Using the Think Aloud Strategy to Launch a Discourse-Rich Mathematics Lesson

Introducing a Mathematical Think Aloud

The idea of elementary students working together on mathematical tasks is not new, but recent attention to creating purposeful discourse in mathematics classrooms prompts us to revisit discourse-promoting strategies for mathematics lessons. The Common Core Standards for Mathematical Practice (CCSSI, 2010) encourage teachers to foster opportunities for students to make conjectures, analyze situations and create and argue solutions with one another. The type of purposeful discourse that promotes these behaviors supports the development of students’ conceptual understanding (NRC, 2001) around high cognitive demand tasks (Smith & Stein, 1998). However, facilitating this type of discourse is no easy feat. How can teachers implement a lesson that promotes purposeful mathematical discourse? In this paper, we focus on the beginning of a lesson that is organized around a high-demand task, that is, we focus on the launch phase of the lesson, when the teacher is getting students ready to work on the task.

We have borrowed the strategy of Think Aloud from literacy (Davey, 1983) to support the launch of this mathematics lesson. In reading, Think Alouds are used to help students attend to their own thinking and comprehension (Bereiter & Bird, 1985). Studies showed that when teachers demonstrate the use of Think Aloud, students learn how to monitor their comprehension (Baumann, Jones & Seifert-Kessell, 1993) leading to better understanding of text in developing readers (Kucan & Beck, 1997). Further, Think Aloud encourages students to share their own thinking.

The goal of demonstrating a Think Aloud to launch a mathematics lesson around a high-demand task is for teachers to model both the type of thinking that develops conceptual understanding and how to share one’s thinking. Jackson and colleagues (2012) noted that how
the teacher sets up the task during the launch determines whether all students are “in the game”.

They explained that how the task is setup “impacts both what students and the teacher are able to achieve during a lesson” (p. 24), highlighting the importance of the launch for the success of the lesson. A Think Aloud demonstration before releasing students to think and discuss thinking around a high-demand task is a profitable tool for launching a lesson that promotes purposeful mathematical discourse for all students.

**Teachers Learning Mathematical Think Aloud**

As part of a 40-hour, year-long professional development in Project All Included in Mathematics (AIM), we introduced the Think Aloud strategy to participating second grade teachers. We presented the Think Aloud as one way to launch a lesson around addition and subtraction story problems to promote purposeful mathematical discourse that develops conceptual understanding. As the professional development progressed, teachers reported developing success using the Think Aloud. They noted that the Think Aloud got their second graders engaged and also helped students get started working on the problems. Teachers noted that students more readily shared their thinking with each other in lessons launched with a Think Aloud. However, in learning to use Think Aloud, teachers had to carefully consider what constituted an appropriate Think Aloud, that is, a Think Aloud that modeled the kinds of mathematical thinking they wanted to foster in their students.

As an introduction to the strategy, teachers first considered the following two versions of a mathematical Think Aloud for the story problem, “Jason put 4 large plates and 8 small plates on the table. How many plates are on the table in all?” (Fuson, 2009, pg. 208).

**Table 1: Model Think Alouds**

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<th>Think Aloud 1</th>
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<td><strong>Think Aloud 1</strong></td>
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Ok boys and girls, let me tell you how I work on this problem so you can do it too. If you read it carefully, you will see that it asks for how many plates in all are on the table. Let me read the problem again: Jason put 4 large plates and 8 small plates on the table. How many plates are on the table in all?” [Repeat: “how many in all” slowly and with emphasis on the “in all”]. Hum… When someone asks me “in all”, usually means I should be using addition because this means I am putting things together. So, I look for the numbers in the problem, hum, there are 4 plates and then 8 more plates. [Write 4 on the board than say “8 more” with emphasis on more]. So I have 4 and 8 more, that is 4 + 8 [complete the math sentence on the board writing + 8]. Well, now I can do this because I know the question. [Complete the sentence on the board to read 4 + 8 = __] The answer to 4 + 8 we already know that, we learned in first grade. Four plus eight is 12, so I can complete the problem.

