

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

## 2                           **Introducing a Mathematical Think Aloud**

3           The idea of elementary students working together on mathematical tasks is not new,  
4 but recent attention to creating purposeful discourse in mathematics classrooms prompts us to  
5 revisit discourse-promoting strategies for mathematics lessons. The Common Core Standards for  
6 Mathematical Practice (CCSSI, 2010) encourage teachers to foster opportunities for students to  
7 make conjectures, analyze situations and create and argue solutions with one another. The type  
8 of purposeful discourse that promotes these behaviors supports the development of students'  
9 conceptual understanding (NRC, 2001) around high cognitive demand tasks (Smith & Stein,  
10 1998). However, facilitating this type of discourse is no easy feat. How can teachers implement  
11 a lesson that promotes purposeful mathematical discourse? In this paper, we focus on the  
12 beginning of a lesson that is organized around a high-demand task, that is, we focus on the  
13 launch phase of the lesson, when the teacher is getting students ready to work on the task.

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

21           The goal of demonstrating a Think Aloud to launch a mathematics lesson around a  
22 high-demand task is for teachers to model both the type of thinking that develops conceptual  
23 understanding and how to share one's thinking. Jackson and colleagues (2012) noted that how

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

### 30 **Teachers Learning Mathematical Think Aloud**

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

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

45 **Table 1: Model Think Alouds**

<b>Think Aloud 1</b>	<b>Think Aloud 2</b>
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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  $4 + 8 = \underline{\quad}$ ] 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?
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46 Teachers discussed how each Think Aloud set up students for doing mathematics,  
47 including mathematical vocabulary and discourse. In these discussions, teachers pointed out that  
48 Think Aloud 1 was prescriptive and modeled what operation the students should carry out based  
49 on key words. On the other hand, Think Aloud 2 revealed teacher’s thinking and provided  
50 students with a model for how to think out loud through the problem. Teachers concluded that  
51 Think Aloud 2 was more in line with their goals for launching the story problem.

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

### 57 **Teachers Implementing Mathematical Think Aloud**

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

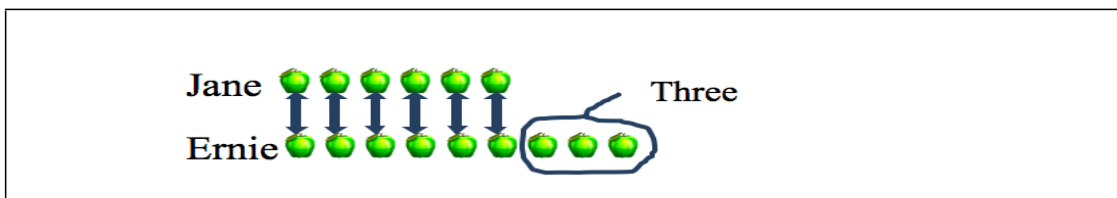
63 “So I’m gonna show you how I would think about this problem... If I was

64 gonna solve it, how I would think and what I would do. First I would read  
65 the problem to myself. [teacher pauses] Jane has six, I'm going to draw a  
66 picture of six, and Ernie has nine. I'm going to draw a picture of how many  
67 Ernie has."

68 Figure 1 displays a rendition of this teacher's final diagram on the board. To conclude her Think  
69 Aloud, she said,

70 "So, when it asks how many more, there are three more that Ernie has. I could also say  
71 that there are three less that Jane has. It's the same thing."

72 With her drawings, the teacher wanted to provide students with a model that  
73 showed how she thought about the problem.



74  
75 **Figure 1: Teacher Representation**

### 76 **Teachers' Reflections: Successes and Challenges of the Think Aloud**

77 Teachers' reflections described Think Aloud as a way to launch a lesson that  
78 supported purposeful mathematical discourse. One teacher reflected, "I feel like my Think Aloud  
79 set my students up for success when later they worked similar story problems with their group."

80 Another teacher explained, "I think that this activity encouraged discourse [after the launch...].  
81 [Students] discussed with their partners and others at their tables what they discovered." A third  
82 teacher shared, "I think that verbalizing strategies and using vocabulary such as 'more' or 'less'  
83 enabled the children to use more precise language when sharing their work with each other."

84 Thus, overall, teachers saw value on using this strategy. Their reflections, however, also

85 highlighted some challenges.

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

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

105           Teacher: All right, before we get started, let’s just review our expectations during Think  
106 Aloud time. Point to the person whose turn it is to talk. [...] It is my turn to talk. It is my turn  
107 to share with you all of the thoughts that I am having in [my] head, and show you what I’m

108 thinking about as I solve the math problem. So do I need you to call out answers?

109 Class: No!

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

111 Class: No!

112 Teacher: No, I just need you to watch what I'm doing and think about the

113 things that I am doing.

### 114 **Using a Mathematical Think Aloud in Your Classroom**

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

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

131 mathematics classroom:

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

### 147 **Conclusion**

148 Remember, the purpose of the Think Aloud strategy is to make teachers’ thinking explicit  
149 to students. Similar to its use in literacy settings, this strategy requires teachers to consider the  
150 purpose of the Think Aloud and to carefully plan how they may model their mathematical  
151 thinking on a problem to students. Without such planning, a teacher’s Think Aloud can quickly  
152 move beyond the scope of the intended goals and objectives of the lesson. One must also  
153 consider the specific content focus of the lesson and craft the mathematical Think Aloud so that

154 it launches an opportunity for students to take responsibility for their learning, communicate their  
155 thinking, and evaluate strategies and solutions of others. While these skills may not initially  
156 come easily, by hearing their teacher repeatedly model mathematical thinking out loud, students  
157 are given common experiences upon which to build their thinking in discourse-rich lessons. As  
158 these skills develop throughout the school year, all students are afforded opportunities to engage  
159 in mathematics.

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