

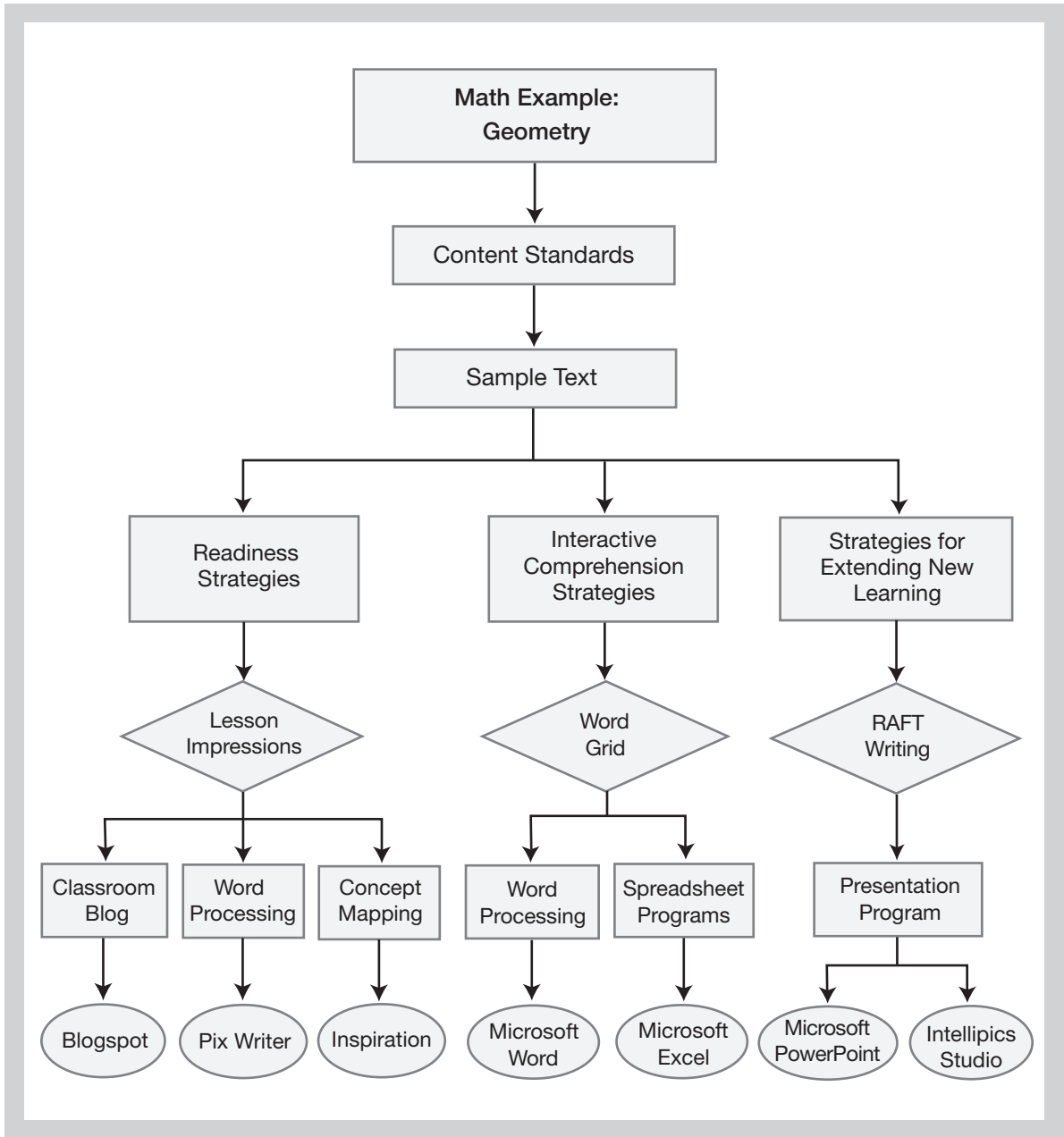
Math:

Content Literacy and Technology

Seeing Forward

In this final content area chapter, you will discover various ways Mr. Cooper employed technology tools to format content literacy strategies to help his students learn about geometry. As you read, notice how Mr. Cooper took full advantage of the Internet and available software options in most Word programs to present the strategies in simple ways that encouraged active student participation. You should also note how these literacy strategies and technology tools have the potential to be applied to teaching and learning topics from a range of content areas.





