

CHAPTER 6

Viewing and Visually Representing Mathematical Information

In many elementary classrooms, there really isn't much art in the part of the day we refer to as language arts—at least not visual art. Although students are exposed to illustrations or photographs in picture books and other texts, we can do so much more as educators to infuse viewing and visual representation into our classrooms. If art, drawing, or movies are part of the day, they are seen as add-ons to the existing curriculum. Oftentimes, visuals and drama are not emphasized in the classroom and are only part of classroom activities if extra time is available. Instead, the abilities to comprehend words on a page and communicate thoughts through words are typically more highly valued forms of communication that educators seek to develop in classrooms.

When educators speak about reading and comprehending, it is typically understood that they are referring to printed words. It is assumed that literature, textbooks, basal readers, morning message charts, and other more traditional forms of imported and local texts are what students should be able to read and understand. However, that view of literacy is gradually changing. Flood and Lapp (1998), for example, refer to this focus and prioritization of reading and writing as an irrational loyalty. The written word is no longer the only type of text that students need to comprehend to be considered literate. Viewing refers to a much wider range of media than books, and visually representing information means sharing knowledge through more than just words, which is why these two areas were added when the English language arts standards were modified in 1996 by IRA and NCTE. Because societal expectations have changed, teaching students to communicate through words and sentences is no longer enough to prepare them to be literate contributors to society.

Although the topic of viewing and visually representing information is gaining attention, there is still a lot to be done. We must no longer think

of literacy as “limited to what the tongue can articulate but what the mind can grasp” (Eisner, 2003, p. 342). According to Berghoff and Borgmann (2007), creating meaning requires much more than answering questions about a text or writing responses. Although comprehension is an important skill to develop, it must apply to more than the standard print media. To be productive citizens and active participants in the world, students must be able to view a variety of texts and understand what they are seeing. They must be able to visually represent their understanding through pictures, graphs, and other methods.

Comprehension still remains the common goal shared by viewing and visually representing nonprint media as well as reading and responding to printed text. However, to comprehend what they view, students need to use many reading skills that are associated with traditional text. Students must use metacognitive skills to monitor their viewing. As viewers, students must know whether they understand the material they are seeing and know what strategies must be used should they not comprehend the visual representation. Students must also view materials with a critical stance so that they are cognizant of the author’s purpose. Instead of looking at individual aspects of what they view, students must look at the total picture. This is similar to reading printed text because we want students to read and not focus on each individual sound and word. Just as we don’t seek to develop word callers with printed text, we don’t want students to superficially state what is shown in something they view. We are asking students to explain their understanding and navigate diverse sign systems to demonstrate that knowledge.

There are many resources available to help teachers transform their classrooms into places where multiliteracies are valued. For instance, Anstey and Bull’s (2006) *Teaching and Learning Multiliteracies: Changing Times, Changing Literacies* acknowledges that the printed text is not obsolete but rather just one type of text available. These authors’ suggestions for classroom application can help educators change the way they teach literacy. We must value multiliteracies with even the youngest of children. In an article written by Crafton, Brennan, and Silvers (2007), we see a first-grade classroom where the teacher shares how her thinking of literacy is continually changing and how her young students thrive as they experience multiliteracies. Although many people may associate the term *multiliteracy* with the use of technology, multiliteracy entails much

more (Caughlan, 2008). We are doing a disservice if we don't expose our students to a wide variety of visuals available. As Williams (2008) shares, the way we teach literacy today is not the way we learned it in the past, and is not the way it will be taught in the future.

To provide students with opportunities to view diverse media and show an understanding of mathematical material, we must provide a variety of experiences for this viewing, which might include plays, commercials, illustrations, graphs, and the Internet. Our classroom activities also require that students be able to visually represent what they are learning. Visually representing may be learned through dramatizations, charts, illustrations, advertisements, and other artistic creations. Just like any other type of communication, students must consider their purpose, the audience, and the form they are using when they visually represent information (Tompkins, 2009).

Students are often motivated to view and visually represent information while they are actively engaged in learning through the creation of new artifacts. Students realize the importance of these activities because they see these types of representations outside of the classroom. According to Kress (2003), students are often exposed to texts that are multimodal. Most students play video games, engage themselves on the Internet, and view images on the computer, on television, and in other media. Despite the fact that images are becoming the predominant form of text, the educational curriculum often remains focused on the traditional printed text (Williams, 2007).

By examining the literacy practices of adolescents, Moje, Overby, Tysvaer, and Morris (2008) find that students are engaged in a wide variety of literacy practices and texts every day. Students who may lack motivation with literacy activities completed within the school context may actively involve themselves in out-of-school literacies (Hinchman, Alvermann, Boyd, Brozo, & Vacca, 2004). Therefore, if we can connect literacies experienced within the school with literacies that students use on a daily basis outside of the school setting, we are helping them connect and see the importance of learning. We are providing authentic literacy activities that prepare students for the world in which they live.

This chapter begins with an overview of the benefits that can be gained by expanding our vision of literacy to include viewing and visually representing information. After that, specific classroom suggestions are

shared for how we might turn our ideas into reality. Examples from a range of grade levels are included to help teachers see how other teachers incorporate viewing and visual representation in their math lessons. Along with developing word knowledge, students can learn to visually represent mathematical information and use dramatic representations to enhance their literacy skills while strengthening their mathematical knowledge.

Benefits of a Changing View of Literacy

Educators today must meet the needs of struggling readers, students whose primary language is different from the language of instruction, and students who may learn more easily through diverse modalities. We must also prepare students to respond to the continually changing literacy demands of the world around them. As we seek to meet the needs of an increasingly diverse group of students and strive to make our lessons more relevant to students' experiences outside the classroom, we see the rewards of our changing view of literacy. This literacy vision is not a set of activities or a prescribed list of skills, but rather a way of viewing our instruction to incorporate this vision throughout the day. Mathematics can provide a natural connection to viewing and visually representing information. Although teachers already use concrete objects and visuals to develop math skills, teachers can expand the use of viewing and visually representing throughout the mathematics curriculum so that more benefits are gained.

Emphasizes the Arts

Proponents of the arts should be pleased to see how highly valued the arts are within such a broad definition of literacy. Arts-based programs benefit other aspects of literacy, and research has shown a link between academic achievement in reading and an arts-based curriculum (Perkins, 1988). Instead of looking at the arts as an add-on or extra for the curriculum already taught in the classroom, the arts need to be integrated into students' learning in order for this type of literacy to develop.

Many researchers stress that students learn better and retain more if taught through diverse modalities (Eisner, 2003; Leland & Harste, 1994). Sarama and Clements (2003) have shown that very young students may learn faster if they have the opportunity to learn mathematics through

songs, drawings, and building blocks. When we allow students to learn through these activities instead of marginalizing the arts, we make them part of the core curriculum (Eisner, 2003).

Supports Multiple Intelligences Theory and Transmediation

Gardner's (1985) multiple intelligences theory states there are eight intelligences: linguistic, logical-mathematical, musical, visual-spatial, bodily-kinesthetic, naturalistic, interpersonal, and intrapersonal. Many educators believe in Moran, Kornhaber, and Gardner's (2006) revised version of this theory, which adds a ninth intelligence, existential. This theory is not meant to limit students by categorizing them into specific types of learners but rather to broaden the way that educators present materials to students because what you do as an educator once you have a better understanding of students' strengths and weaknesses can play a major role in the learning process. Everyone can learn in multiple ways, and we all have strengths, weaknesses, and preferred styles of learning, all of which must be considered when planning instruction to support students' literacy development. In fact, Armstrong (1993) believes that we can use this information to appeal to individuals with learning disabilities by targeting their specific strengths.

