Connecting Class Talk with Individual Student Writing

When first graders seemed to understand symmetry, their teacher gained insight into their individual conceptualizations and the unique sources from which they drew perspectives.

By Madelyn M. Williams and Tutita M. Casa

Isaac Asimov, one of the most prolific science fiction writers of his time, once noted, "Writing, to me, is simply thinking through my fingers." As recommended by NCTM (1991; 2000), I (Williams) regularly rely on my first graders' writing to assess their reasoning about important math concepts. I hope that they also "think through their fingers." Their writing serves as a culminating activity that allows me to better assess the depth of each student's understanding following class activities and discussions. I use a talk frame (Casa under review) to keep an organized record of a class discussion on the board and to explicitly connect what students have experienced and discussed as a class with their individual writing (see **fig. 1**). This process allows me to first generally assess students and then progress to a more individualized assessment of their understanding. I give my students the freedom to decide whether to refer to the notes on the talk frame to help them with their writing.

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Because students could reference the talk frame, I became curious about each *individual* student's depth of understanding. I had ideas about the *class's* reasoning about different concepts from the activities, our discussions, and the talk frame, but from where were individuals drawing their ideas? Were they writing about what they truly understood, or were they simply copying what they thought I wanted to read from the talk frame? Were they relying more on the class activities and discussions? I set out to look into these questions by analyzing my students' individual writing pieces from a symmetry lesson.

FIGURE 1

To guide class activities and discussions, students investigated symmetry in various ways that allowed for different assessment opportunities.

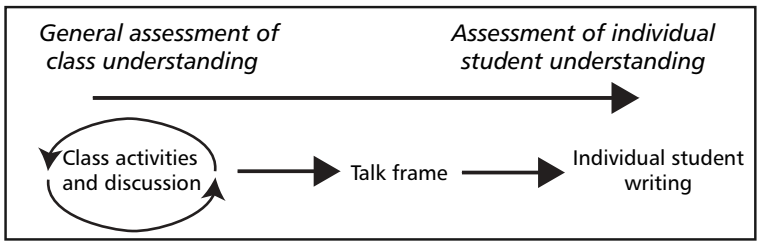
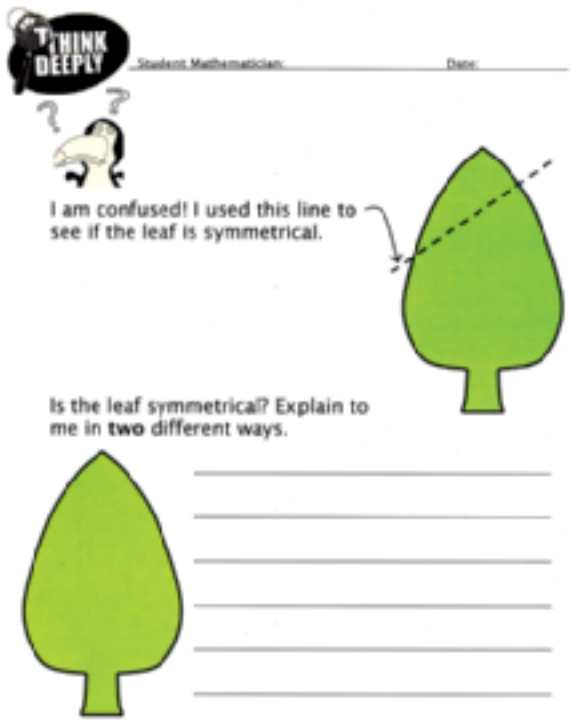


FIGURE 2

The symmetry question involved using *Exploring Shape Games: Geometry with Imi and Zani* (Gavin et al. 2010).



Ideas that guided class activities

The class investigated symmetry in various ways using *Exploring Shape Games: Geometry with Imi and Zani* (Gavin et al. 2010) to discover the following concepts:

- **Symmetrical** shapes have lines that divide them exactly in half, and their identical part is reflected on the other side of the line.
- **Some** shapes have one or more lines of symmetry, whereas others do not.
- **Not** all lines drawn on shapes are lines of symmetry.

