Experimenting with Making Student Thinking Visible

Grade 1 Mathematics
Alyssa Ricken, Eugene, Oregon Public Schools

I have been experimenting in my first grade class with making student thinking visible in all subject areas, but have found myself able to be more successful with it when teaching math. The math program that the district has adopted has this built into the dialogue and lessons on a daily basis.

Students are working on counting numbers 1-20 and being able to represent that number with pictures or objects. In this review activity, students were asked to show a representation of the number 20 in more than one way (pictures, numbers, tally marks, etc.). Students were asked to come up and share their drawings/work if willing. Several opted to share and most accurately represented the number 20 and were able to explain it to the class. I then encouraged many conversations between students about their process. The following example of one of those conversations raised questions for me.

Teacher: “Student 1, would you like to come up and share your representation of 20?”

Student 1 came up. He put his paper down and stated that he showed 20 by drawing circles and writing the numbers above the object. As he began pointing and counting the objects, he realized he’d done something that wasn’t quite right. He finished counting on the number 21. All of the numbers were present but he had recorded the number 13 twice. While he was counting, he was so into pointing to the numbers that he was unaware of saying 13 twice. When he ended up with 21 objects instead of 20 he was puzzled.

He seemed stuck; several hands went up to help explain what they noticed. First, I gave him an opportunity to explain what he thought he did and what he could fix. When he had no response, I encouraged him to call on another student. I could tell that he was feeling very sensitive and was having a difficult time moving past this moment.

He called on Student 2.

Student 2: “I noticed you had a number twice.”
Teacher: “Student 1, what do you think? Do you notice what Student 2 is saying?”
Student 1: (No response—visibly upset.)
Teacher: “This is a great learning opportunity. Thanks so much Student 1 for sharing your work. Let’s see if we can learn together more about what happened and fix it. You have the right process, now we have to adjust your work to match what you thought you did. Does anyone want to help Student 1 by explaining how he could change the representation?”

Student 3: “I noticed you have two number 13s. You could erase the second 13 and all the numbers after.”
Teacher: “What do you think Student 4? Would that help Student 1?”
Student 4: “Yes—then Student 1 could write new numbers.”
Teacher: “Student 1, why don’t you try that?” (The representations were done on dry erase boards so this was easy to do. The student still seemed fragile so I went and stood next to him. I asked another question as follows.)

Teacher: “Class, how can we help Student 1 reconstruct these numbers?”
Class: “We could count!”
Student 5: “And Student 1 could write.”

We counted, he recorded the numerals, and the dialogue continued. Student 1 quickly fixed his original work by erasing the 21st object and numeral. I had him explain this quick change and the kids were in agreement that it was correct.

The lesson continued and this child seemed fine, but there were moments during this exchange when I questioned what I was doing. I felt bad about his sensitivity (near tears). I tell my class from day one, “Questions are a sign of intelligence,” a motto I adopted from my own fifth grade teacher. I explain that sometimes we have to question why or how we came up with an answer to better understand it and help others understand it too. I stress that it’s okay not to have all the answers, but by asking questions and watching/listening to others we have more of an opportunity to learn. But even in an encouraging environment some kids can be more sensitive than others when observing their own mistakes and making changes.

So my question is: How far do you push it? Did I handle it okay? What should a teacher do when a student seems sensitive and vulnerable? How far should we push without feeling as if we need to “save” the child? In the past I would have been quicker to move on to a new student to save the one struggling, but in this case I worked through it, hoping that the student would learn and be comfortable with the process. I also hoped that this student would be willing to share again, whether or not his answer was correct, and I wanted others to gain through this experience that what’s important is not necessarily to have the right answer, but rather to understand their own thinking. It’s about the process. I want these experiences to encourage all students to be willing to share their thinking, whether they volunteer to answer or are all called upon in future lessons. I don’t want them to worry simply about being wrong or right.

Questions:
1. Which of the operating principles are evident in how Ms. Ricken facilitated this interaction among students? Underline the evidence and label each.
2. How would you respond to the questions she poses in the last paragraph? Write a brief (two to three-sentence) response reflective of ideas raised in this course.
Experimenting with Making Student Thinking Visible

Grade 2 Mathematics
Annette Corbeau, Eugene, Oregon Public Schools

The challenge to make my students thinking more visible was one I looked forward to. I feel that our math program, *Investigations*, encourages students to show their thinking and helps students to realize that there may be more than one solution to any given problem. However, the discussion piece of *Investigations* has always been my weakness. I often feel that I don’t have sufficient time to really allow my students to express their thinking.