The multiple intelligences theory encourages collaboration and allows students to work together to better meet their needs. Collaborating in flexible groups is a component of both the English language arts (IRA & NCTE, 1996) and NCTM (2000) standards. Students with strengths in one area can complement other students' strengths by working together to understand information presented in the classroom. This scaffolding helps students understand and learn more because of the students' zone of proximal development (Vygotsky, 1934/1978). Being productive members of society requires the use of several intelligences. By working together, students realize their own strengths and how to collaborate with others to develop diverse methods of learning. By providing rich experiences for students to interact directly with materials (Moran et al., 2006), teachers help students develop these intelligences.

The idea of providing students with a wide variety of experiences to support diverse learning ties into the theory of transmediation. Transmediation occurs when students take information they learned in one

communication system (i.e., reading, writing, speaking, or listening) and show this information in another sign system (Leland & Harste, 1994). By creating visual representations based on the written word, they are doing just that. When students view something, such as a play or television commercial, then share their understanding through another sign system, they are experiencing transmediation. Moving between different systems of meaning allows for a deeper understanding of material (Short, Harste, & Burke, 1996). In our goal to help all students learn, we need to be sure that we are providing educational access to everyone. Students need to have the opportunity to learn and express themselves in a variety of communication systems.

This view of literacy may also be beneficial for those students who tend to struggle with the traditional form of literacy valued in schools (Hinchman et al., 2004). Students who have difficulty with reading printed texts may actually find that connecting with other types of literacy is beneficial (Flood & Lapp, 1995) and can then make intertextual connections between the diverse texts. Intertextuality, coined by Kristeva (1984), allows students to see that information they learned in a previous text can be applied to new knowledge. Therefore, seeing the link between visuals, printed words, and even oral language can strengthen literacy development. By looking at diverse media, students will realize that each of these media are not distinct resources, but rather that these types of text support various aspects of literacy and are interrelated. A diversity of texts can help students develop a more solid understanding of content knowledge.

Scaffolds English Learners

The idea of viewing and visually representing is beneficial for students whose first language may not be English. Research encourages educators to provide visuals when introducing new words to ELs. These visuals may be pictures, objects, or even actions (Helman & Burns, 2008). With visual representation, we ask students to show their knowledge through charts, posters, and even illustrations in class books they may be creating. ELs often learn more quickly when presented with such visuals, so the experience we provide them while viewing the creations and visually creating their own understanding can scaffold their learning.

In fact, research suggests that an arts-based curriculum may be especially beneficial for ELs (Spina, 2006). By encouraging ELs to create a visual or dramatize an action to go with a word, we help them expand their sight word vocabulary (Helman & Burns, 2008). Also, drama can allow them to better understand what they are learning because they are directly experiencing the lesson and developing a deeper understanding of the content. By providing multiple opportunities for students to read and experience words, we help students expand their vocabularies. Research shows that students must read words numerous times in order for the words to be learned (Hargis, Terhaar-Yonkers, Williams, & Reed, 1988), and a curriculum that includes viewing and visually representing material can provide even more opportunities for students to be exposed to words.

Our schools are becoming more and more culturally diverse. As our classrooms become more diverse, we must continue to strive to meet all students' needs. To prepare all learners for the world in which they live, we must use strategies that help students with diverse cultural backgrounds.

Enhances Out-of-School Literacies

As we continually strive to show our students connections between what they are learning in school and what they do outside of the classroom, fostering viewing and visual representation skills will help. These skills tie closely to the types of literacy our students use every day and the literacies with which they must become even more adept at understanding. When our students are not in school, they often spend countless hours engaging on the Internet, playing video games, and watching videos, movies, television shows, and commercials. Students are bombarded by all types of advertisements through other media (e.g., billboards, fliers). Although these visual representations are a common part of life, few students are savvy viewers. They need to be taught how to comprehend a variety of visual media to be truly literate.

Ties Easily to Technology

Technology is continually changing the world as we know it. Researchers and scholars warn us that if we don't allow students to navigate the wide variety of media that they encounter on a daily basis, including technology-enhanced media, we are doing a disservice to our students (McPherson,

2007). These are powerful literacies that are essential for preparing students to attain jobs and have an impact on the world (Finn, 1999). We must provide students with experiences to analyze various forms of media and be intelligent, knowledgeable consumers of it. If we are preparing students to be truly literate, they must understand technology and be able to comprehend, synthesize, and analyze all types of information and communication technologies.

When viewing information on the Internet, students select links that interest them. By doing this, students may develop a deeper understanding of some aspects of a particular topic but actually gain a more limited understanding of the overall topic. Also, students often look for visuals that explain the text on the Internet (Liu, 2005). Since research shows that 99% of U.S. public schools report that they have Internet access (National Center for Education Statistics, 2002), technology should be tied into the curriculum. Many researchers warn that technology should not be just an additional layer to the curriculum (Smolin & Lawless, 2003), but instead must be woven throughout the content. By using technology, students can access a variety of information and present information in a number of ways (Ikpeze & Boyd, 2007). In fact, all of the technologies to which students have access (e.g., Internet, e-mail, digital videos) are changing the way we see literacy and the knowledge that students will need to be successful in the workplace (Leu, 2000).

Encourages Struggling Readers

It is unsurprising that many activities pertaining to viewing and visually representing information involve drawing. Educators have shown that drawing can help modify the attitudes of students who may have negative attitudes toward writing and reading (Sneed, 1995). A wide variety of students are present in today's classroom, and they each come to us with different strengths. Some students' strength is drawing or visually representing, and allowing them to communicate in that manner can help improve their literacy skills and self-confidence (Sneed, 1995). Finally, drawing can help motivate learning-disabled students to develop other areas of literacy such as reading and writing (Sidelnick & Svoboda, 2000).

Turning Our Ideas Into Reality

Our goal as literacy leaders is to prepare students to be contributing members of society, and viewing and visually representing are two important aspects of literacy that need to be developed. Yet, it is not an easy task. Research shows that it is much easier to talk about a broadened definition of literacy than it is to actually apply it in the classroom (Sheridan-Thomas, 2007). The rest of this chapter is designed to provide a variety of easily implemented ideas for fostering viewing and visually representing mathematical information in the elementary classroom. Each of the activities discussed can nurture other aspects of literacy development such as talking and listening, but the ideas are presented here for teachers to see where viewing and visually representing information can tie into the classroom.

All of the activities discussed in the following sections fall into three categories. Some involve creating a visual representation on paper to reinforce students' mathematical word knowledge. Other activities use visual representation via drawing to help students communicate mathematical knowledge to others. Finally, the remaining activities are not visual in the traditional sense, but rather they involve students using their verbal and nonverbal skills to show mathematical meaning through drama.

The activities shared not only tie into the English language arts Standards 4 and 5, which focus on communicating knowledge appropriate for different purposes and audiences, but also help meet English language arts Standards 1, 6, 7, and 8, which specifically reference nonprint texts or technological resources (IRA & NCTE, 1996; see Appendix A). NCTM's (2000) process standards are also supported through viewing and visually representing information; students are expected not only to organize and communicate their mathematical thinking but also share their mathematical knowledge through representations (see Appendix B).

