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Prereading Strategies and Activities

Review/Preview Process
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Chapter One begins with the Review/Preview process. Later strategies and activities refer back to this process.

Quick Teaching Tip: Expect resistance.

Students often balk at reading geometric content. I try to focus on the notion that many of my students resist out of fear of the unknown or of failure and I am the motivator and guide who will lead them down the path to success. Therefore, at the start of the school year, I use familiar activities or strategies that have yielded success in the past. When I try a new strategy later in the year, I expect I will need to demonstrate to the class how to do it and I also plan on working with some students individually. Incorporating peer work throughout the lesson plans, even during prereading activities, can be a great motivator. But remember that *you* are the guide and must keep your students on track.

Prelude

The strategies and activities explored in this chapter prepare students to read and learn efficiently from the text. Doing activities before reading the lesson may seem backward or at least time-consuming. Students typically skim through the content, perhaps focusing on some of the worked-out examples, and then go right to the assigned problems. If they instead prepare themselves to learn, they change their thinking from what they were doing last to what they need to do next: read and retain the content.

Every subject in academia is unique in terms of what students learn, why they learn it, and how they learn it. Geometry is the science or study of visual thinking. Thus, the geometry textbook often looks different from an algebra or an English textbook. Certainly there are more diagrams. Many pages contain long processes and proofs spelled out in logical and numbered steps. Other geometry texts contain paragraph-style proofs that students will need much practice both writing and reading to understand and do correctly. If the section in the textbook contains many written constructions, students will find it helpful to have pencil, paper, straightedge, and compass handy. Even if the prereading strategy is merely to scan topics, titles, captions, and diagrams, students who do this preparation will be better able to read and reflect on the content.

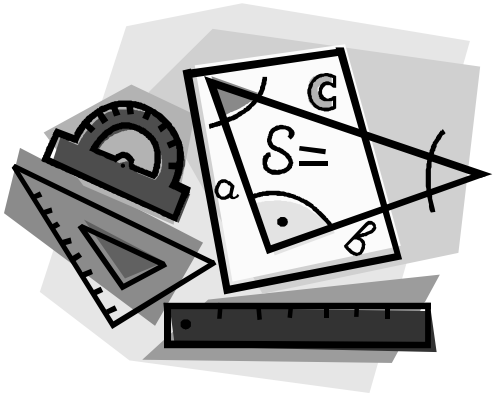
As teachers of mathematics, we are often limited by time constraints and the amount of content we are obliged to cover. Some of us may feel that teaching reading is not a priority. In fact, we are actually preparing students to read and learn from reading geometric text. If we choose one or two prereading strategies and assign these often and regularly, students may naturally incorporate this strategy into their personal learning or studying process. A good learning process for a day in geometry class would have students complete the prereading activity, read the lesson, reflect and share with the class what they have learned, and do the assigned homework problems as a class, in small groups, or individually. Moreover, if we address the reading of content early and regularly in the course, we may instill learning habits that successfully carry over to other courses. Our students may become effective readers and successful communicators of geometry and mathematics.

The *Principles and Standards for School Mathematics of 2000* (NCTM, 2000) encourage students to "understand how mathematical ideas interconnect and build on one another to produce a coherent whole" (p. 354). It is essential that the geometry lessons enable students to focus their potential. The lessons should be selected with these criteria in mind:

- Does the lesson promote discussion among the students?
- Does the lesson improve students' comprehension of mathematical concepts?

- Does the lesson lend itself to real-world relevance, thus leading students to make important connections?

These may seem like lofty goals, but I am never disappointed when I guide my students in this direction. I've created the following activities and strategies with these criteria in mind.



Review/Preview Process

WHAT? Description

The review/preview process, which takes place prior to the students' reading of the text, has two parts: (1) teachers present a review of the prerequisite or background material needed to understand the new content and (2) students preview the new content.

To review the background content, teachers should do one or more of the following:

- Summarize background material.
- Pose a problem from the background material.
- Share a historical anecdote regarding the new concepts.
- Present an interesting problem for the students to solve after they have read and learned the new content.
- Sketch an appropriate geometric figure, labeling or pointing out the necessary parts.

To preview the assigned reading, students should complete the following tasks:

- Note the title.
- Note all subheads.
- Note all boxed or highlighted definitions and theorems.
- Note all pictures and graphics.
- Note all other boxed or highlighted special sections, such as biographies of mathematicians or special applications.