Classroom Case Study

Teacher: Mr. Cooper

Grade Level: Intermediate

Lesson Topic: Geometry

Content Standards

Content standards applicable to this lesson are:

- Identify and use appropriate terminology for geometrical elements.
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships (NCTM Standard).
- Identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes (NCTM Standard).
- Classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids (NCTM Standard).

Sample Text for This Lesson

What Is Geometry?

Circles, triangles, and squares are shapes. Geometry is the mathematical study of shapes, figures, and positions in space. It is useful in many careers such as architecture and carpentry.

In geometry, measurements and comparisons are made of lines, angles, points, planes, and surfaces. A shape is the outer form of an object or figure such as a circle, triangle, square, rectangle, parallelogram, trapezoid, rhombus, octagon, pentagon, and hexagon. There are equilateral, isosceles, and right triangles. A solid is a three-dimensional figure such as a cube, cylinder, cone, prism, or pyramid. Other solid shapes include the tetrahedron and octahedron. Positions in space are things like points, lines, and angles.

Formulas can be used to figure out the dimensions of shapes and figures. Instruments such as rulers, triangles, compasses, and

protractors are used in geometry. Today, many people also use graphing calculators and computers in geometry.

The Greeks made many contributions to our understanding of geometry. For example, Archimedes is credited as the first to calculate the ratio between a circle's diameter and its circumference, now known as pi. Pythagoras is famous for his theorem, which states that in any right-angled triangle the sum of the squares on the two shorter sides equals the square of the hypotenuse. However, many people think the Egyptians and Babylonians knew this math much earlier.

Readiness

Strategy: Lesson Impression

Technology Applications

Classroom blog, with optional support from concept mapping, standard word processing, and rebus-based word processing.

Software Used in This Lesson

Any of a number of free, classroom blog programs, with optional use of *Inspiration*, *Microsoft Word*, and *PixWriter*.

Recall from Chapter 4 that the lesson impression strategy exposes students to the content to be read by giving them just enough information in the form of key terms and phrases to activate their prior knowledge and develop an "impression," which serves as a prediction to be compared with the actual content. This strategy also gives the teacher valuable impressions regarding the students' understandings of those terms. Presented with the important vocabulary and phrases extracted from the text to be read, students develop an impression in the form of a narrative or a description of what they will be learning, using these words. Students then share their impression with other members of the class.

A classroom blog is a technology application that is especially suited to this strategy, as Mr. Cooper, the fifth-grade math

teacher discovered. A blog is simply a website (a web-based log, hence the term *blog*) where anyone may post information on a particular topic. Once posted, the information can be read and responded to by others. Some blogs are open for posting, viewing, and commenting by the general public; others are developed as private sites with a defined membership and posting controls.

A number of websites offer a system for developing free, safe, and easy-to-use, teacher-controlled classroom blogs (see resources at the end of this chapter for a listing). Teachers initiate a classroom blog through a verification process. Once the classroom blog is registered and the students are signed up, the teacher sets up a posting, or assignment. Students compose a short article related to the assignment, and post it to the blog. In most educational blog sites, there is a system for reviewing postings and comments—the teacher approves the posting, or asks the student to revise it. Once the posting is approved, it is published, and classmates and other audiences read and reply to the article. The teacher also controls the replies, approving comments prior to posting. Thus, the security and social networking features support the literacy process of the classroom blog—submit, revise, approve; comment, revise, approve.

In the example shown in Figure 7.1, Mr. Cooper took words describing geometrical shapes taken from the sample reading selection. He posted these words to a classroom blog, along with directions. An example of his directions, a student response from José, and a comment from Mary are shown.

Even though blogging supports a causal style of writing, Mr. Cooper knew that developing an acceptable posting would not be an automatic process for all his students. His more fluent writers were easily able to compose their post on the blog input screen, but his struggling learners benefited from the literacy support that a word processor or concept mapping software provided. Here are some suggestions, based on Mr. Cooper's experiences, for using alternative technology tools with which to apply lesson impressions.