Reinforcing Word Knowledge Through Visual Representation

Helping students build their mathematical vocabulary is an important goal for any teacher. To do this, students need to develop a solid understanding of terms they encounter. While teachers should use concrete, hands-on experiences to help create this knowledge, viewing and visual representation activities can help reinforce that learning.

It is imperative that students develop an understanding of academic terms related to mathematics. Although some of these words are found solely within the field of mathematics, many may have multiple meanings and mean something very different in other contexts. By creating visuals and viewing these visual representations of content-specific vocabulary, students reinforce and expand their mathematical knowledge.

Each of the five strategies discussed in this section are designed to help students expand their mathematical vocabulary through the creation of visuals. The story problem visual isn't a concrete drawing but rather a visual that helps students understand how specific words can give clues to the operations they need to answer word problems. Creative concepts encourage students to use a variety of materials and ideas when helping others understand mathematical concepts. Lastly, picture dictionaries, multimeaning word cards, and the verbal-visual word association strategy involve drawing pictures and are designed to help students create items that build their vocabulary knowledge.

Conquering the Words in Word Problems. Many students struggle as they attempt to solve word problems, yet the terminology found in the problems is rarely unique. In fact, students see many of these words on a daily basis. In a word problem, a lot of information is expressed through a minimal number of words. Students must read the problem to determine which words provide key information for solving the problem. Students often have difficulty translating the words in the problem into the math symbols that represent the operations. For example, words as simple as *is* have a mathematical symbol—the equals sign—yet many students miss that tiny but important word in problems. A word problem visual can help students develop a better understanding of word usage within such problems. Even when students can complete mathematical equations, successfully completing word problems requiring the same operations is often difficult because students do not fully understand the operations needed to solve the problems.

One sixth-grade teacher created a visual to help students remember the order of operations and understand the vocabulary often seen in word problems. First, a paper was divided into five parts: the four corner areas plus a circle in the center. The four corner sections were numbered 1 through 4 counterclockwise, beginning in the top right corner, and

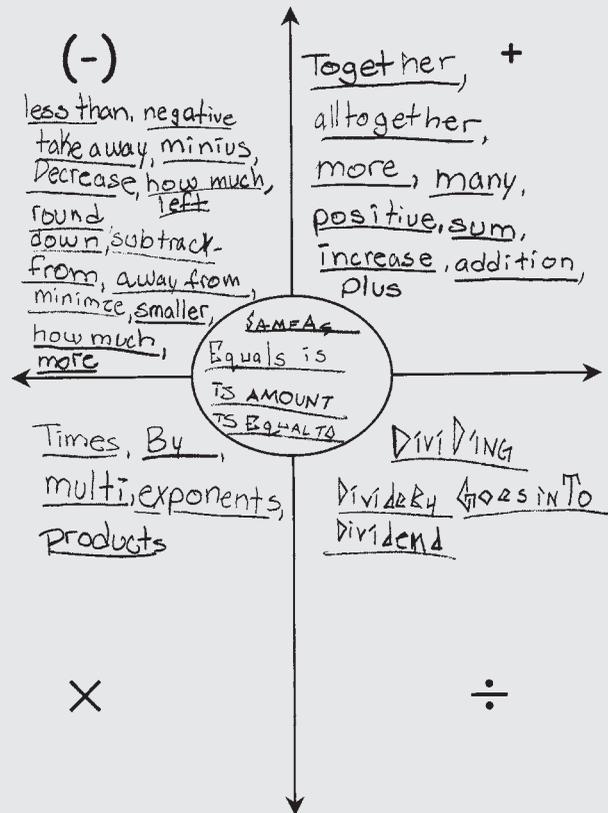
the circle was numbered 5. The order in which the corner sections were numbered corresponds with the order the topics were learned in earlier grades: (1) addition, (2) subtraction, (3) multiplication, and (4) division. The concept of equality was placed in the center circle, position 5, because that concept is used with the other four processes. A large letter C can be drawn on the page to remind students to proceed counterclockwise around the four corner areas.

To complete the visual, the class was divided into small groups. Each group was then assigned the task of brainstorming a list of possible terms for one of the visual's five sections. One group had to think of words used for *plus*, one for *minus*, one for *times*, one for *divide by*, and another for *equals*. After the groups completed their assignment, each group orally shared their brainstormed creations on an overhead transparency. After each presentation, the rest of the class had the opportunity to share any additional ideas that might be added to that section. By the end of the activity, each student had created an individualized sheet with a variety of words on it. For example, Figure 5 is the sheet that Charles created.

Even though the visual is very basic, it helps students think about a variety of mathematical operations. The information is also arranged in such a way that it makes sense to students. They realize the order of operations and think about each operation in the order in which it was taught. By thinking about the words they see in word problems and talking about their ideas with peers, students can focus on the importance of specific words in word problems. Throughout the year, students continue to add words to the different sections as they talk with classmates and tackle more difficult mathematical word problems. This teacher found that many students continue to carry around their crumpled piece of paper containing the visual for years, and former students often mention how important that sheet of paper was for helping them decode word problems.

Creative Concepts. Often, the best way to develop a solid understanding of material is to teach it to others, and developing vocabulary knowledge is no exception. One idea is to have students select a concept they want to teach and develop a visual to reinforce the information. Students can work in small groups to brainstorm and share ways to visually depict the information. Students have to consider their audience and develop a unique way to help the audience retain the information. Through developing and

Figure 5. Visual Created by a Sixth Grader to Aid With Understanding Word Problems



sharing their creation, students reinforce their own content knowledge. This strategy can work well with mathematical concepts at all grade levels in elementary school.

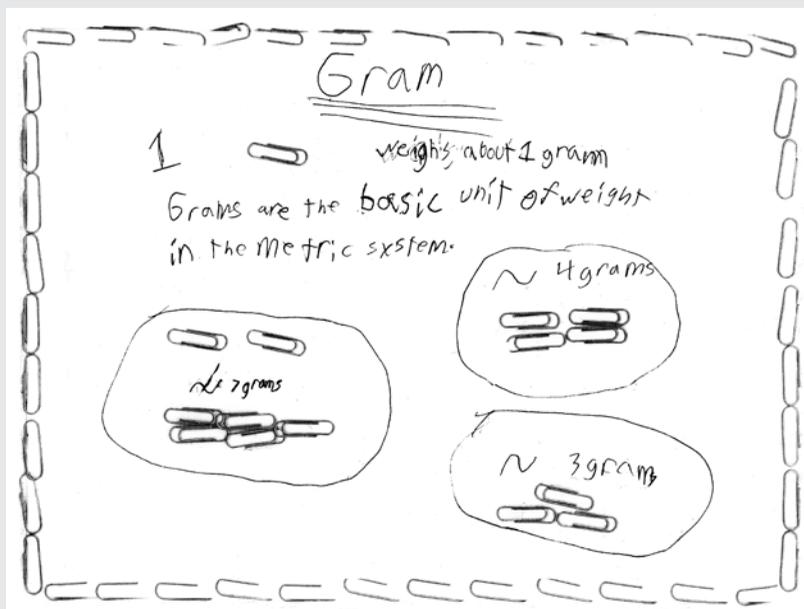
One teacher wanted sixth-grade students to develop creative ideas for representing the mathematical vocabulary they were learning. She presented them with the following scenario:

You are now the teacher of a sixth-grade classroom. Your students are tired of looking up vocabulary words and writing their definitions. It is your job to find a creative way of representing a vocabulary word and its definition.