To help students begin to realize some of these ideas, they placed a mirror on the line of symmetry to see the original figure and folded the design in half to see that it matched. They also worked with several formats to address these core concepts in various ways, including using manipulatives like pattern blocks, relying on figures drawn on paper, and cutting out their own symmetrical figures.

The question

Once the class had had multiple opportunities to discover these concepts about symmetry, I posed a question (see **fig. 2**; Gavin et al. 2010) that required them to justify whether or not a drawing of a leaf is symmetrical. They first needed to state if, in fact, they thought the leaf is symmetrical. The leaf is symmetrical, but the dotted line was included on the drawing to have students consider that not all lines that divide a figure are lines of symmetry. To give me a sense of the depth of students' understanding, they then had to justify in two different ways why the leaf is symmetrical.

I wondered how each student understood symmetry. Did they conceptualize it using a mirror to see if the line of symmetry divided the shape so the reflection and the original design match? Would they rely on another strategy,

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such as folding the shape on the line of symmetry, to find matching halves? Did they think of a line drawn down the middle to divide the leaf?

Gathering student ideas

Before sharing the talk frame that I used with the symmetry lesson, I described it further and explained how to implement it.

The talk frame is an interactive graphic organizer that tracks the development of ideas on the board as students reason through a significant mathematical question. This record allows students and the teacher to refer back to earlier thoughts in the conversation that may help further their thinking. **Figure 3** provides a picture of a talk frame and how to use each section. Students must understand a question if they are to successfully respond to it; the *Think* section supports this notion. I write all student ideas under Talk Ideas on the talk frame whether or not they are correct; otherwise, rather than relying on their own reasoning, students might take cues from me as to whether their ideas are correct. I also make sure to take notes representing exact student ideas so they have ownership over their thoughts. With students' help, I summarize the discussion in the We Understand section when I feel confident that the class has grasped the concept.

A talk frame about symmetry

I began to get a sense of the class's depth of understanding as I used the talk frame. When I first presented the question about symmetry, my students immediately began telling me that the dotted line on the leaf was not symmetrical. However, I asked them to consider whether the leaf was still symmetrical despite the fact that the line was not a line of symmetry. I focused on the question that required them to reason about different ways to justify their ideas about symmetry for the talk frame. I prompted students to formulate a simpler question but still represent the given task. Together they decided that the question, "Is the leaf symmetrical?" would be the Think question.

Ellie came up with the first idea (see **fig. 4**): "When you put a line in the middle, it is the

FIGURE 3

The teacher gave students the freedom to decide whether to refer to the notes on the interactive graphic organizer to help them with their writing.

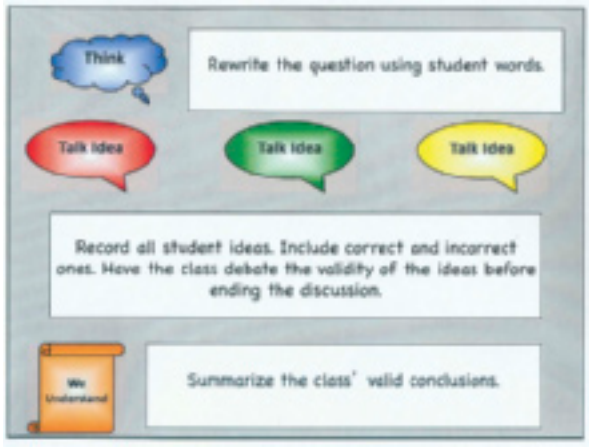

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FIGURE 4

Comparing students' thought processes gave the teacher access to information: Students seemed to have a good understanding of symmetry but had different perspectives.

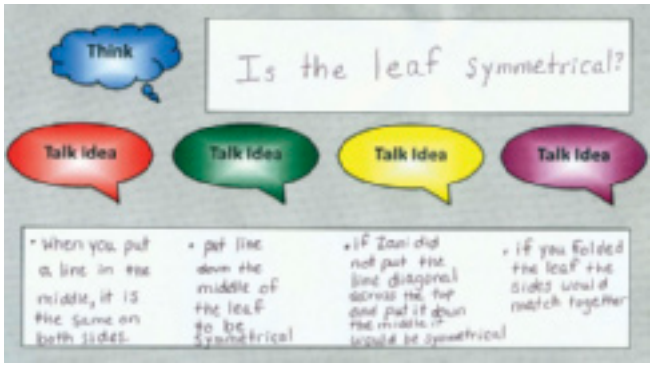


FIGURE 5

Surprising their teacher, students blended ideas from the talk frame or wrote their own ideas to justify why the leaf was symmetrical.