Ok boys and girls, let me tell you how I think about this problem to help me understand it. First, I read the problem very carefully and think about what the story is telling me. Let me do that: Jason put 4 large plates and 8 small plates on the table. How many plates are on the table in all? Ok, so, let me think about that: Jason is setting the table. He first sets the large plates and there are 4 of them. Then he gets the small plates and he puts them on the table as well. There are 8 of those on the table so I am going to have to show all of them. Small plates and large plates, they are all on the table. I am going to make a drawing... Let me do that and read my problem one more time. So, if I have the table here like Jason, I put 4 large plates and 8 small plates on the table. Now, the question I have to answer is how many plates are on the table. I want to know the number of plates on the table. Ok, I can see what is on the table and what Jason did to set it up. Let me tell
you, that this is my drawing, but you do not have to draw it the way I did. I just wanted to show you how I think about the problem to help me see it. And I will leave the rest to you… How many plates are on the table?

Teachers discussed how each Think Aloud set up students for doing mathematics, including mathematical vocabulary and discourse. In these discussions, teachers pointed out that Think Aloud 1 was prescriptive and modeled what operation the students should carry out based on key words. On the other hand, Think Aloud 2 revealed teacher’s thinking and provided students with a model for how to think out loud through the problem. Teachers concluded that Think Aloud 2 was more in line with their goals for launching the story problem.

Teachers in the professional development worked in pairs to practice using the Think Aloud in ways similar to the second example. Later, they worked in their school groups to plan a lesson in which they launched student work on a story problem using the Think Aloud strategy. After video-taping the implementation of Think Aloud in their classrooms, teachers watched their own Think Aloud and reflected on their work.

**Teachers Implementing Mathematical Think Aloud**

Four teachers from a school planned a lesson on comparison story problems and chose the following problem to launch the lesson: “Jane and Ernie have some apples. Jane has six apples and Ernie has nine apples. Who has more apples? How many more?” (Fuson, pg. 222). The following is an excerpt from one teacher’s mathematical Think Aloud, which is in many ways similar to what a few teachers reported.

“So I’m gonna show you how I would think about this problem… If I was
gonna solve it, how I would think and what I would do. First I would read

the problem to myself. [teacher pauses] Jane has six, I’m going to draw a

picture of six, and Ernie has nine. I’m going to draw a picture of how many

Ernie has.”

Figure 1 displays a rendition of this teacher’s final diagram on the board. To conclude her Think

Aloud, she said,

“So, when it asks how many more, there are three more that Ernie has. I could also say

that there are three less that Jane has. It’s the same thing.”

With her drawings, the teacher wanted to provide students with a model that

showed how she thought about the problem.

Figure 1: Teacher Representation

Teachers’ Reflections: Successes and Challenges of the Think Aloud

Teachers’ reflections described Think Aloud as a way to launch a lesson that

supported purposeful mathematical discourse. One teacher reflected, “I feel like my Think Aloud

set my students up for success when later they worked similar story problems with their group.”

Another teacher explained, “I think that this activity encouraged discourse [after the launch…].

[Students] discussed with their partners and others at their tables what they discovered.” A third

teacher shared, “I think that verbalizing strategies and using vocabulary such as ‘more’ or ‘less’

enabled the children to use more precise language when sharing their work with each other.”

Thus, overall, teachers saw value on using this strategy. Their reflections, however, also
highlighted some challenges.

The first challenge considered was the question of exactly how far into solving a problem they should model the situation. Teachers shared in their reflections comments such as “At the end I felt that I was just modeling a strategy [to solve the problem] and not including what I was thinking along the way,” and “Anyway—math wise—I am not sure if I ‘crossed the line’ from Think Aloud to showing how to solve the problem. I was trying to provide a visual, but it seemed like maybe in the end I was just solving it.” Having used representations similar to Figure 1, teachers noted that when they used a particular drawing in the Think Aloud to actually solve the problem, students copied the particular representation the teacher had used when they solved similar subsequent problems. Thus, teachers wondered whether students were still thinking about the problem or copying what the teacher demonstrated.