Then the students worked in groups of two or three to develop a visual to help their peers remember mathematical concepts. This activity not only provided the element of choice by allowing students to select a term but also gave them the opportunity to visually represent mathematical concepts. The opportunity to work together on these creations added even further to the educational value of the activity. As the students discussed ideas for their projects and brainstormed possible concepts, they used their oral language skills. Therefore, students not only refined their knowledge of the term they chose but also strengthened their understanding of a number of other mathematical concepts.

James and Beau decided to use their imagination and a number of paper clips to help their sixth-grade classmates understand the concept of gram. The visual the boys created shows that one paper clip is about one gram and includes the term's definition (see Figure 6). Their visual also includes groups of paper clips with approximate weights for each group.

Figure 6. Paper Clip Poster Created by Two Sixth Graders to Explain Grams



A group of three girls wanted to help their peers understand stem-and-leaf plots. Figure 7 shows the visual representation that the girls made to help others understand the concept. At the top of their brightly colored creation, they wrote a fact about stem-and-leaf plots, then added the definition and a sample below.

Both groups chose very different concepts and used different materials to make their creations. However, the entire class gained from this exercise. After the creations were developed, students orally shared their visuals with their peers. While listening to others in the class share their presentations,

Figure 7. Visual Created by Three Students to Teach Stem-and-Leaf Plots

S
T
E
M
L
E
A
F

Facts: In a stem and leaf plot you always have to have a key

A stem and leaf plot helps show data.

An example is:

Stem	Leaf
1	2 4 7
2	1 3 8 9
3	2 3 7

KEY: 2/8 = 28

Stem	Leaf
The first digit in a number. The number in the tens place.	The second digit in a number. The number in the ones place.

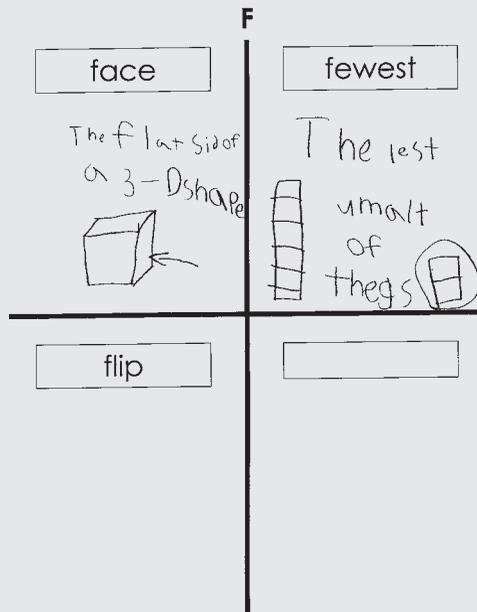
the students were able to synthesize new information on the concepts with knowledge that they already possessed. Students had the opportunity to view other presentations, talk about what they saw, and see how peers who chose the same concept may have represented it very differently. With the wide variety of mathematical concepts represented in this activity, the teacher chose to display these visuals in the classroom as a form of local text.

Picture Dictionaries. Dictionaries are often a wonderful source of information for students. When they are unsure of the meaning of a word, they may see a picture in a dictionary that helps them better understand the definition. Teachers sometimes use student-created picture dictionaries with ELs, since pictures have universal meaning. When the students create the images, they know what they are showing and can more easily remember the word's definition. I have seen many teachers of young students instruct them to add terms with which they are struggling to their picture dictionaries so that the visuals are individualized and meet the specific needs of each student.

One teacher had first graders create mathematical picture dictionaries. Although the text pages were alike for each student, there were blank areas for the students to individualize their dictionaries as needed. The students were enthusiastic about the project and eager to share how they visualized the concepts. The teacher chose concepts that the students had experienced with concrete objects previously in the classroom but were still having difficulty understanding. You could see the wheels spinning as the students thought about how to draw a picture to represent the concept of fewest. J.C. was excited when he came up with the idea to draw two groups of squares and circle the group with the fewest (see Figure 8). By drawing a picture and writing about the concept, J.C. reinforced previous learning. Later the teacher asked the students to color the pages before the sheets were cut and stapled to form a mathematical picture dictionary for the class to use as a local text.

Multimeaning Word Cards. In the elementary grades, students are taught to recognize and understand homophones and homonyms: Homophones are words that sound alike but are spelled differently, whereas homonyms not only sound alike but are also spelled the same. Teaching these terms is important because both types of words can include math concepts. There

Figure 8. Page From a First Grader's Math Picture Dictionary



are many trade books that can be used to teach about these two types of words. Two popular books are Gwynne's (2005, 2006) *A Chocolate Moose for Dinner* and *The King Who Rained*. Also, teachers may enjoy Terban's (2007a, 2007b) *Eight Ate: A Feast of Homonym Riddles* and *How Much Can a Bare Bear Bear? What Are Homonyms and Homophones?*

It is important for students to learn that some of these words are actually mathematical terms. *Eight/ate* and *weight/wait* are just two of the homophones that students need to learn because one term in each set has a mathematical meaning. There are also homonyms with mathematical definitions, including *yard*, *mass*, and *volume*. Each of these words has a mathematical meaning plus a different meaning when used in other contexts. Although these words may cause some confusion for all students, homonyms can be particularly challenging for ELs.

As students are introduced to these words, teachers may have them create word cards of homonyms and homophones. On these multimeaning word cards, students can write the selected word and create an illustration

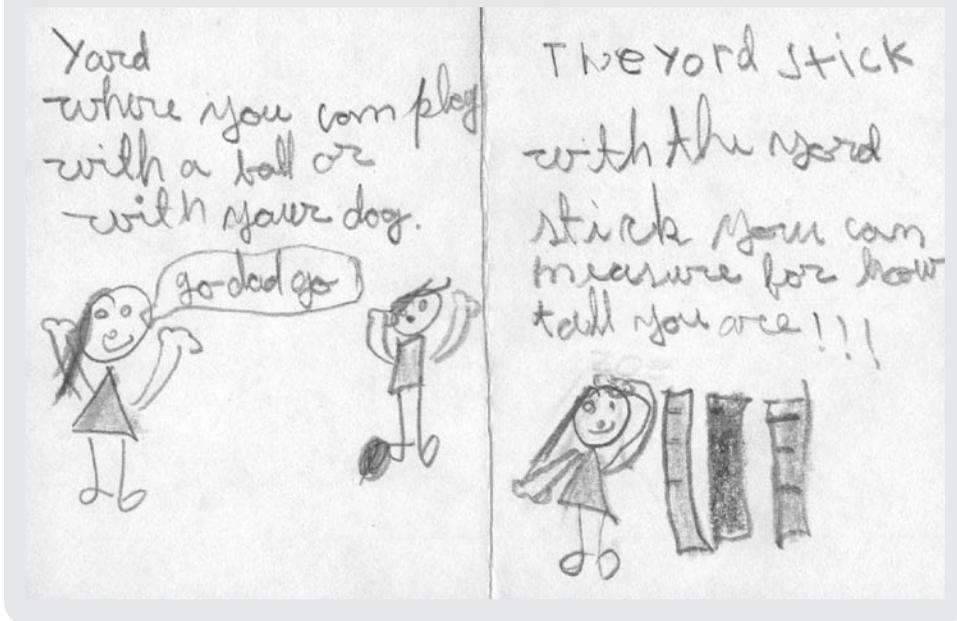
to show the mathematical and everyday meanings of the word. If the term is a homophone, the teacher may choose to have students write both spellings for the word and draw a picture for each meaning. Then the students can share the cards with a partner or the teacher to ensure that the mathematical meaning is understood, which further reinforces the information. The thought processes required to discuss, write, and draw homonyms and homophones helps students understand that some words can have very different meanings, even though the words sound alike and sometimes are spelled the same.