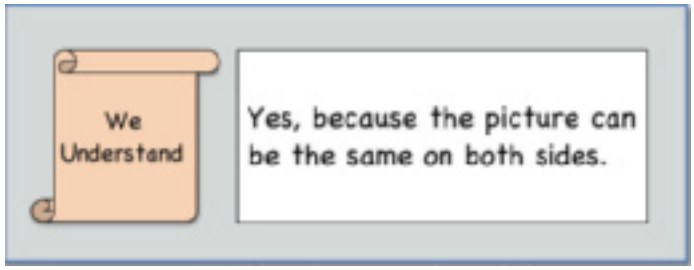
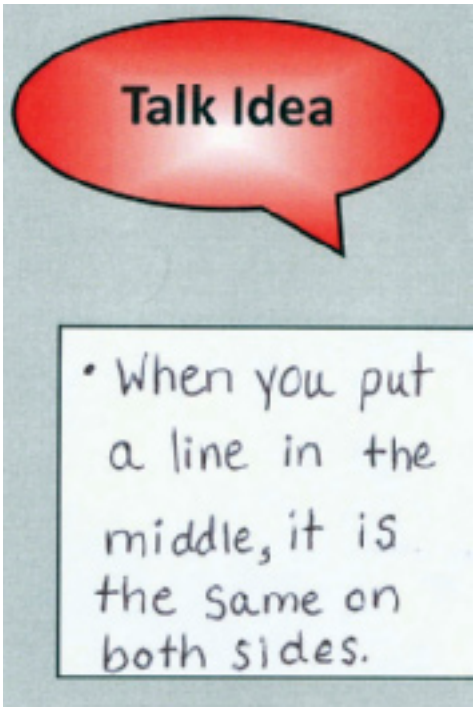


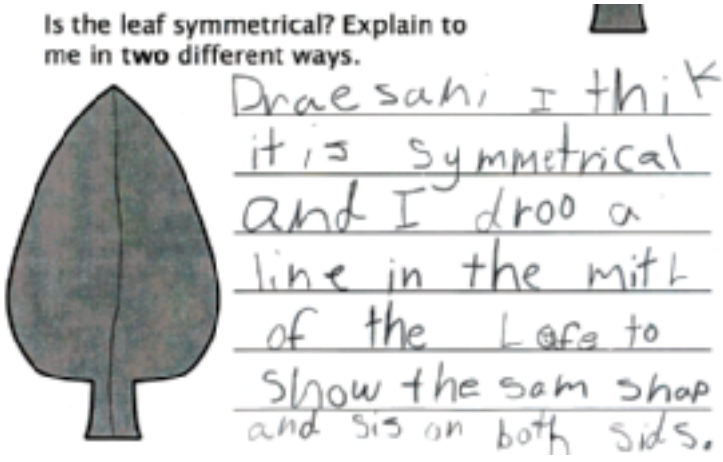
FIGURE 6

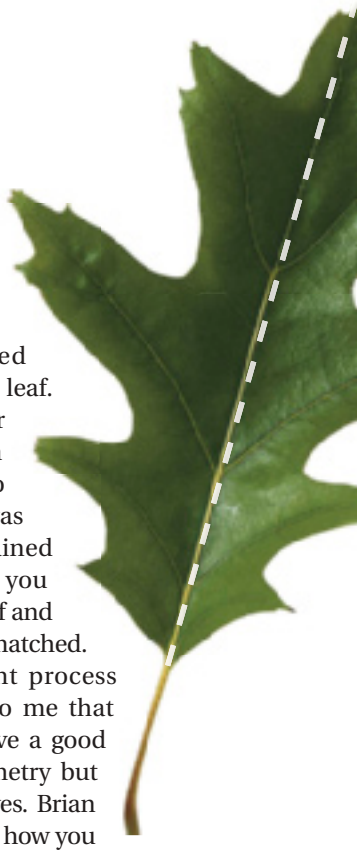
Hoping to assess individual understanding from student writing, the teacher was surprised when students went beyond the talk frame ideas.