FIGURE 7.1

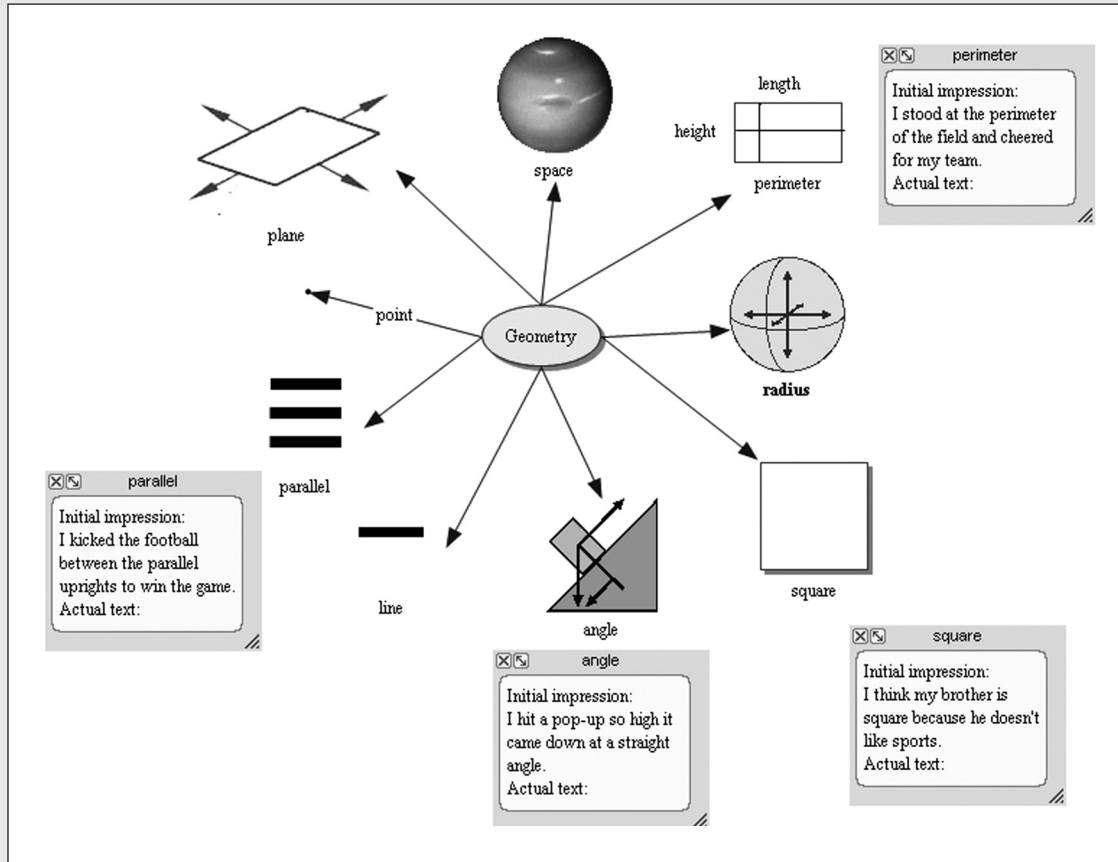
Example of Using Blogs with the Lesson Impressions Strategy

Mr. Cooper said . . .
Geometry in everyday language Post your version of sentences or a short story using the following geometric terms. square parallel point perimeter angle line plane space radius April 10, 2008 2:18 PM
José said...
1. I think my brother is square because he doesn't like sports. 2. I kicked the football between the parallel uprights to win the game. 3. I stood at the perimeter of the field and cheered for my team. 4. I hit a pop-up so high it came down at a straight angle. April 10, 2008 2:21 PM
Post a Comment
Mary said . . . José, what do you mean by "my brother is square"? Is he as tall as he is wide? April 11, 2008 2:21 PM

In using the lesson impression strategy, students use their initial impressions to guide the learning process. As they read, they are directed to pay attention to what they are learning, notice how it compares to their initial impressions, and keep a record of similarities and differences between their initial impressions and the actual text. Mr. Cooper used the program Inspiration as a technology tool in this process. Figure 7.2 is an example of Mr. Cooper's display of the nine "lesson impression" words in a concept mapping format. This map was created during a discussion with the students, using the "rapid fire" tools to form quick and

FIGURE 7.2

**Concept Map of Lesson Impression Strategy,
Showing Diagram and Outline Views**



Source: Diagram created in Inspiration® by Inspiration Software®, Inc.

easy links from the main idea to the impression words. During the interactive discussion, the students were able to recommend pictures for the concepts using the picture library and other clip art sources. Mr. Cooper added a blank note to each concept, and directed his students to write their impressions, sentences, or ideas in this note section. The file was saved as a template, and then synched to his students who had hand-helds and to those

FIGURE 7.2 (continued)