The lesson I chose was the first story problem lesson from second grade *Investigations*. Up to this point in the year, students had been exploring manipulatives, finding ways to make 10, and playing games to practice their math facts. This math lesson introduces them to story problems, beginning with an addition problem. The goal of the lesson is for students to visualize and represent addition, as well as to solve the problem.

I introduced the lesson by having students join me in the carpet area. I explained that I was going to tell them a story, and that I would ask them a question at the end. Instead of answering the question, I asked that they draw a picture on their white board that showed how they would find the answer. I then read the story: “Fifteen children are playing on the playground. Twelve more children come to play. How many children are on the playground now?”

I asked the class not to talk for two minutes while everyone did their thinking and drawing. I was surprised at how busy they all were with the task. After two minutes, I asked them to give me a thumbs up if they had an answer they were happy with. All but two of the students indicated that they were ready.

I asked one student (Student A) to stand up and tell the class how she had solved the problem, and reminded the rest of the class to be respectful listeners (empty hands, still bodies, voices off) while she spoke. She showed her work, which included making 15 tally marks in one row and 12 more in another. She explained to the class, “I made 15 marks for the kids that were on the playground. And then I made 12 more for the kids that came later. And then I counted them all up and that was 27.”

What was interesting to me was that as soon as Student A finished speaking, several children in the class quickly erased their work and made tally marks. These were kids who had arrived at the same answer, but in a different way!

I thanked Student A and asked if anyone had solved the problem the same way. Several children raised their hands. I then asked if anyone had solved it a different way. Kids glanced around at each other, and Student B hesitantly raised his hand. I asked him to stand up and share, and had the rest of the class turn to face him. He showed his board which had $2+5=7$, 27 written on it, and explained his thinking as follows: “2 and 5 makes 7... and then I took the 10 and the 10 and made 20. So it’s 27.” Seeing the confused looks on several children’s faces, I asked Student B where he found the two 10s. He answered that he knew that 15 was 10 and 5, and that 12 was 10 and 2. I asked if anyone else had solved the problem this way, and one other student raised his hand.
I continued to ask for different ways to solve the same problem. We ended up with seven different strategies that we made into a poster for the classroom. We named the strategies (counting all, counting on, using math facts, etc.). I told the class that now they had the chance to do a story problem in their books that was similar to the story I had just told them. I showed them the page in the book and reminded them that they needed to show their thinking at the bottom of the page. I reminded them that they could refer to the poster if they needed help getting started.

Students returned to their seats and I couldn’t believe how quiet they were as they worked on their next math problem. After several minutes we had a “gallery walk”. Students left their math work on their desks for others to see, and took three minutes to walk around the room. Their task was to find one person who had solved the problem the same way they had, and one person who had used a different strategy.

At the end of the gallery walk, the children complimented each other on interesting strategies. They noticed how easy it was to understand some people’s work, and how they could now see the point of putting a box around their answer. The interesting thing to me was that they made these observations without prompting by me.

This was a great lesson for me. I came out of it feeling like I had really hit my target both mathematically and in nurturing our “mathematics community.” I noticed several students who typically tune out come back to the discussion after Student B gave his answer. These kids worked harder on solving the problem than they have worked on anything else this year. I made a point of returning to them after the gallery walk. They were all so proud that they had found another student using the same strategy they had used.

Hearing the different strategies used by students also gave me some insight into which students were ready for more streamlined strategies and which needed re-teaching with “counting all” or “counting on”.

It was encouraging for me to see how well students responded to the opportunity to share their thinking. Giving many students the chance to share, rather than just one or two, ended up including far more children than just the six who contribute in discussions. The majority of the class felt validated by hearing and seeing someone share their same strategy. They were far more motivated when they returned to their seats to solve the next problem on their own.

Since teaching this lesson, I have made much better use of the discussion portion of the Investigations lessons. Having done this experiment, and witnessing the level of student engagement, perseverance, and pride showed me that it was well worth taking the extra minutes to allow students to explain their own thinking in front of the class. The awareness that there is more than one way to solve a problem, and more than one way to explain your thinking was a big “A-ha” moment for my students. They now often request gallery walks during our learning, not only during math, but during art, writing, etc.