For instance, one fourth-grade teacher used student-created word cards with Chloe, an EL who recently moved from South America to the United States. The teacher showed Chloe each word individually, and together they discussed the various meanings for each word. The teacher encouraged her to provide additional details for the words and wrote down what Chloe dictated. This provided an opportunity for the student to talk about some of the words. Then Chloe was given a set of cards with homophones or a homonym written on each. On each card, Chloe drew pictures of both meanings to help her remember that the words could have everyday meanings as well as meanings specific to math. On the cards, she also wrote several phrases and some of the details that she and her teacher had discussed.

On her multimeaning word card for the term *yard*, it is evident that Chloe is showing two different meanings for the term (see Figure 9). On the left-hand side of the card, Chloe illustrated and wrote about her yard at home. When she thinks of that definition of yard, she thinks about playing with a ball, her dog, and her dad. On the right-hand side of the card, we see how she might use the term in a mathematical setting. She showed herself with her hand at the top of her head as she is trying to measure herself with a yard stick. Chloe was eager to create and talk about the cards she created with her teacher, and the teacher felt that they helped Chloe understand a variety of homonyms and homophones.

Although the creation of multimeaning word cards has value, even more can be gained by actively incorporating them into the classroom as a form of local text. If the student-created cards are made on large sheets of paper, they can easily become part of a word wall in the classroom. Word walls often contain content area vocabulary that students might find difficult. The cards can even be photocopied and made into a matching

Figure 9. A Fourth-Grade EL's Multimeaning Word Card



game for students who need the additional reinforcement to work with during their free time.

Verbal-Visual Word Association Strategy. This strategy was designed many years ago to provide an alternative to rote memorization of vocabulary definitions (Eeds & Cockrum, 1985). Later, the strategy was modified and a visual aid added (Readence, Bean, & Baldwin, 1998). Researchers have implemented the verbal-visual word association strategy into classrooms and found support for diverse learners (Hopkins & Bean, 1999). This vocabulary strategy can easily be tied into a number of content areas including mathematics.

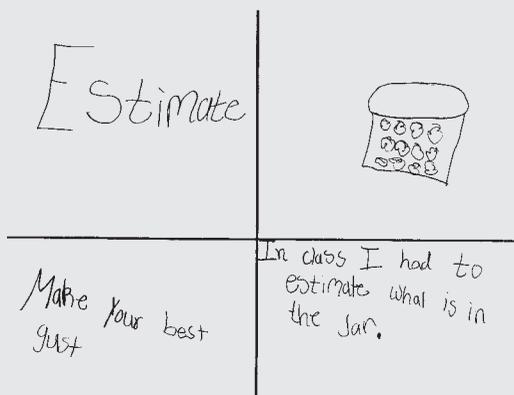
To successfully complete this activity, the student divides a piece of paper into four sections. In one of the four sections, the student writes the term or concept. Then in another section, the student draws an illustration to help remember the meaning of the term. Not only is the drawing important as a memory tool but also as a visual representation of the

student's personal association with the term. Thus, remembering the term is now more than just rote memorization of content vocabulary. In a third section, the student writes the term's definition. Finally, the student uses the term in a sentence in the last section.

A second-grade student, Sherrell, created a verbal-visual word association for the term *estimate*, which is shown in Figure 10. In the first section, she listed the vocabulary term *estimate*. She also explained what *estimate* means to her, emulating something her teacher has probably said often in class, "Make your best guess." Throughout the year, Sherrell's teacher filled a jar with different items and allowed students to estimate the number of items the jar contained. When it came to drawing a visual, Sherrell thought about a jar of marbles that she had seen in class and drew a simple illustration of that jar. To complete the activity, she reflected back on an activity for which the class had to estimate the number of marbles in the jar and wrote a sentence about that experience using the term *estimate*.

Sometimes with very young students, teachers create the image used in the verbal-visual word association activity. However, those drawings are less meaningful to the students because they do not represent the students' personal connections to the term. By having the students draw something

Figure 10. A Second Grader's Verbal-Visual Word Association Card for *Estimate*



that they associate with the term and come up with a sentence using the word, they are much more apt to remember the concept later.

When I use this strategy with very young students, I sometimes modify the four sections of the paper so that they are not equal in size. I find that students need much less room to write the term than they do to complete the rest of the activity. Therefore, I allow only a small amount of space for the students to write the actual vocabulary word and create larger boxes for each of the other three parts of the activity. One sheet of paper can be large enough to complete the activity for four vocabulary words.

Visually Communicating Information

Along with reinforcing word knowledge through visual representation, students can also use it to communicate mathematical information. Instead of focusing on specific terms, the students visually explain broader topics. These visuals may share how to perform certain mathematical operations, provide information that enhances oral reports, or even help convey the meaning of student-created story problems. The important thing to remember is that the use of the visuals allows students to develop their viewing and visual representation skills.

Persuasive Advertisements. An excellent time to discuss propaganda techniques and the ability to influence other people's decisions through visual representations is when students learn about persuasive writing. Elementary students learn about these six propaganda devices as part of the curriculum so they can readily recognize these techniques when they are used: glittering generality, name calling, bandwagon, testimonial, card stacking, and rewards (Tompkins, 2009). Students may enjoy using some of these techniques to create an advertisement to see if their peers can recognize the persuasive technique being used to influence their opinions.

Because many students have ample opportunities to experience the Internet and view television advertisements designed to persuade the viewer to react in a particular manner, students can readily relate this activity to the outside world. In this activity, they must think about mathematical content they've learned to create an advertisement about the steps needed to perform a mathematical operation, then make a presentation to their classmates to convince them that they need to perform these steps in a certain manner. When creating such advertisements, students must think

about the purpose of the visual and the audience with whom they are trying to communicate.

One fourth-grade teacher decided to have her students complete this activity when her students were learning about propagand techniques. The teacher began by looking up the definition with the class, then gave a few examples of these techniques. The students discussed the media, television, and advertisements and were surprised to learn that advertising is designed to persuade them. They had never really thought about advertising or its purpose.

The class then discussed the purpose of advertisements and targeting audiences. The teacher introduced the idea that most persuasive advertisements use a catchy slogan to help convince people and make their point memorable. Students were quick to recognize and share slogans they heard on television, such as McDonald's "i'm lovin' it TM" and Nike's "Just Do It. TM" This led to a discussion about the people students saw in those commercials and the implied message that "everyone is doing it, so you should, too."

Each student evaluated his or her favorite multiplying method and created a persuasive advertisement to convince classmates to use that method. Borrowing from the media reviewed, many students even came up with slogans. In Figure 11A, the student encourages peers to "Do it the Lattice Way Not the baddest way!" According to the visual, the method is described as quick and fun. Also, the directions are listed to instruct readers on the method's steps. The student wants the audience to see value in the lattice method.

Another student decided to compare the way people read math problems to the way they read written words on a page. As shown in Figure 11B, she wrote at the top of her visual, "You May Read Left-to-Right, but in Multiplying Work Right-to-Left! (2 digit by 2 digit)."

All of the students presented their advertisements to the class, and then the entire class voted on which student had the most convincing advertisement. This activity not only drew on visual communication but also required students to articulate their thoughts to their peers. Teachers may even incorporate technology into the activity by recording the presentations or sharing photographs of them with others via the Internet.