Geometry		
I. square	IV. line	VII. radius
Initial impression I think my brother is square because he doesn't like sports. Actual text	Initial impression Actual text	Initial impression Actual text
II. parallel	V. plane	VIII. point
Initial impression I kicked the football between the parallel uprights to win the game. Actual text	Initial impression Actual text	Initial impression Actual text
III. angle	VI. space	IX. perimeter
Initial impression I hit a pop up so high it came down at a straight angle. Actual text	Initial impression Actual text	Initial impression I stood at the perimeter of the field and cheered for my team. Actual text

with laptop computers. (Obviously, there are other ways to transfer this type of file to student computer work stations besides synchronization for classes that do not have this equipment—uploading to a class or school server, e-mailing, or copying to a disc or flash drive. And for classrooms that operate with only one computer station, the picture and outline views of the file may be printed for student use as worksheets.) Once the template was transferred, Mr. Cooper gave his students the option of composing their thoughts in diagram or the outline view of the program, or of transferring it to a word processor for further input.

In this example, note that José entered impressions for *perimeter*, *parallel*, *angle*, and *square* into the note section, hiding and showing the notes as desired. Once he was satisfied with his

work, he copied and pasted his sentences to his post on the classroom blog. When José began to read the text on geometric terms, he would have the option of switching to the outline view to take notes, comparing his sentences to what the actual text said about each concept. José could choose to compose these thoughts within the Inspiration program itself (it comes equipped with a spell check and word guide feature) or transfer his work to a word processor (such as *Microsoft Word*) for further editing.

For younger students, English language learners, or other students who could benefit from scaffolded literacy support, consider using a specialized word processor. PixWriter is an example of rebus-word processor—one that automatically associates a picture with a word. PixWriter has a library of 6,000 pictures, which are used to reference over 10,000 words. The words are read aloud as they are typed, and students can write in either English or Spanish. One particularly useful feature is the easy-to-use writing set-up, in which students can write by selecting buttons filled with pictures and words. In addition to the extensive picture library, the program has the option of incorporating additional or alternate pictures and clip art for standard picture-vocabulary associations. Figure 7.3 is an example of José's first sentence impression using *PixWriter* with a writing set-up. Once his story is completed, José can copy the text and paste it into his blog posting.

Interactive Comprehension

Strategy: Word Grid

Technology Applications

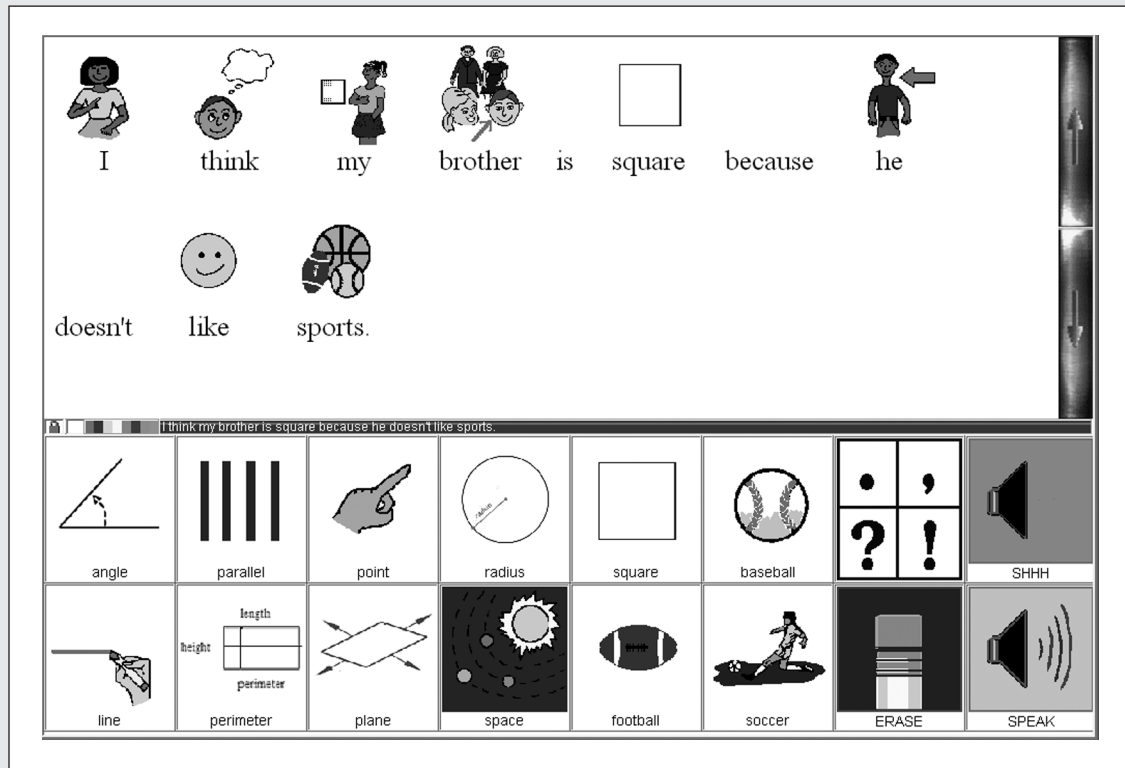
Word processor and personal computers (laptops or hand-helds)