WHY? Objectives

Geometry students who learn and use the review/preview process can:

- Recall necessary mathematical concepts and processes.
- Connect previously learned concepts with new concepts.

- Approach new content with curiosity and interest.
- Pose questions regarding new concepts and anticipate the answers to these questions.
- Delineate or categorize different methods or concepts regarding the main topics from the text.

HOW? Example

The lesson that follows gives a review/preview worksheet. Students may use the questions in the worksheet to assist in the review/preview process.

Review/Preview Process

NAME _____ DATE _____

ASSIGNMENT: Briefly answer the following questions as you preview the section on _____ on pages _____.

List all titles and subtitles from the new content.
What background concepts do I need to know?
What new geometric shapes or concepts do I anticipate learning?
What questions do I have regarding the new content?

Knowledge Ratings

WHAT? Description

Charts that ask the student to assess their prior knowledge are called *knowledge ratings* (Blachowicz, 1986). The teacher presents students with a list of geometric concepts or topics and surveys their knowledge on these topics.

WHY? Objectives

The knowledge rating process allows geometry students to:

- Understand their capabilities and review their knowledge base.
- Target problem areas and make study plans.
- Point out to the teacher areas that may present difficulties for them.

HOW? Example

The following lessons show how knowledge ratings can be used for different geometry lesson plans. A template for use in creating lessons is included.

Knowledge Ratings: Triangles

NAME _____ DATE _____

ASSIGNMENT: How much do you know about these terms? Put an X in the spaces that signal your knowledge.

	A Lot!	**Some**	**Not Much**
Right triangle			
Isosceles triangle			
Acute triangle			
Obtuse triangle			
Scalene triangle			
Sine			
Cosine			

Knowledge Ratings: Lines and Angles

NAME DATE

ASSIGNMENT: How much do you know about the geometric concepts listed in the table? Put an X in the spaces that signal your knowledge.

	Can Define	Can Give an Example	Can Sketch Basic Graph	Am Totally Lost
Parallel				
Perpendicular				
Transversal				
Vertical angles				
Alternating interior angles				
Adjacent angles				
Complementary angles				
Supplementary angles				

Knowledge Ratings: Polygons

NAME _____ DATE _____

ASSIGNMENT: How much do you know about the geometric shapes listed below? Put an X in the spaces that best signal your knowledge.

	Can Define	**Can Give Formula or Explain How to Find Area**	**Can Sketch the Basic Shape**	**Can Give Sum of All Vertex Angles**
Quadrilateral				
Rectangle				
Trapezoid				
Pentagon				
Hexagon				
Octagon				

Knowledge Ratings: Template

NAME _____ DATE _____

ASSIGNMENT: How much do you know about _____? Put an X in the space that best describes your knowledge.

Anticipation Guides

WHAT? Description

Anticipation guides (Herber, 1978) are lists of statements that challenge students to explore their knowledge of concepts prior to reading a text. As they then read the text, they discover explanations of the concepts. A mathematical anticipation guide usually contains four to five statements, each with two parts. In the first part, the student is asked to agree or disagree with each statement. The second part then asks the student to read the text. After reading the text, the student determines whether the text agrees or disagrees with each statement.

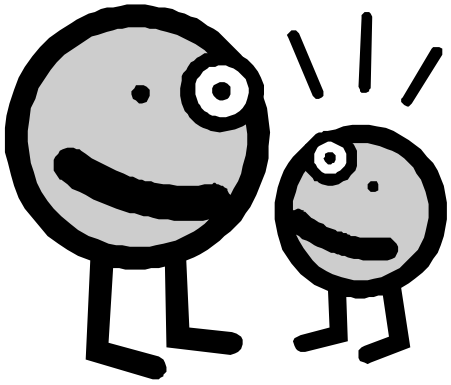
WHY? Objectives

Anticipation guides allow and motivate geometry students to:

- Complete anticipation charts.
- Explore their opinions and prior knowledge of geometric concepts.
- Read closely to find evidence to support their claims or discover the text's view.
- Uncover and identify any misconceptions regarding these concepts.

HOW? Examples

The following lessons are just a few ways to approach anticipation guides.