Although these examples were created by fourth graders, this activity can be modified for younger students. Primary-grade students can talk

Figure 11. Two Persuasive Advertisements by Fourth Graders

A

Lattice Method

It is the most fastest and colorful way to multiply.

Do it the Lattice Way

Not the boddest way!

The Lattice Way!

Directions

1. Multiply the 2 numbers by the top right corner.
2. Make a square.
3. Make the square into 4 different parts.
4. You put one diagonal in each box.
5. Then put your first number that you are multiplying and put it on the top of the square. Next put the second number you are multiplying on the right side of the square.
6. Multiply the 2 corner triangles by the top right corner.
7. Multiply the one by the top corner on the side and the top left together.
8. Multiply the number on the side bottom of the top right together.
9. Multiply the bottom corner triangle. Next add the two triangles by the top right corner.
10. Multiply the other diagonal triangles. When that's your answer.
11. Add the bottom corner triangle. Next add the two triangles by the top right corner.

B

You May Pread Left-to-Right, but in Multiplying Work Right-to-Left! (2 digit by 2 digit)

Step 1. 28×32 Multiply the 2 ones digits. $2 \times 2 = 4$

Step 2. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \end{array}$ Put the 6 in the ones column and carry your one.

Step 3. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \\ 840 \end{array}$ Multiply $2 \times 3 = 6$ and add the carried one to the 4 ($4 + 1 = 5$)

Step 4. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \\ 840 \end{array}$ cross out the 2 in 32 and put a zero for a place holder under the six

Step 5. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \\ 840 \end{array}$ Multiply $3 \times 8 = 24$ Put the 4 in the tens spot and carry the six

Step 6. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \\ 840 \\ 1240 \end{array}$ Multiply $2 \times 3 = 6$ and add the 6 ($6 + 6 = 12$) (Just put down 12)

Step 7. $\begin{array}{r} 28 \\ \times 32 \\ \hline 56 \\ 840 \\ 1240 \\ \hline 1296 \end{array}$ Add the 2 numbers and Tadaah! You get the answer.

Once you get the hang of it the right-to-left method is so simple that the hardest mental products will only partially get the right answer, while right-to-left because it's the easiest way.

about some of the commercials they see on television and discuss the ways that advertisements try to persuade people to buy a product, see a movie, or even visit an amusement park. The teacher can list those suggestions on the board, then focus on what the students have learned in mathematics. Why is it important to use concrete objects when you are learning to add? Why should students subtract or add columns in math problems from right to left? Why should students learn to create and read bar graphs?

After discussing these topics as a class, students can work in groups and choose a persuasion strategy to create an advertisement encouraging others to use concrete objects or complete mathematical problems in a certain manner. Then the students can share their advertisements with another class. Even though your students might not know the specific term for the propaganda device used, creating an advertisement is an excellent way to introduce the concept of propaganda and another way to incorporate viewing and visually representing into the younger grades.

Class-Created Mathematical Trade Books. For class-created books, each student contributes a page, then the book is laminated and used in classroom libraries or checked out by individual students to share at home. The activity has a great deal of value. Along with developing writing skills, students feel pride in the fact that they are authors. They are motivated to do their best writing for this project and eager to read the class-created book. Creating mathematical trade books with students can have additional benefits by reinforcing the mathematical skills and providing a literacy–mathematics connection. Students might share these books with younger students or even peers.

In one fourth-grade class, the teacher read the mathematical trade book *Each Orange Had 8 Slices: A Counting Book* (Giganti, 1999). This is a wonderful book for learning about patterns, multiplying, and solving math problems. Along with the engaging text, students are exposed to bright, colorful pictures that complement the math problems. As the fourth-grade teacher read the story to the students, she introduced multiplication properties (e.g., communicative, associative, zero), and the class discussed each of the properties and why they are important. While answering the questions presented on each page, the students noticed the repetitive phrase that starts each page, “On my way...” The class discussed the qualities that made the story enjoyable. Students mentioned that they liked

the pictures and that each page had a puzzle to solve. As the students more closely analyzed the text, they noticed that each puzzle was created from three sets of numbers and that there were three questions to go along with each puzzle. It made math fun.

The class then decided to create their own trade book that was laminated and saved, so they could reread the pages later and try to solve their peers' math problems. This class-created book, *On the Way, a Fourth Grader Saw...Can You Solve Equation?*, was modeled after the children's book they had just read. Because the students each created a page for this local text, they had to think about how to make a good puzzle. The illustration had to be accurate and complement the text on the page. Also, the students needed to be sure that the text made sense and that there was a solution.

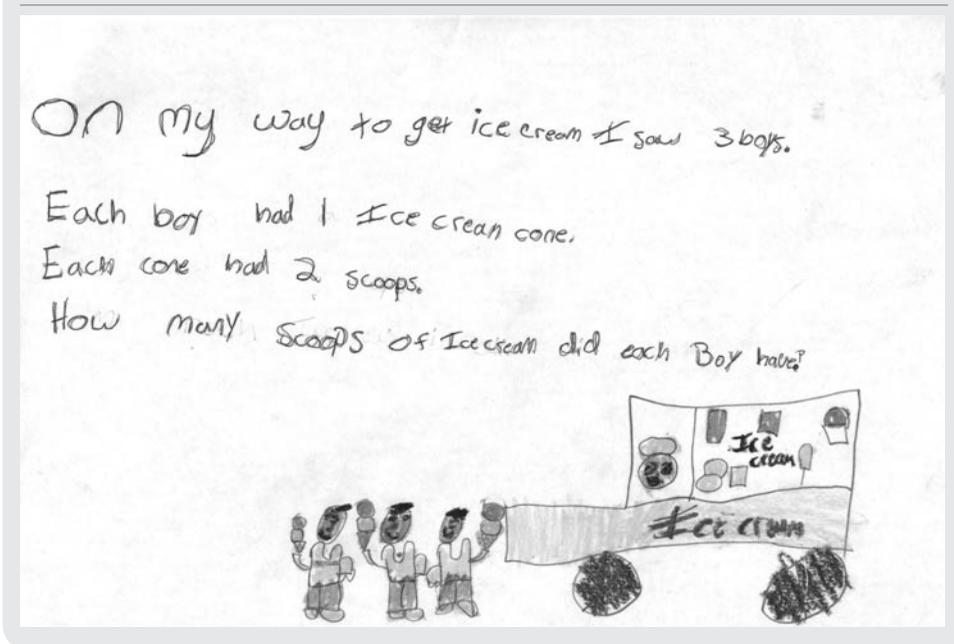
J.T.'s page for the class book relates to buying ice cream (see Figure 12). His statements are clear, and it is easy to understand the problem. J.T. actually wrote a pretty tricky mathematical problem, though, whether he meant to or not. After reading the first three lines of the page, one expects to be asked for the total number of scoops, but the final question doesn't ask that. Pages like the one J.T. created require the reader to read the problem carefully.

The picture J.T. drew accurately represents his math problem. The type of illustrations found in a class-created book might be very different from drawings students make for themselves to help them figure out simple word problems. Crespo and Kyriakides (2007) conducted research with first-through fourth-grade students and found that two types of drawing—iconic and pictographic—are often created by students in math classrooms. Iconic drawings are very basic. Instead of creating detailed, visually appealing drawings, students might draw four circles with a line through the middle of them to illustrate a problem such as the following:

Mary has four Reuben sandwiches. She is walking to school and finds that seven of her friends forgot to pack their lunch. How can she divide the four sandwiches so that each of her friends has something to eat?