Software Used in This Lesson: *Microsoft Word*

Other possibilities: Spreadsheet programs (as found in *Appleworks*, *Microsoft Works*, or *Microsoft Excel*) *Inspire Data*, *Read and Write Gold* (texthelp)

FIGURE 7.3

**Example of Lesson Impression Strategy
Using PixWriter® by Slater Software, Inc.**



Word grids are often used to teach and to learn critical vocabulary in an organized visual manner. Using a word grid, students record the essential features, concepts, or ideas of key terms in a chart format. When using this strategy, the teacher either assigns key terms to the grid for students to complete, or the students gather related vocabulary words and key features to help build the grid. Using a legend that connects the content term with the feature, students fill in the grid as they progress through an exploration of the topic.

FIGURE 7.4**Example of a Word Grid Using the Tables Feature of a Standard Word Processor**

Geometric Terms	4-Sided	Sides of Equal Length	Sides are Parallel	Others: (list)
parallelogram	yes	no	yes	
polygon				
rectangle	yes	no	yes	
square	yes	yes	yes	

Legend:

yes = feature is present, no = feature is not present, maybe = feature is sometimes present.

Pairing technology with word grids offers the opportunity for students to develop comprehension skills while using technology in the context of a genuine task. Word grids may be developed in several ways.

Mr. Cooper guided his students in developing a word grid from a standard word processor (see Figure 7.4). He demonstrated how to build a 5×5 table, 5 columns and 5 rows, from the table icon on the standard *Microsoft Word* toolbar. He designated the first row (horizontal axis) as a title row, and labeled the first cell in the first row “Geometric Terms.” Together, the class skimmed the text to determine the terms that were being studied, then listed them in the first column (the vertical axis). Next, as they read the textbook and engaged in class discussion, they determined important features of each of these terms, and listed them across the column headings. Finally, they developed a legend: “yes” indicated the feature was present, “no” meant the feature was not present, and “maybe” indicated the feature could sometimes be present. Mr. Cooper then showed his class how to add more columns and more rows to the table in case they were needed for new terms or as yet undescribed features (using `table>insert>row` or `column`).

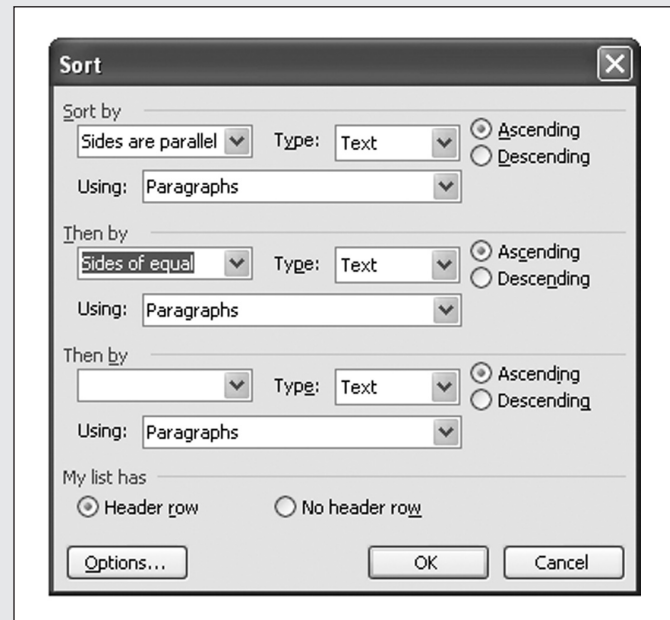
As the students read the selection, they filled in pertinent features of terms listed in the word grid and added new features and new terms as needed. Once the grid was complete, the teacher led a discussion intended to help the students discover the shared and the unique characteristics of the key terms. The example in Figure 7.4 is quite simple. It contains few terms and few features; similarities and differences can easily be discerned visually (e.g., Which of these geometric figures have 4 sides? Which figures do not have 4 sides?). However, many text-based readings have a much greater number of terms and features that need to be analyzed in order to be better understood. In these cases, technology can add efficiency to the process of learning and analyzing the vocabulary terms.

