Focus on Student Practice

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Do your students get bored if they are required to spend too much time on a problem? Do they balk when you ask them to explain their thinking? Is their primary goal to finish quickly rather than being thorough and reflective?

As the Common Core State Standards (CCSS) for Mathematical Practice are implemented it may be challenging to have our students “Make sense of problems and persevere in solving them.”

With a goal for our students to develop these practices, we may need to reflect on our own practice as teachers and, if necessary, revise our practices to encourage and support our students’ practice.

What does it mean to have our students “Make sense of problems…”?

In a classroom where the teacher shows how to do the problem and the students practice what is shown to them, it is the teacher who is making sense of the problem and not the students. If students are to be the ones doing the sense-making then we have to encourage their active participation. When we do that, we have to step back and give our students space and time to think about the problem-solving situations and the mathematics.

Recently I was a guest of Joseph Reo in his 5th grade classroom at Universal Bluford Charter School. I chose this problem to present to his students:

**Wooden Legs**

Wendy builds wooden dollhouse furniture. She uses the same kind of legs to make 3-legged stools and 4-legged tables. She has a supply of 31 legs and wants to use them all to make stools and tables. Find all the possible ways she can use all 31 legs. Explain how you solved the problem and how you know you have found all solutions.

Continued on page 18 ➢ ➢
Because I wanted the students to make sense of the problem, I did not hand it out or display it, but I told them I was going to read them a story. I read only the following:

**Wooden Legs**
Wendy builds wooden dollhouse furniture. She uses the same kind of legs to make 3-legged stools and 4-legged tables. She has a supply of 31 legs and wants to use them all to make stools and tables.

Then I stopped and asked the students, “What did you hear?” Some of their responses were:
- ✔ wooden
- ✔ legs
- ✔ 31
- ✔ she built dollhouse furniture
- ✔ she has a full supply of 32 legs
- ✔ 3-legged chairs and 4-legged stools

When they offered these details, I did not react to indicate if I thought they were right or wrong. Instead, I listened and invited more comments. Very importantly, I did not repeat any of their comments but just encouraged the students to speak and others (including me) to listen.

*Tip: When you have a whole class discussion, try not to repeat anything a student says. Not only does this help with time management but it also allows the students’ voices to be valued.*

Once it seemed that we had heard from everyone who wanted to contribute, I told the students to think about what they “thought” they had heard. I read the story a second time and asked if they wanted to confirm things or possibly change or add something now that they had listened again.

More students raised hands than in the first round and I could see and hear the students working to make sense of the story.

Next I asked if they could say the story in their own words. After a few students responded I asked them if there were any 3-legged stools in the room or 4-legged tables. From their responses I could hear connections being made and I was becoming convinced that they had enough ideas about what was taking place in the story that we could continue to the next part.

I said, “Now that we’ve thought about what’s happening in this story, what could a question be?” Some of their responses were:
- ✔ How many legs are there total?
- ✔ Why does she use the same legs?
- ✔ If Wendy had 31 legs and she used 7 of them to make a 3-legged stool and a 4-legged table, how many legs would she have left?

At that point I displayed the full problem with the additional information and the question. Some students were immediately ready to share ideas with the full class. I told them to hold on to those thoughts because we were now shifting gears to work in groups to solve it.

*Tip: Sometimes when I present a scenario (a problem with the question removed) students think of the exact question from the problem and/or a question that is just as or more mathematically intriguing. If that is the case, I may choose not to reveal the original problem with its question but instead use what the students wondered. I honor their sense making!*

Mr. Reo and I offered manipulatives (toothpicks, straws, or plastic rods) to any groups who wanted to use them to think about the legs in the problem. All of the groups chose to use manipulatives and were quickly engaged in thinking about how to use all 31 legs to create combinations of 3-legged stools and 4-legged tables.

**How Does It Look?**
When students are engaged in making sense of the problem, they are talking! Whether students are involved in a whole class discussion or working in pairs or groups, the main role of
the teacher is to listen and to encourage students to talk and to listen. At first the students are talking to the teacher but, with time and practice, they will be talking with each other.

Tip: A teacher will not be able to hear everything each student says. That is okay! And, in fact, embracing that idea is the only way to logistically maximize opportunities for students to each be able to make sense of problems.

In the case of the Wooden Legs problem, having manipulatives gave students a very helpful prop that they could use as they talked about the combinations of threes and fours. Mr. Reo was happy to see that every group of students was completely engaged. We heard no sounds of boredom or “I don’t get this” or other complaints.

How Does It Sound?
We might hear the teacher say:

✔ How do you know?
✔ Can you tell me more?
✔ What did you do?
✔ Do you agree?
✔ How does that make sense?
✔ Why do that?
✔ Why did she say that?

If we only have to focus on one person’s practice (our own as the teacher) we have a much easier control job than if we have to focus on each student’s practice! This change requires a major shift in our classroom environment.

Tip: Ultimately our goal is to have students asking these questions of each other!

What Does “...Persevere in Solving Them” Mean?
The second half of the Mathematical Practice “... and persevere in solving them” may also require a shift from the teacher demanding that students persevere (or suffer the consequences) to where the students have a “practice” of persevering because they are involved in problem solving as a process. Students who

✔ engage in a problem over time,
✔ talk about their ideas,
✔ use a variety of representations,
✔ write their ideas and receive feedback,
✔ reflect on their ideas and revise,
✔ and more. . .

are practicing perseverance!

The day I visited the fifth grade students to introduce the Wooden Legs problem I was also introducing them to the Math Forum’s online Problems of the Week site. I had made individualized login instructions and our plan was that I would show a few students how to get started entering their solutions and explanations to the problem on the computer. In turn, on subsequent days other students would use group work time to enter their solutions. The students I had worked with would assist with any technical instructions if their classmates needed help.

Before leaving the classroom that morning I explained to the students that I would be giving them feedback on what they submitted online and my expectation was that once they read my feedback they would reflect and revise.

Tip: As a guest in Mr. Reo’s class I did a lot of things in the 60 minutes that he scheduled for me. I modeled the introduction of a problem to show how students can be encouraged to make sense of it. I engaged the students in a group work activity to solve the problem using manipulatives. I introduced the online Problems of the Week functionality designed to encourage students to communicate, receive feedback, reflect, and revise (ideally several times). A teacher supporting his/her students to “make sense of problems and persevere in solving them” might break these activities up over several days.

After my visit, Joseph and I have been in e-mail contact and I have continued to provide feedback to his students online. Not surprisingly, putting their ideas into words and typing them for me to read is very challenging. Perseverance will definitely play a role in the work we have ahead of us.

I chose the first practice—Make sense of problems and persevere in solving them—as

Continued on page 20 ➢ ➢
the focus of this article because for me it is key to have the students make sense and persevere before being able to address the remaining seven practices.

Establishing expectations, believing in our students, and helping them learn the routines to complete the process of problem solving is our role as we help our students develop the Standards for Mathematical Practice.

Related Links at the Math Forum Web Site


Think You Don’t Have Time to Use the PoWs? <http://mathforum.org/pow/teacher/PoWsDontHaveTime.pdf>.