Because the professional development focused on strategies to promote purposeful mathematical discourse among students, teachers considered the fact that modeling the Think Aloud as a strategy in which the teacher did all the talk was a challenge. Upon reflection, one teacher shared “…many of my students wanted to chime in and help me answer the story problem.” A second teacher reported “…my students were dying to give their two cents as well and wanted to answer the questions I was asking myself as I was thinking aloud.” A third teacher described how she resolved this issue by putting in place a norm for Think Aloud. She explained, “I had used Think Aloud to launch the previous two lessons on problem solving before I recorded my launch…” An excerpt from her classroom video follows:

Teacher: All right, before we get started, let’s just review our expectations during Think Aloud time. Point to the person whose turn it is to talk. […] It is my turn to talk. It is my turn to share with you all of the thoughts that I am having in [my] head, and show you what I’m
thinking about as I solve the math problem. So do I need you to call out answers?

Class: No!

Teacher: Do I need you to try to solve the problem?

Class: No!

Teacher: No, I just need you to watch what I’m doing and think about the things that I am doing.

Using a Mathematical Think Aloud in Your Classroom

When you consider the Think Aloud as a strategy for promoting purposeful mathematical discourse, it is important to note that there is a big difference between modeling thinking and demonstrating procedures. Regardless of the mathematical goal of your lesson, taking the Think Aloud too far bypasses the intended purpose of the strategy, which is to model thinking. As evident in the teachers’ reflections, if explicit procedures are modeled, a diagram revealing the answer, or a direct answer provided, then the Think Aloud has gone too far. Your students may be used to seeing teachers or their parents model procedures, so it is important to be explicit to students that you are modeling a way of thinking about a task. You may explain that you want them to be able to attend to your thinking and also be able to talk about their own thinking when they are working on the task. Thus, a mathematical Think Aloud should also be carefully constructed to set students up for rich conversations with one another about conjectures, multiple strategies, and possibly multiple solutions to the task(s) that will follow. This careful construction should prompt the students to not only talk about their thinking but also listen to and ask questions about each other’s thinking.

Having worked with elementary teachers on the Think Aloud strategy, we believe the following tips may be helpful as you consider how you may implement it in your own
mathematics classroom:

- Set the expectation for students that Think Aloud is a time for you, the teacher, to speak, not the students. Students should be engaged in active listening.
- Decide on your purpose. Consider what you want students to attend to when you use the Think Aloud strategy.
- Identify mathematical ideas you are using that your students have already encountered. You might use phrases in your Think Aloud to alert students to important prior knowledge, like “I remember that…” or “This is a lot like…”
- Consider extra supports you can use to help your students, including English Language Learners, follow your thinking. Such supports may include drawings, using gestures or physical objects, writing out important vocabulary, and giving synonyms.
- Consider writing out a script or key talking points before you start to ensure that you convey your intended goal of sharing your thinking and that you do not take the Think Aloud too far. As evident in the teachers’ reflections, if explicit procedures are modeled, a diagram revealing the answer, or a direct answer provided, then the Think Aloud has gone too far.

**Conclusion**

Remember, the purpose of the Think Aloud strategy is to make teachers’ thinking explicit to students. Similar to its use in literacy settings, this strategy requires teachers to consider the purpose of the Think Aloud and to carefully plan how they may model their mathematical thinking on a problem to students. Without such planning, a teacher’s Think Aloud can quickly move beyond the scope of the intended goals and objectives of the lesson. One must also consider the specific content focus of the lesson and craft the mathematical Think Aloud so that
it launches an opportunity for students to take responsibility for their learning, communicate their thinking, and evaluate strategies and solutions of others. While these skills may not initially come easily, by hearing their teacher repeatedly model mathematical thinking out loud, students are given common experiences upon which to build their thinking in discourse-rich lessons. As these skills develop throughout the school year, all students are afforded opportunities to engage in mathematics.

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