misconceptions when solving mathematical word problems:

Students struggle with reading and restating the problems in their own words, limiting their comprehension of what the word problem is about. They struggle with identifying the correct operation because of this lack of context of the story. They do not know to try to visualize a structure or the patterns in the problem. When a problem is complex they struggle with breaking it down into logical steps or sequences. Often they do not know or apply strategies correctly and asking them to make conjectures about the problem is difficult. They think finishing first is important and often do not attempt to justify their thinking.

The Three Reads Problem Solving Routine:

Read the problem stem three times, each time asking a different question:

First Read: What is this situation about?

Second Read: What are the quantities in this situation?

Third Read: What are all the possible mathematical questions we could ask of this situation? Draw a diagram of the problem.

Debrief each question with student-to-student discourse.

A SAMPLE "THREE READS" LESSON:

Beginning the lesson:

"Today we are going to work together on making sense of a mathematical problem. Sometimes these are called word or story problems. Just like when we read stories in books we have to comprehend what the story is about. We will read it three times because good readers re-read stories to make sense of them. Each time I am going to ask you to discuss and respond to a specific question. The first time you will have to listen very carefully because I am going to read it out loud to you. You won't have it in front of you."

FIRST READ: (focus: comprehending the text)
"Listen carefully. What I would like you to listen for is:

What is this situation about? MP1

(NOTE: focus on the context only, not the mathematics/numbers, not the answer; just the context. Do you understand the words that describe this situation?)

Read out loud a problem stem, a word problem without the question.

"Martin, Maria, and Leona downloaded songs from iTunes. Martin downloaded 45 more songs than Maria. Maria downloaded 15 more songs than Leona. Together they downloaded 300 songs."

Discuss: encourage student-to-student discourse as they make sense of the problem MP1 and reason abstractly MP2. The teacher might ask: How would you describe the problem in your own words? What is the context of the story? Can someone tell the story using different words?

SECOND READ: (focus: comprehending the mathematics)
"Here is the situation in the story. Good readers also listen for important details and think about their prior learning and background experiences." ***(display the story for all to see on document camera/chart etc).***
_____(teacher/ student) will read it aloud for us to think about. What mathematicians listen for is the important information in the situation. What I mean by that is the quantities (numbers and their units and their relationships. Mathematicians look for explicit quantities (e.g., 64 inches) and implicit quantities (e.g. John's height). Always look for both! Sometimes they are not numbers!

"What are the quantities in this situation? How are those quantities related?" MP2

Discuss: encourage student-to-student discourse. Make a class list of possible questions. Discuss weather or not the information (contextual, mathematical, explicit or implicit) could help them answer their questions. The teacher might ask: What do you notice about the quantities? MP6 Are their any patterns or relationships? MP 7

THIRD READ: (focus: listing all possible mathematical questions)
"_____(teacher/student) will read the situation for us one more time. This time mathematicians stop to think about all the possible questions we could ask of this situation/problem. Not what the people in the situation are wearing/doing, but questions about the quantities and their relationships."

What are all the possible mathematical questions we could ask of this situation? MP1

Discuss: encouraging student-to-student discourse.

WORKING ON THE PROBLEM:

"Here is a copy of the problem for you to put in your math journals".
(have problem run on mailing labels or cut into strips to be glued into journals.)

"Martin, Maria, and Leona downloaded songs from iTunes. Martin downloaded 45 more songs than Maria. Maria downloaded 15 more songs than Leona. Together they downloaded 300 songs."

Begin by drawing a diagram to help you work toward solving the problem that represents the quantities in the problem and to show how they are related.
Use your diagram to solve the problem. MP4

Discuss/Teacher-to-student Discourse: Compare and contrast different ways of thinking. (This is Mathematician _____'s diagram. Who can explain _____'s way of thinking? MP 3
How is her way of thinking similar/different to yours?) MP2;
Share two or three diagrams (How are these diagrams the same?
How are they different?);
Choose which two or three diagrams to discuss deeply (select & sequence diagrams from less sophisticated to more sophisticated); ask students to evaluate the diagrams in small groups MP3

Choose a question that you are interested in answering from our bank of questions about the situation?
Persevere and answer another question.
Justify your solution using words, numbers and/or pictures.
Can you prove that your solution is correct?
Are there other questions on our list that you can answer?

Possible Teacher Coaching Prompts:

Which diagram shows the relationships among the quantities in a clear manner?
Which diagram would help you the most to solve the problem? Why?);
Make connections from one diagram to the next (_____showed the total downloads here.
Where do you see Maria's downloads in _____diagram?).

Some other possible questions to prompt discussion/discourse about student shared diagrams:

"How does _____'s diagram show…"(name a specific quantity and /or relationship). MP2 and MP3

"Where is…"(Name a specific quantity and /or relationship in this diagram?) MP2 and MP4

"Do you see any new relationships in this diagram?...one that wasn't explicitly given in the problem statement" MP8 (ex: in music downloads, the amount of songs downloaded by Martin is dependent on the amount that Leona and Maria downloaded) Are there any tools in our classroom that would help us represent the situation? MP5

The purpose of this discussion/discourse is to scaffold every student's thinking to understanding the problem, think about various ways to begin to work toward a solution, and find a solution, as well as, give those students who are ready, opportunities to stretch their thinking and deepen their understanding.

At this point the students would work on the problem independently and continue practicing CCSS content standards at their math center activities/Work Places. Meanwhile the teacher works with another guided math group, and the first group would be called back in a day or two to look at possible solutions and strategies with the teacher. This scaffolding of the problem solving process using the CCSS 8 Mathematical Practices in guided math groups supports autonomous learning among all students while they are engaged in independent work, homework, and math center activities/Work Places.

Adapted from Grace Kelemanik's *Three Read Strategy*;
Mov*ing Beyond Answer-getting* http://math.serpmedia.org/tools_problems.html
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