Question:
As you think about operating principles for making student thinking visible and the classroom climate and conditions that support it, what is significant to you about what is described in this experiment? Be specific and explain why.
Experimenting with Making Student Thinking Visible

Grade 6 Language Arts
Elizabeth Nordling, Eugene, Oregon Public Schools

My sixth grade Language Arts class was reading *The Greyling* by Jane Yolen as an introductory story to our unit on parts of a story. After reading the story as a class, I asked students to discuss in table groups what they thought the theme of the story was and to explain their thinking by locating evidence in the story to support their ideas. My goal was to have them make their thinking visible within the table groups in preparation for making their thinking visible in the whole group setting. When we came together in the whole group, I encouraged students to share possible themes discussed in their groups and alerted the class to be prepared to agree or disagree based on evidence from the story.

Here is a dialogue sample of the whole-class discussion:

**Student A:** “I think the theme is ‘if you love something, you have to let it go’. They loved their son, but he wanted to go out to sea because he was really a selchie (seal who takes on human form). They had to let him go.”

**Teacher:** “Who agrees, disagrees or wants to add to (Student D’s) theme?”

**Student B:** “Also, Greyling comes back to visit, so I think it is, ‘if you love something you have to let it go’, and if it comes back then it loves you back.”

**Teacher:** “Anyone else?” *Wait time, with no hands going up.* “Can anyone take this a step further and relate what is happening here to an actual experience with your parents?” *After one minute of no hands going up, someone has an idea.*

**Student C:** “It is just like going off to college! Your parents have to let you go live your own life, just like Greyling had to go live his own life in the sea.”

**Teacher:** “And?” *Now a lot of hands are in the air.*

**Student D:** “He comes back to visit. Just like we will come back to visit our parents.”

The portion of the all class discussion that I shared highlights some aspects of making thinking visible that I think I am good at and some that I am struggling with. I often ask, “Why?” I tell students from the very first day of class that I will always expect them to explain their answers, and to expect me to ask them, “Why?” all the time. I ask students to agree or disagree and explain why to get them thinking and listening to their classmates’ ideas. I also ask them to comment on or add to a classmate’s ideas. I used wait time well in this example, but it is definitely something that I struggle with. I am always in a hurry to move on to the next thing. On this day, the class discussion basically ended where I left off in the sample above. Once the students figured out the answer I was looking for, I moved on to the next thing instead of dwelling on the thought process. Why continue thinking when I am clearly pleased with the answer a classmate already gave? I am learning that this style of constant questions and thinking out loud is not only something that I as a teacher will need to practice and work on, but also something that students need to practice. They look at class discussion as a place to share the correct answer, not as a place to discover and build the many possible answers. I need to work on a culture of trust in my classroom where students are willing put their ideas and themselves out on a limb without the fear of being wrong. Class discussion needs to be altered from a place to share answers, to a sounding board of thinking to create answers.
Questions:
1. List the operating principles Ms. Nordling highlights as those that are already embedded in her practice and underscore where she references them in the text.
2. She highlights several challenges or obstacles she is aware of that she’d like to focus on and overcome. Imagine that you are her coach and she is looking to you for suggestions. Reflecting on all that we have explored in the course so far, what specific operating principles or classroom conditions might you suggest she try next in an effort to expand her capacity and that of her students?
Experimenting with Making Student Thinking Visible

High School Chemistry
Carol Standefer, Eugene, Oregon Public Schools

This experiment in making thinking visible centered around a lesson on the atom in my Chemistry classes. Prior to this activity, the students had been introduced to the evolution of atomic theory and the structure of the atom based on current theory. The activity involved students working in groups of four to complete a review packet about atoms and isotopes. To create positive interdependence within the group and promote students explaining their thinking to one another, I announced to students that I would randomly collect one packet from each group as representative of the whole group’s completion of the assignment (therefore credit for their in-class work); therefore, they needed to be in agreement on the answers and conclusions. The packet included a variety of activities from fill-in-the-blank answers, to drawings, to calculations, and finally to drawing complex comparisons.