(a) To defend their answers, many students began with a mathematical idea from the talk frame.



(b) Then they added something of their own to expand on the idea. Lauren wrote, "Dear Zani, I think it is symmetrical, and I drew a line in the middle of the leaf to show the same shape and size on both sides."





same on both sides." Most students agreed with this concept, so their subsequent ideas reflected this continued thought process and concentrated on the "middle" of the leaf. Not until the end of our conversation did Brian think of another way to reason why the leaf was symmetrical. He explained to his classmates that you could fold the leaf in half and check to see if the sides matched. Comparing his thought process with Ellie's indicated to me that students seemed to have a good understanding of symmetry but had different perspectives. Brian was thinking in terms of how you could tell if the leaf was symmetrical, whereas Ellie explained why the line down the middle was a line of symmetry. Because the class had reached a point of agreement on the correct mathematical ideas, I was ready to wrap up the discussion. I summarized the ideas in the We Understand section (see **fig. 5**).

Time for writing

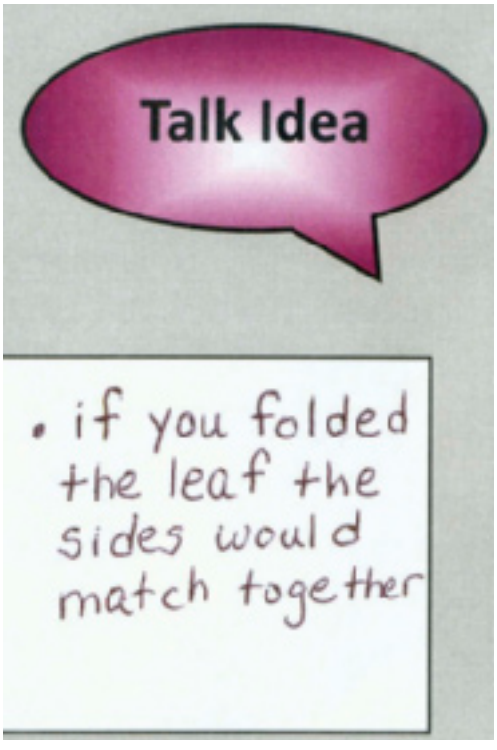
Once I had a good grasp of what the class understood about symmetry, it was time for students to tell me their personal understanding of it. I was hoping that their writing about symmetry would help me better assess their individual understanding, not just an idea they had copied from the talk frame. What surprised me most when I read their writing was that students had not copied ideas word-for-word from the talk frame. Instead they had blended ideas from the talk frame or had written their own ideas to justify why the leaf was symmetrical. I noticed that many students began with a mathematical idea from the talk frame (see **fig. 6a**) but added something to expand on the idea or explain it in their own words. Lauren used the idea from the talk frame that a line down the middle makes it the same on both sides (see **fig. 6b**). However, she further demonstrated her mathematical understanding

FIGURE 7

The first graders combined different ideas from the talk frame into one statement to describe symmetry, indicating an ability to synthesize the conversation.

(a) Marco wrote, "The shape is a symmetrical shape, because if you fold it in the middle, the sides will be the same."

(b) The folding action came from one Talk Idea.



(c) The concept of the sides being the same came from another Talk Idea.