For example, in most word processors, the tables have a sort feature that enables the table content to be sorted by at least three variables. Therefore, the teacher may ask or students may ask of each other or themselves the question, Which figures have parallel sides that are not of equal length?

By activating the sort feature (see screen shot, Figure 7.5), the table order changes. According to this new visual display, the parallelogram and the rectangle are sorted together, each having those characteristics (see Figure 7.6).

FIGURE 7.5

The Dialog Box for the Sort Feature in MS Word 2003®



Microsoft product screen shot reprinted with permission from Microsoft Corporation.

FIGURE 7.6**Example of a Sorted Word Grid**

Geometric Terms	4-Sided	Sides of Equal Length	Sides are Parallel	Others: (list)
polygon				
parallelogram	yes	no	yes	
rectangle	yes	no	yes	
square	yes	yes	yes	

Legend:

yes = feature is present, no = feature is not present, maybe = feature is sometimes present.

TIPS

Consider these other software options:

- This basic concept of using technology in the context of a genuine task—in this case developing word grids—could be extended to other software programs. Spreadsheets, such as those offered in *Appleworks*, *Microsoft Works*, and *Microsoft Office (Excel)*, are excellent tools for developing charts and graphs. Spreadsheets have much greater sorting and analysis capabilities than the simple options shown in the word-processing tables. A number of resources are available to assist teachers in developing lessons for analyzing data. They are listed in the resources section at the end of this chapter.
- Some students might benefit from text-to-speech features, or having the content of the word grid read aloud. Read and Write Gold (Texthelp) is a software package that functions as an add-on toolbar designed to provide text-to-speech capabilities and other literacy supports to most computer programs. It is currently available for installation on computers or network servers, or as a portable USB device that could be used with any computer without program installation.
- *InspireData* is a new software program from Inspiration, Inc. that is designed to assist students in depicting visual displays of data. This program may be useful in the development and analysis of the content of large word grids.

- Finally, for teachers who are still struggling with the one-computer classroom, using a word processor to construct word grids is still possible. Although it will not be possible for students to use the interactive features of the word processor without access to individual stations, the teacher may still use word processing or spreadsheets to construct the grids and print them on paper for the students to complete.

Extending New Learning

Strategy: RAFT Writing

Technology Applications

Digital storytelling using presentation programs, student access to computers for individual use or use by teams

Software Used in This Lesson: Microsoft PowerPoint

Other Possibilities: HyperStudio, Intellipics Studio

Writing in math is a powerful tool. It offers students the opportunity to articulate their thoughts for themselves and others and provides teachers with insights into students' knowledge and understanding (Sibley, 2003). By writing in math, students learn to express mathematical ideas in ways that make sense to them and further develop their ability to communicate mathematical concepts through more conventional representations. Standards from the National Council for Teachers of Mathematics (NCTM) support nurturing the ability to write about mathematics across the grades. Furthermore, math standards in communication state that:

Instructional programs from pre-kindergarten through grade 12 should enable all students to—