However, to create a pictographic drawing, the student might draw a girl at school with her seven friends who forgot to pack their lunches. This picture would be much more detailed and more closely resemble pictures that students often see in mathematical trade books.

Figure 12. A Fourth Grader's Contribution to a Class-Created Mathematical Trade Book



Crespo and Kyriakides (2007) stress that we can use the pictures that students create when solving math problems as “windows into their mathematical thinking” (p. 122). Regardless of the type of drawing produced, we can gain much more insight by talking about these drawings. A student can be asked to share why he or she did or did not include certain information in the illustration and which parts of the picture help the reader solve the problem. Did the student draw the illustration as they were writing the problem or reading another mathematical problem, or was the drawing created afterward? Would it be helpful if the illustration were more or less detailed? Was the amount of detail related to the purpose of the illustration? If the student created the visual to help solve a math problem, was the picture different from the type of visual he or she would make to go with a math problem created for a trade book that others might read? Why or why not? Did the students take into consideration the audience for the visual when creating it? These types of conversations

can help students gain even more from drawings they create through mathematical lessons. As with other types of literacy, students are required to think about the audience for the drawing and the purpose behind creating the visual.

After the class book was made, the students read through the book and attempted to solve the problems. Before making the text a permanent part of the classroom, the fourth graders shared their creation with first-grade partners. A local text such as a class-made book shared with other grade levels has a lot of value in the classroom.

Oral Report Visuals. Oral reports can serve a valuable purpose in the classroom by helping students learn to research, organize, and communicate information to an audience. Along with oral and written communication skills, the visuals students create for oral presentations can help promote viewing and visual representation. Oral reports are an excellent activity that teachers can use to tie literacy skills into any content area, and math is no exception.

The possibilities for topics that tie into mathematics are practically endless. Students might be asked to research and report on the epistemology, or word origins, of some interesting mathematical terms. The students may study and share information on currencies used in other parts of the world or research and collect data on lunches purchased in the cafeteria to determine which ones are the most popular. Students may even search the Internet to determine the cost to eat at a number of restaurants with online menus and then graph the results to share with others. Another idea is for students to interview people of a variety of ages to see how the teaching of math has changed over time and present their results to their classmates. Also, students might research a famous mathematician and share what the world gained from that person. Selecting a topic is only the first of these seven steps, which are encouraged when creating a mathematical oral report:

1. *Select a topic.* The element of choice is important here. The class might brainstorm a few ideas and then each student can select a topic from the options. By allowing the class to select their topics, students feel that they are part of the decision-making process and are motivated to do a good job.

2. *Obtain information.* This can be done through a variety of methods. Students might conduct interviews, go online to research information, read books, or use any combination of these ideas. The important thing is for students to use factual mathematical information as part of their presentations.
3. *Take notes.* Students must write down information that they think they might want to share in the report.
4. *Compile and organize information.* At this time, students decide what is important and put this information on note cards. It is important that they learn to use keywords and not write down everything they plan to say.
5. *Create visual aids.* Students have to determine what information can be easily shared through a visual aid. There are many types of visual aids that students can use, including environmental print, graphs, charts, videos, and concrete objects. The visual aids should enhance the presentation and not take the place of or be redundant with the information presented in the oral report. The ability to create an effective visual aid is a difficult skill to learn. Students have to decide what information is better shared through words in the oral report and what can be shared better through the visual medium.
6. *Organize the report.* Students should make sure that their reports make sense. They must pick the order in which their note cards will be shared so that their information is easily understood and determine the order in which they want to share the visual images they created. Practicing the oral report at this step helps students do their best possible job.
7. *Present the report.* Even though this is the last step, it isn't the most important one. All of the steps are important. Again, choice can help make oral reports more fun for the student. The class might brainstorm some interesting ways to present their information. Teachers may find that the oral reports are better prepared as a small group the first time the class creates them. In addition, the students have the added benefit of collaborative learning.

A fourth- through sixth-grade teacher at a Montessori school decided to have her students develop group oral reports that would incorporate

viewing and visual representation as well as mathematical skills. The teacher began by having the students brainstorm topics they could research for their oral reports. The following are some of the ideas the class came up with:

- Money around the world
- Graphing favorite foods, math symbols, colors, and animals of the entire school
- War strategies that use math
- How money has changed over the years (e.g., inflation)
- Famous mathematicians
- A study of how different math tools (e.g., compass) were created
- Architecture

The students had several guidelines to follow. Each group's oral report was to last three to five minutes, a visual aid had to be used, and each student in the group had to speak during the presentation. The students chose their own groups and then selected their topics.

Most of the class chose to research favorite foods, animals, and colors in the school. The students were aware that these are not topics specifically related to mathematics, so they had to create visuals (i.e., time lines, charts, diagrams) that incorporated mathematical skills. As part of this project, students had the opportunity to practice their oral language skills by asking questions of peers in each of the classrooms at the school, listening to responses, and talking about the process. The groups also created graphs and other visuals to illustrate their findings.

One group of boys, B.J., Harrison, and Ely, decided to research war strategies because war was an area of interest that began when the class talked about Veterans Day. However, when the boys started researching the topic, they decided to look at the casualties of each U.S. war to compare the number of casualties in a graph. Therefore, the three boys were able to research an area of interest to them, develop their literacy skills, and enhance their mathematical knowledge through the visual. The graph they created to mount on their poster showed the number of casualties in eight wars beginning with the Revolutionary War and ending with the War on Terrorism. The boys found the information and the pictures for their poster on the Internet. The pictures included the famous photograph of soldiers

raising the flag on Iwo Jima and the advertisement for Rosie the Riveter saying, “We can do it!” During their oral report, the boys explained the differences between the wars and what caused more or less deaths in each. The group also created visuals to help share the information and statistics with their viewers.

This oral report was presented as a skit, so each of the three boys could talk and add to the report. The boys typed up their presentation as follows:

Harrison: As you can see the casualties for the wars shoot up in WW2 when it shot up to 77,000,000 and in the civil war it was pretty high to.

B.J.: YEAH I KNOW!

Harrison: yep it’s pretty big huh?

Ely: was the battle of Iwo Jima a bloody battle because I saw a picture and it was pretty cool.

B.J.: yeah and then the photo where the united states were putting up the flag in Iwo Jima they didn’t take the picture in the heat of battle they took while the people where posing

Ely: the person on the picture that said we can do it her name was Rosie the riveter in WW2 they made a drug called penicillin it fought germs that infected wounds.

Harrison: that is the WW2 part of our oral report now for the Vietnam in the Vietnam war they had much faster and much more high tech planes than in WW2 therefore less deaths in the air force but there was also less deaths than in the WW2 because there were a lot more germ fighting drugs so when they got wounded they could help and clean the wounded.

B.J.: the terrorism is still going on now and that is a very bloody battle.

Ely: when we were in the WW2 Hitler’s army was very big and he thought he would rule the world.

Harrison: so did I!

Through these reports, the students gained valuable research skills and had the opportunity to view and scrutinize information on the Internet and in other texts. Then the students determined the information they needed to write their reports and selected the best methods to visually represent their topics. Peers had an opportunity to view the information during the oral reports and ask questions of the presenters. Mathematical knowledge was reinforced through the creation of a variety of charts, including pie graphs and bar charts. Afterward, the students were able to reflect on how they might better take the audience into consideration when representing

information. Along with all of these important skills, the students had an opportunity to see how math ties into the world.