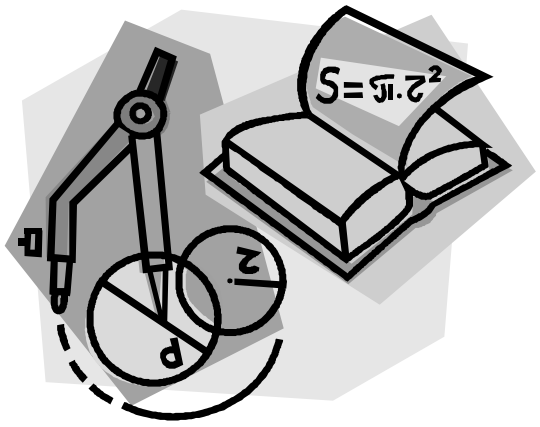


Anticipation Guides: Circles

NAME _____ DATE _____

ASSIGNMENT: In the column labeled **Me**, place a check next to any statement with which you **agree**. After reading the section, consider the column labeled **Text** and place a check next to any statement with which the text agrees.

Me	Text	
_____	_____	1. A circle is the set of points that are all the same distance from a center point.
_____	_____	2. Pi is equal to the circumference of a circle divided by its radius.
_____	_____	3. A tangent line touches the circle at exactly one point.
_____	_____	4. The diameter is the longest chord on a circle.
_____	_____	5. The formula for the area of a circle is $A = 2\pi r$.



Anticipation Guides: Polyhedra

NAME _____ DATE _____

ASSIGNMENT: In the column labeled **Me**, place a check next to any statement with which you **agree**. After reading the section, consider the column labeled **Text** and place a check next to any statement with which the text agrees.

Me	Text	
_____	_____	1. There are exactly five Platonic solids.
_____	_____	2. A Platonic solid is a regular polyhedron.
_____	_____	3. Polyhedra are three-dimensional solids with polygons for faces.
_____	_____	4. A sphere is a polyhedron.
_____	_____	5. $V + F = E - 2$ (where V = number of vertices, F = number of faces, and E = number of edges) holds for all polyhedra.

Anticipation Guides: Euclidean Geometry

NAME _____ DATE _____

ASSIGNMENT: In the column labeled **Me**, place a check next to any statement with which you **agree**. After reading the section, consider the column labeled **Text** and place a check next to any statement with which the text agrees.

Me	Text	
_____	_____	1. Euclid described a point as "that which takes up no space."
_____	_____	2. Euclidean geometry contains five postulates or assumptions.
_____	_____	3. The undefined terms for this geometry are *point, line,* and *angle.*
_____	_____	4. A theorem is a mathematical statement that is proven from the postulates and other proven theorems.
_____	_____	5. The fifth postulate is called the parallel postulate.

PreP (Prereading Plan)

WHAT? Description

The prereading plan (PreP) (Langer, 1981) is a group brainstorming activity. The teacher guides students in activating, sharing, and fine-tuning prior knowledge. Initially, the teacher chooses one of the key concepts of the reading or lesson and then guides the students in brainstorming of this concept. Langer suggests that the teacher follow a three-step process to guide the students' collective thoughts:

1. *Initial associations.* The teacher asks, "What comes to mind when you hear . . . ?" The teacher writes the student responses on the board.
2. *Secondary reflections.* The teacher asks individual students about their responses: "What made you think of . . . ?" The teacher writes these reflections on the board.
3. *Refining knowledge.* The teacher asks, "Do you have any new ideas or thoughts after hearing your peers' ideas?" The teacher writes new ideas on the board.

WHY? Objectives

Through the group brainstorming process, students will:

- Activate prior knowledge.
- Hear and reflect on peers' ideas.
- Clarify, refine, and enlarge their knowledge.

HOW? Example

Here is how the three-step process works with the concept of triangle:

1. *Initial associations.* Students might identify ideas that come to mind with the word *triangle*—for example, a plane figure, a right triangle, and angles.
2. *Secondary reflections.* When the teacher asks the students how they came up with those ideas, the students respond in this way: for *plane figure,* "three sides that are line segments"; for *right triangle,* "has one 90-degree angle"; and for *angles,* "measures sum up to 180 degrees."
3. *Refining knowledge.* The discussion yielded these new ideas from the students: "There are obtuse triangles, containing one angle greater than 90 degrees, and acute triangles, containing one angle less than 90 degrees," and "Trigonometry is used to find measures in right triangles."

Problem-Solving PreP

The National Council of Supervisors of Mathematics (1988) states that the principal reason for studying mathematics is to learn to solve problems.

