Story Problem Days during Math Workshop

Story problems are used often in math because students find having numbers in context more intriguing than just the "naked" computations. However, choosing the learning goal for a "story problem day" takes thought and practice.

Here are three common foci for story problem days and suggestions for the mini-lessons and closure that would go with each one.

Learning Goal 1: Introducing New Problem Types

Here the learning goal for the day is to help students understand a new type of problem. The tables on pages 88 & 89 of the CCSS combined with the OA Progressions document describe and give examples of the types of contexts we should use at each grade level. When we introduce a new type of context, it often means helping students to understand specific mathematical vocabulary or to visualize what is happening in the story.

Before Phase / Mini-lesson (2-7 minutes):

- One or two context/problem only
- Acted out with students and lifelike/realistic objects if possible
- Purposeful attention to language (for example, "he got 'some' more," "she had 'some'," "groups of," "rows of" and how we picture "some" as just a group without knowing the quantity or that "groups of" means that each group has that quantity.
- Purposefully identifying the unknown quantity without calculating it

During Phase / Problem solving (30-45 minutes)

- Students solve only the one or two problems introduced in the mini-lesson
    - Finding the "number" answer for the unknown and being able to share how that was done using physical models (manipulatives)
    - If possible making a pictorial recording of what was modeled with the physical models
    - Depending on the grade level and time of year, a written explanation of how the problem was solved (this would be "how to" genre writing)
- Teachers are collecting data
    - formative assessment data as they listen to students tell about what they are doing and why they are doing it (on the grading spreadsheets).
    - which two or three strategies would be best to show to the whole class and in which order

After Phase / Closure (15-20 minutes)

- Sharing the problem solving strategies and representations
- Teachers may have to be the recorder as students share so that a possible pictorial representation is shown.
- The teacher asks specific questions about connections to the story context: What did you do for this part of the story? Why did you do that? What does is tell us? Who did the problem in a way similar to _____?
- Often at this stage there is little emphasis on the symbolic / equation

Sometimes there is time for two rounds of this in one 60 minute workshop. Only one story problem is introduced during the first mini-lesson. Then the process is repeated so that students can use the same strategy or someone else's for the second similar problem.

Learning Goal 2: Symbolic Representations for "New" Problem Types

Here the learning goal is to help students connect the actions in the problem to a mathematical operation. In grades other than kindergarten where the "+" and "-" symbol are first introduced and connected to actions, these lessons expand the depth of students' knowledge about the four basic operations. Thus, in all but kindergarten where the students are just told, "we show joining with a +" and grade three where they are told the meanings of "x" and "÷," we follow the standards and connect their previous knowledge to the new knowledge.

Before Phase / Mini-lesson (3-7 minutes)

- Simple story problems to revisit how we show action in the pictorial representations (arrows, crossing out, lines connecting matching items) and how those actions connect with the equation and with the words in the story problem, OR
- Simple story problems to revisit the types of symbols appropriate for unknowns in the equations, OR Later…
- A sample justification to critique

During Phase / Problem Solving (30-45 minutes)

- All students start with the same two problems which differ in problem type (one a familiar type for which most are comfortable writing equations, the second the related problem type for which you are learning about the equation most likely means having the unknown in another place or another meaning for the operation such as the comparison problems). Additional problems of each type are available to work on as students finish the first two.
- Student work includes pictorial representations with action indicated and an equation with a symbol for the unknown. (Depending on the difficulty of problems, the grade level of your students, and size of numbers in the problems, your students may use physical models before making pictures.)
- Depending on the grade level and time of year a written justification of the operation symbol in the equation connecting the words from the problem with the actions in the picture to the +, - , x, or ÷ in the equation. (For example, "The problem said she "spent" money which means it went away so I crossed it out in the picture and used a minus in the equation.") (This would be "persuasive" genre writing.)
- Teachers are collecting data
    - formative assessment data as they listen to students tell about what they are doing and why they are doing it.
    - All the equations that have been associated with each of the first two problems and decide which ones to share

After Phase / Closure (15-20 minutes)

- At most two pictorial representations and the related equations for each problem will likely be shared.
- Teachers should prompt students for the justifications of the equations: How did you know which operation symbol? What is the label (unit) for each number in the equation? Where did you put the unknown? Why?
- After the equations for the two problems are available, teachers should ask compare/contrast questions: How are they the same? How are they different? Why?

Learning Goal 3: Computation Strategies

Here the learning goal is to help students move to more and more efficient and flexible computation strategies as well as develop deep number sense. In this case the problem contexts are relatively straight forward, single step addition, subtraction, multiplication or division. The contexts give students parameters for making judgments about whether or not their answers are reasonable. In these cases the pictorial representation is de-emphasized because it is quite obvious to students what the operation should be.

Before Phase / Mini-lesson (3-7 minutes)

- Think alouds concerning which tools are appropriate (if any) for the size numbers in the problems, OR
- Collecting estimation strategies for a "naked number" problem of similar magnitude to that of the problems the students will be solving, (for example, for the problem 47 – 29 the teacher might ask, "Would the answer to this be more than 10? How do you know? Less than 30? How do you know? About what do you think the answer would be? Why?), OR
- Collecting estimates for the magnitude, or size, of the answer for the first problem they are about to do.

During Phase / Problem Solving (30-45 minutes)

- All students start with the same two problems which require the same types of computation. Additional problems of a variety of types are available to work on as students finish the first two.
- Student work focuses on recording the steps in the computation. Pictorial representations are de-emphasized.
- Depending on the grade level, one of two types of math writing may be emphasized:
    - a written justification for the reasonableness of the results of the answers for the first two problems. (For example, I know my answer is reasonable because if I estimate by doing…. My answer should be a bit larger than that and it is.) (This would be "persuasive" genre writing)
    - A written explanation/justification of the computation steps with "because" statements that use place value and properties language / vocab. (For example, "First I added 4 hundreds and 2 hundreds together , then when I added 5 tens and 6 tens I knew I had another hundred and a ten…")
- Teachers are collecting data
    - formative assessment data as they listen to students tell about what they are doing and why they are doing it.
    - Two or three computation strategies to show (ordered from least to most sophisticated)

After Phase / Closure (15-20 minutes)

- Students share computation strategies with visuals and/or place value language justifications
- Teachers prompt as necessary for clarification
- Teachers may have to be the recorder as students share so that a written record of the steps can be developed in an organized way that students can follow.

Sometimes there is time for two rounds of this in one 60 minute workshop.

- A second mini-lesson may or may not be used. If no mini-lesson is used, the process is repeated so that students can use the same strategy or someone else's for the second similar problem.
- If a mini-lesson is used, it is to have the whole group practice someone's strategy together and then let them try it with a new problem. Share pros and cons of this "new" strategy, easy parts and hard parts, parts understood and not understood during the last closure.