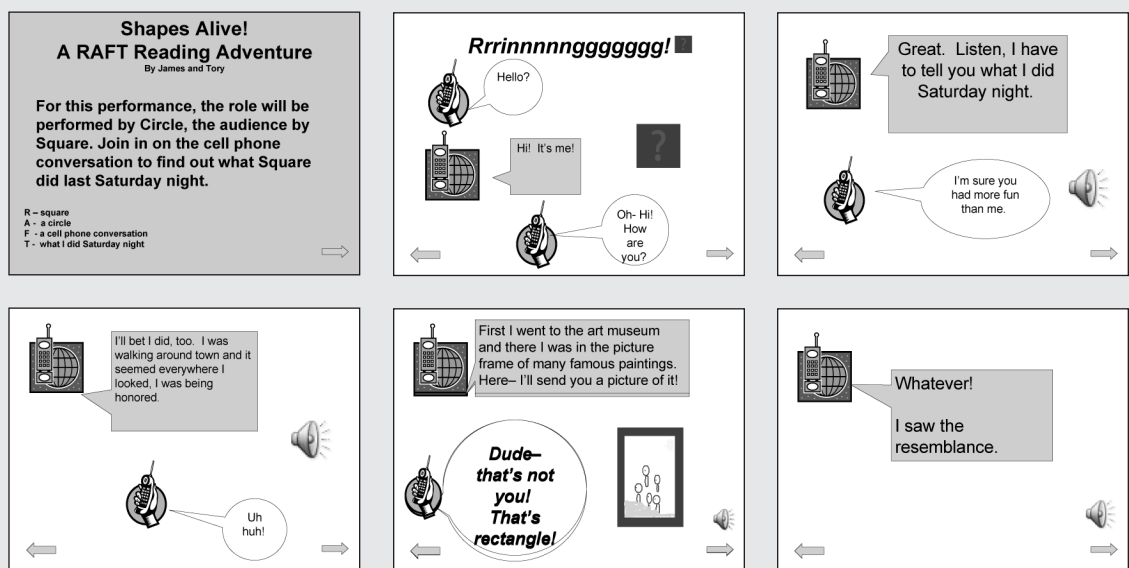
- organize and consolidate their mathematical thinking through communication;
- communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- analyze and evaluate the mathematical thinking and strategies of others;
- use the language of mathematics to express mathematical ideas precisely. (NCTM, 2000)

The RAFT writing strategy is well suited to encourage these abilities. Recall that students use the letters of the RAFT acronym (R—role of writer; A—audience; F—format; T—topic) to write a short topic-focused piece based on newly learned information, processes, and concepts. The designations for each letter of RAFT can either be given to the students or the students can be allowed the freedom to choose their own role, audience, and format when composing a RAFT. In this example, Mr. Cooper paired the RAFT strategy with digital storytelling procedures. He used the following steps when incorporating RAFT. (These steps were modified from advice on using digital books to teach math, developed by Wilkerson, 2001.)

1. The first step was to identify the mathematical concept(s) to be addressed. In this case, the concept was the occurrence of geometric shapes in everyday life.
2. Mr. Cooper determined that his students would create the digital stories as an extension of their learning about geometric shapes. (Other uses for digital stories include introductory, developmental, and review lessons.)
3. He identified the RAFT strategy to guide the character(s) and story line, and worked with the students to create individual RAFT outlines.
4. He then asked the students to create a storyboard—developing the script and sketches of the pictures they would use in each slide. He limited their assignment to between 5 and 10 slides.
5. Mr. Cooper gave the students a choice of presentation format (e.g., *HyperStudio* or *PowerPoint*) and set up a template for the project—title page and 5 slides with forward and back navigation buttons. He organized the digital cameras for check-out and made the classroom scanner available. After the students had developed a storyboard sketching out the contents of each slide, he directed them to gather pictures using the camera, scanners, clip art, and drawing software.
6. Using the presentation software, the students put their book together, using text, pictures, and recording their own narrations.

FIGURE 7.7

Example of Using a Digital Story with the RAFT Writing Strategy



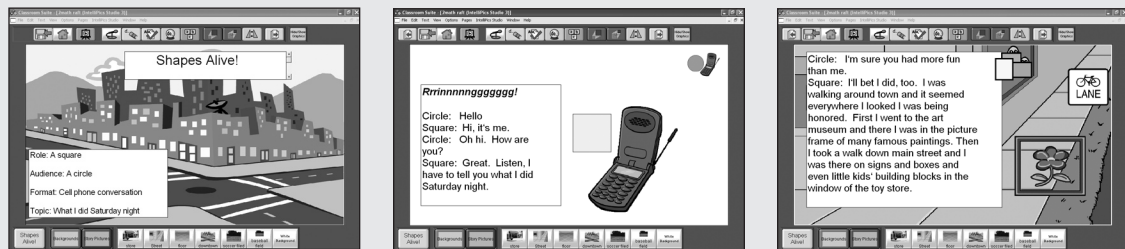
Source: Diagram created using PowerPoint® by Microsoft, Inc.

then put the script, pictures, and narration together in the template developed by the teacher. The example shown in Figure 7.7 was developed in *PowerPoint*, using *Microsoft Office* clip art and drawing features.