Dramatic Representations

Along with creating concrete visuals that students can view, there are many benefits to incorporating dramatic representations into the classroom. Research has shown that even the act of creating visualizations in students' minds helps with their understanding of topics (Ross & Roe, 1977). Furthermore, drama helps motivate students and interest them in the material. Drama naturally motivates students to learn because they are actively engaged in the activity and eager to complete the experience. Also, research has shown that drama has the potential to influence attitudes on learning (DeRita & Weaver, 1991). Therefore, very young students who are developing attitudes and interests may develop positive attitudes toward mathematics when they experience a connection between drama and math.

According to McMaster (1998), drama is a form of communication that is meaningful to students and allows them to develop skills through social interaction. Drama encourages collaboration among students as they work together to act out a concept. Teachers benefit from the use of drama in the classroom because the dramatic presentations provide immediate feedback on whether students understand the concepts (McMaster, 1998).

Through dramatic activities, students must be aware of their audience. They not only articulate their ideas through words but also convey their thoughts through actions. This type of acting helps provide experiences for students who learn best through bodily-kinesthetic activities (Gardner, 1987).

Informal Drama Activities. Allowing students to view dramatic activities and visually represent meaning through verbal and nonverbal dramatizations is an excellent activity for promoting literacy development. Although plays require a significant amount of work and time from the teacher and the students, many of the same benefits with less time and work can be achieved through informal drama. As students are involved in the dramatic experience, they develop a deeper understanding of terms. The audience members must observe the drama, listen closely, and think about what is happening to comprehend the presentation. The

students evaluate the activity by determining whether it makes sense and may think about other ways to demonstrate the same concepts. Although McMaster (1998) shares a number of literacy benefits that can be achieved by incorporating drama into classroom lessons, many basic mathematical concepts can be reinforced through informal dramatic activities. Also, drama can broaden vocabulary knowledge (Duffelmeyer & Duffelmeyer, 1979).

For example, one kindergarten teacher uses this type of activity to help students demonstrate their understanding of the mathematical concept of positional words such as *over*, *under*, *beside*, and *on*. Helping students understand and use positional words is a common concept in the kindergarten mathematics curriculum and is listed in many kindergarten textbooks and curriculum guides. As the class sits on the carpet in the room, the teacher reads the Big Book *The Napping House* (Wood, 1991). This repetitive tale appeals to young students with its illustrations and cumulative rhyme. As the teacher carefully reviews each page, the students show the position of each character (granny, flea, mouse, cat, dog, and boy) with individual stick puppets they've created for each.

Students are given the opportunity to look at a page and then say something they notice about the page using the positional words. During experiences like this, students might say something such as, "The mouse is beside the cat." Then each of the students arrange the mouse and cat puppets to show that sentence. Furthermore, the students use positional vocabulary to discuss changes that occur in the illustrations. For example, on one page granny is *beside* the boy instead of *on* the boy. Students then talk about how the position of granny has changed by using the positional words.

This type of learning helps students understand mathematical concepts and reinforces learning because the lesson encourages the use of physical movement. Later the students will remember the meaning because they were actively involved in experiencing the words. Teachers might use other activities involving bodily-kinesthetic responses to help students experience and act out other mathematical terms, such as *dividing*, *adding*, and *subtracting*. Although concrete objects and manipulatives are essential materials for learning mathematics, informal drama activities offer the teacher another opportunity to improve literacy skills and expand mathematical understanding.

Besides younger students, who enjoy and learn from these types of informal drama activities, older students who struggle with basic concepts may benefit from the reinforcement provided through the drama also. ELs may expand their vocabulary through hearing the words or mathematical terms and participating in the activities.

Mathematical Story Dramatizations. Students benefit from acting out teacher-created mathematical stories. Armstrong (1994) created a story to teach first graders about time, and as he shared his story with the students, they acted it out. This type of dramatic activity can be tied to mathematical trade books easily. Students aren't required to create elaborate costumes or a backdrop for this type of activity; they need only portray the characters and act out the mathematical story. These story dramatizations are more formal than the previously discussed drama activities. Often a greater amount of time is put into preparing this activity or writing the script, and there is an audience for the presentation. Students consider the audience when they act out their part and realize through their voice, movements, or facial expressions—depending on the type of presentation—that they are communicating mathematical information with others.

A third-grade teacher created a short play, *The Story of Place Value!*, to reinforce concepts that the students were learning. In the play, there is a very confused king. Although he rules a land that is rich and fertile for growing amazing candy, the people of the land have to pay taxes in the form of rice. The people love what the king grows, and therefore he receives many bags of rice. However, he cannot figure out how to count the bags because he only has 10 fingers. The king then asks each of his three bright sons to suggest a solution. One son finally comes to the conclusion that, if the rice bags are grouped in piles of 10, the bags can be counted more easily. The king is very happy and gives his crown to the son who came up with the answer.

The students loved performing and viewing the play. This activity served to help the students understand the mathematical concept of place value. As an extension activity and to build on the students' enthusiasm, the third-graders created their own plays, which incorporated mathematical concepts. The students performed their plays for their peers and were able to demonstrate reading, writing, listening, and talking skills. The students

learned to visually represent and view mathematical concepts that were presented in a nonprint format.

The power of drama cannot be underestimated. Although many teachers may hesitate to include it in the curriculum, drama can be a very educational activity at any age level and a means to encourage literacy skill development while connecting learning to mathematics. Once again, teachers need to make sure that the time involved is justified by the learning that is occurring. There is little benefit from spending a great deal of class time creating costumes and scenery when a simple and easily made item can serve to let the viewers know which student is which character. In the student-created play previously discussed, a paper crown represented the king. Students could wear tags around their necks stating their characters' names, too.

If teachers do not want to be concerned with movement on stage or simple items for costumes, the class may present their plays as Readers Theatre. Scripts for Readers Theatre can be found in books, located on the Internet, or created by the students and teacher. Those created by the class have additional literacy benefits because students also develop their written language skills.

Students can sit or stand as they read their parts, since there is no movement or costumes to help students portray their characters. Thus, students are required to depict their characters through vocal tone, inflection, and juncture. By using Readers Theatre for drama, the focus is on oral language skills and not on the ability to visually represent characters through costume and movement. Students need to use prosody to express the feelings and beliefs of their characters. Readers Theatre has also been shown to benefit struggling readers (Rinehart, 1999; Tyler & Chard, 2000), and the benefits of incorporating drama into the classroom can far outweigh the time spent on the activity.

WHERE DO I GO FROM HERE?

As educators, we must be prepared to support a broad view of literacy including viewing and visually representing. Harste, Woodward, and Burke (1984) encourage us to allow students to generate and share their ideas through dancing, drawing, and dramatic activities. Students at all levels

need the opportunity to interact and experience a range of media and texts. Just as visual literacies are becoming more prevalent in our lives, visual literacy is one more way to reach our students. Students must see that we can view more than just a “text-centric approach” (Piro, 2002, p. 127). No longer solely found in books or other printed matter, valued texts may sometimes be read in a nonlinear manner.

We can integrate the arts more easily by collaborating with colleagues in other areas of the curriculum (Berghoff, Borgmann, & Parr, 2005). This type of teaching helps us incorporate the newest aspect of language arts—viewing and visually representing—into areas such as mathematics. Through activities such as those discussed in this chapter, we can continue to foster literacy development and help students develop a deeper understanding of mathematical concepts.