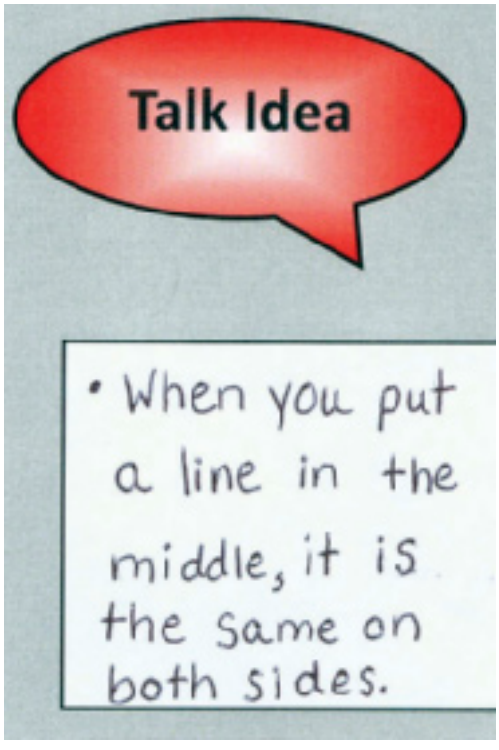
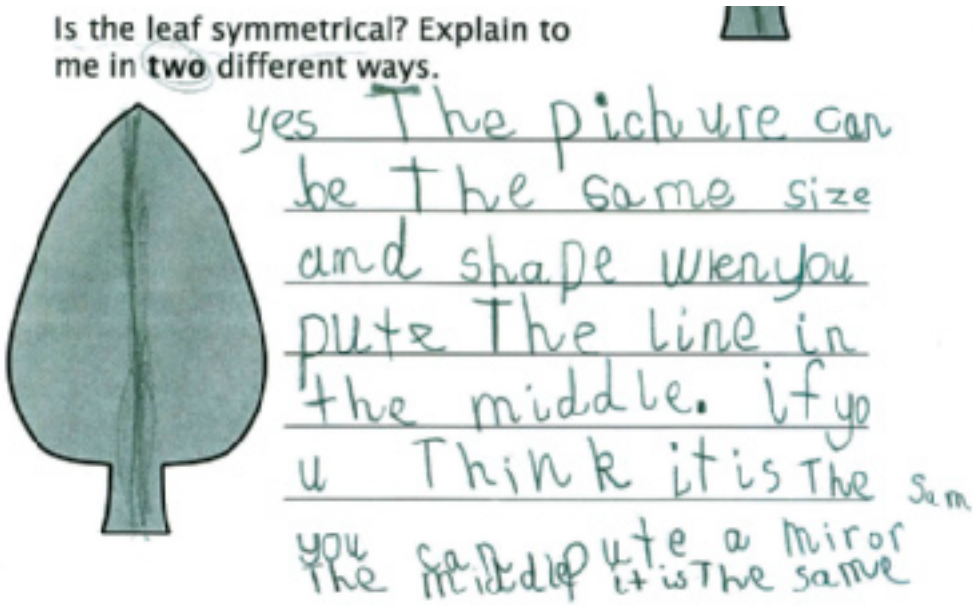


FIGURE 8

Some students, like Garret, used approaches that were not represented on the talk frame, suggesting they relied more on previous activities than on the talk frame.



by describing the symmetrical halves as the same shape and size. From her explanation, I concluded that Lauren understood what *same* means in the context of symmetry.

I also noticed that my first graders were able to blend two different ideas from the talk frame into one statement to describe symmetry, indicating their ability to synthesize the conversation (see **fig. 7a**). Both the folding action (see **fig. 7b**) and the spoken "sides are the same" (see **fig. 7c**) were ideas from the talk frame; however, they came from two different Talk Ideas. Marco blended them to explain the leaf's symmetry. I felt confident his writing represented his thinking because I noted his connections to the talk frame and how he reformulated these ideas into his own words.

Some students reasoned about symmetry by using strategies that were not represented on the talk frame, suggesting that they relied more on previous activities than on the talk frame. I learned from Garret's writing that the mirror activity resonated with him in his conceptualization of symmetry (see **fig. 8**). He wrote, "Yes. The picture can be the same size and shape when you put the line in the middle. If you think it is the same, you can put a mirror in the middle; it is the same."

Postlesson reflection

This analysis of my teaching gave me the opportunity to determine what part of my instruction students drew from to express their understanding of symmetry in their writing. Although they used the notes on the talk frame as a reference for their writing, they also drew from our class activities and discussions. My first graders generated new ideas and expanded on the thoughts that we had come up with as a class and had recorded on the talk frame. I will continue to use the talk frame to connect

class activities and discussions with individual student writing because it showcases student ideas but does not hamper individuals from expressing their personal understanding.

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