Some students benefit from a presentation program that offers more structure to develop their digital stories. Figure 7.8 takes James and Tory’s RAFT and inserts it into the storybook template from the program *Intellipics Studio* (Intellitools, Inc.). Using the same RAFT theme, teachers can set up the basic template, entering a choice of backgrounds and pictures appropriate for young children from the program’s picture library into pre-set buttons. As the students write their story, they have access to literacy controls, such as text to speech, word prediction, and spell checking. They are able to illustrate their story by clicking on the pre-set pictures from buttons at the bottom of the screen.

FIGURE 7.8

RAFT Writing Using a Template from Intellipics Studio®



Source: Diagram created using Classroom Suite® by Intellitools, Inc. Used with the permission of Intellitools, Inc.

Mr. Cooper may take further advantage of the RAFTing strategy by forming groups of four students to create story problems based on the RAFTs. Using the RAFT about rectangles, the first student in one of the groups wrote the first sentence of the problem: "On an evening walk I came upon a sign with two sets of parallel lines." The second student picked up the story problem by writing: "The parallel lines also looked like they were the same length." The third student added: "To be sure I pulled out my T-ruler and compass, and sure enough both sets of lines were parallel and all four lines were the same length. What shape was it?" The fourth and final student of the group had to answer the question in the final line of the story problem: "The sign was in the shape of a rectangle called a square." Mr. Cooper had the other group members verify the answer and discuss the problem as a group to make any necessary revisions. Groups then exchanged their story problems for further practice in applying new understandings.

TIPS

Wilkinson (2001) offers the following tips for developing digital stories for math:

- Keep length short (5–15 frames is sufficient).
- Keep text short and images simple.

- Use audio capability as needed (e.g., provide button for non-readers to have book read to them).
- Include page forward and back options (to allow reader to “flip” pages back and forth).
- Maintain a story line.
- Save in read-only format.
- If students are creating their own, give them a basic format and include a rubric.
- Be aware of copyright issues and the possibility of infringement.
- Use consistent background and text fonts as appropriate.
- Use a clip art file appropriate for young children.
- Encourage students to create their own designs and images using a digital camera or drawing software. (p. 60)

Looking Back

As you discovered, Mr. Cooper’s math class enjoyed the benefits of his imaginative applications of technology-mediated content literacy strategies for learning geometry terms and concepts. Mr. Cooper presented lesson impressions, word grids, and RAFT writing in ways that stimulated students from all ability levels to respond actively, generate meaningful ideas, and reflect on new understandings. Mr. Cooper knew that he could sustain the students’ attention to learning by giving them opportunities to interact with geometry content using digital formats at each phase of the lesson. You also learned that commonly available software can be versatile tools in the hands of content teachers. Be sure to reflect on the multiple applications of technology by the teachers showcased in Chapters 4, 5, 6, and 7, and consider how the various technology tools can serve your own strategic content teaching.

Questions for Study

- Which technology applications and content literacy strategies employed by Mr. Cooper can you and your colleagues most readily put to use in teaching lessons from your own curriculum?

Think about how this could be accomplished with a specific topic, a specific literacy strategy, and a specific technology application.

- Among the descriptions and references to multimedia made in this chapter, which would you like to learn more about? In your role as a literacy coach, classroom teacher, or administrator, establish and/or participate in a team that gathers useful information about and skills with this software?

References

- NCTM. (2000). *Standards for school mathematics*. Accessed on June 12, 2007, from <http://standards.nctm.org/document/chapter3/comm.htm>
- Silbey, R. (2003, April). Math out loud! *Instructor*, 7, 112.
- Wilkerson, T. (2001). Reading and writing the digital way: Using digital books to teach math. *Learning and Leading with Technology*, 29(3) 42–45, 60–61.

Resources

General:

- National library of virtual manipulatives: <http://nlvm.usu.edu/en/nav/vlibrary.html>
- Video clips: www.unitedstreaming.com/
- Digital Storyteller, a Web-based tool to construct narratives: www.digitalstoryteller.org/
- Classroomclipart.com
- Fusion www.writerlearning.com/
- Free source of pictures for noncommercial purposes: Flickr (www.flickr.com)
- English/Spanish translation of math terms: www.math.com/tables/spanish/eng-spa.htm

Safe blogging for classrooms:

- The Blog-Meister, created by educator and speaker David Warlick: <http://classblogmeister.com>
- Blogspot: www.blogspot.com
- E-pals: www.epals.com
- IMBEE: www.imbee.com/
- Center for Technology and Teacher Education's blogging activities page: www.teacherlink.org/content/blog