While the students worked on the packets, I circulated amongst the groups (there were nine groups) and tried to focus on getting them to answer each other’s questions, rather than having me answer them. It was challenging to try to redirect them towards each other rather than relying solely on me. An example of the dialogue:

Student A: “I don’t get what an isotope is?”
Teacher: “Can someone else here answer that?”
Student B: “It’s where there are different numbers of neutrons.”
Teacher: “Different numbers of neutrons where?”
Student B: “In the same atom—the same atom with the same number of protons, but different number of neutrons.”
Student A: “So then, how do you draw the two isotopes of carbon?”
Teacher: “Who feels like they can do that?”
Student A: “Can’t you just show me?”

As I thought about this particular exchange and started noting a pattern as I visited several other groups, it occurred to me that we had a ways to go to get to the point where the students were trusting each other and relying on each other as resources to support their understanding. They trust that I know what I’m talking about, and that made them just want to have me help them. The activity ended up taking quite a bit longer than I had anticipated, simply because I spent so much time at the beginning trying to get the students to talk to and trust each other. Of course, with 36 students and nine groups to get around to, they did eventually realize that they were not going to have my full attention for very long at a time.

In the first 30 to 45 minutes when I was spending time with the groups, I consciously tried to remember the operating principles and prompts I could use to encourage students to make more of their thinking visible. I realized that there are some that I do naturally, like asking other students if they agree or disagree, or asking a student to clarify their thinking, but others were difficult for me. I found that I’m not really very good at wait time. I want to “rescue” someone from having to feel uncomfortable for even a millisecond so I jump in with the answer. Writing this now makes me remember back to my teacher education program, where one of the professors talked about the difference between facilitative anxiety and debilitating anxiety and how the former can be very beneficial. This is clearly an area where I need to encourage my students to take risks. Of course, I have to establish some safety around this as well.
After the initial half hour or so, I was able to circulate amongst the groups and be more of an observer rather than an integral part of the groups. This is where it became fun for me. The students really did start to listen and learn from one another. At this point they were doing the majority of the talking and many were doing an excellent job of explaining their thinking to the others. There were some students who were reticent to participate fully or openly admit that they were a bit lost. I’m hopeful that as I spend more time with these sorts of activities, these students will feel more comfortable.

I was pleased to see how the students who understood more quickly took it upon themselves to be encouraging and helpful to those who struggled. This may be in part because of the way I structured the activity.

One of the things that I took away from our first class session on making thinking visible was the idea that volunteering is not optional. I’ve always resisted the idea of making students participate because I always felt that making a shy student speak up would be humiliating to them. Perhaps that is the enabler in me, but I now realize that I may actually be enabling those students to succeed less, because if they know I’m not going to challenge them, then they can check out.

In the activity for this assignment, I told the class that I would be randomly calling on members of each group, which was why it was important that they had group consensus on their answers. I felt like, if I called on a “shy” person in the group, they would not feel singled out as they were not reporting what they as an individual did, but what the group did. This seemed to cause the group to really help each other and encourage each other.

Observing and practicing this activity was really helpful to me. It is something I am trying to structure into more and more of my teaching. I am finding, however, that old habits are hard to change. It takes more effort on my part not to just “give” information. I know that part of this is because I feel the pressure to deliver or provide the students with a set amount of curriculum. It takes more time to allow the questioning and conversation between myself and students and between the students themselves. I wonder though that if this becomes the norm, then perhaps it would move more quickly. And, of course, I do realize that if there are students who aren’t getting it all, then what is the point of delivering all of the prescribed curriculum?

One of my biggest struggles right now is not to confirm automatically to a student’s right or wrong answer to a question. I have been so accustomed to immediately saying, “Yes, that’s right!” to the first student who answers. It makes so much more sense that this would discourage others from even thinking about an answer when they know hot-shot Johnny is going to answer it right away. I am really working on this. I have to say that I’ve bitten my tongue more than once in the past few weeks. I am very hopeful that as I practice this more and more, I will actually get better and better at it. I look forward to the rewards that come with watching the students think out loud.

Questions:
1. Create a t-chart that summarizes on the left side all of the operating principles and instructional behaviors Ms. Standefer has applied in this lesson, and on the right side the operating principles and give-ups she has identified as areas for continuous growth in her practice.
2. Compare and contrast at least two or three ways in which you see your own current practice with making thinking visible matching what Ms. Standefer describes.