WHAT? Description

Problem solving is the process of resolving the confusion or mystery of an unfamiliar situation. The twentieth-century mathematician George Polya devoted his life to helping students become good problem solvers. In his famous book *How to Solve It* (Polya, 1973), he outlines a four-step process for solving problems:

1. *Understand the problem.* Read, reread, make a guess, restate the problem, and/or rewrite the question.
2. *Devise a plan.* Draw a picture, construct a table or graph, use a model, find a pattern, work backward, and/or use a formula or equation appropriate to solving the problem.
3. *Carry out the plan.* Write out work, solve an equation, and/or recheck work.
4. *Look back.* Verify or check the solution referring to the initial problem, reread the problem, generalize to a larger problem, pose questions for further exploration, and/or compose related problems.

During the problem-solving prereading (PreP) process, students follow a guided reading format to help hone their problem-solving skills. They can use this process prior to or during a section covering geometric applications.

WHY? Objectives

The problem-solving PreP process asks geometry students to:

- Spend time reading problems for understanding.
- Find personal meaning by rewriting problems in their own words.

- Practice using different strategies to solve problems.
- Focus on the understanding phase of problem solving.
- Build confidence in their ability to solve problems.

HOW? Examples

The lessons that follow provide good examples.

Problem-Solving PreP

NAME DATE

ASSIGNMENT: Read the word problem. Then use the instructions in the box to solve it. Refer to the list of problem-solving strategies to complete the "Devise a Plan" section in the box.

Problem: A right triangle with sides that measure 6 inches, 8 inches, and 10 inches has a square constructed off each of the three sides (for example, the 6-inch side has a square with each side length of 6 inches). Which is greater: The sum of the areas of the two squares of the two shorter sides or the square of the longer side?

Problem-Solving Strategies

- Draw a picture.
- Guess and check.
- Sketch a table or graph.
- Find a pattern.
- Work backward.
- Use a formula or equation.
- Use a model.

UNDERSTAND: Rewrite the problem in your own words.
UNDERSTAND: Make a guess, and explain your reasoning.
DEVISE A PLAN: Choose one of the problem-solving strategies listed above.
CARRY OUT THE PLAN: Use the strategy to solve the problem.
LOOK BACK: Create a similar problem.

Problem-Solving PreP

NAME _____ DATE _____

ASSIGNMENT: Read the word problem. Then use the instructions in the box to solve it. Refer to the list of problem-solving strategies to complete the "Devise a Plan" section in the box.

Problem: Imagine that the earth is a perfect sphere and its circumference is exactly 25,000 miles at the equator. Now imagine that a band is placed around the earth directly above the equator. The circumference of the band is 10 feet longer than the circumference of the earth. Is it possible to place a 12-inch ruler between the earth and the band?

Problem-Solving Strategies

- Draw a picture.
- Guess and check.
- Sketch a table or graph.
- Find a pattern.
- Work backward.
- Use a formula or equation.
- Use a model.

UNDERSTAND: Rewrite the problem in your own words.
UNDERSTAND: Make a guess, and explain your reasoning.
DEVISE A PLAN: Choose one of the problem-solving strategies listed above.
CARRY OUT THE PLAN: Use the strategy to solve the problem.
LOOK BACK: Create a similar problem.

Problem-Solving PreP

NAME _____ DATE _____

ASSIGNMENT: Read the word problem. Then use the instructions in the box to solve it. Refer to the list of problem-solving strategies to complete the "Devise a Plan" section in the box.

Problem: The Hobbits Bilbo, Frodo, and Samwise each live along a circle with a market as the center of the circle. The circumference of the circle is 2 miles. If each of their houses is an equal distance from the center of the circle, what is that distance?

Problem-Solving Strategies

- Draw a picture.
- Guess and check.
- Sketch a table or graph.
- Find a pattern.
- Work backward.
- Use a formula or equation.
- Use a model.

UNDERSTAND: Rewrite the problem in your own words.
UNDERSTAND: Make a guess, and explain your reasoning.
DEVISE A PLAN: Choose one of the problem-solving strategies listed above.
CARRY OUT THE PLAN: Use the strategy to solve the problem.
LOOK BACK: Create a similar problem.

Problem-Solving PreP: Template

NAME _____ DATE _____

ASSIGNMENT: Read the word problem. Then use the instructions in the box to solve it. Refer to the list of problem-solving strategies to complete the "Devise a Plan" section in the box.

Problem:

Problem-Solving Strategies

- Draw a picture.
- Guess and check.
- Sketch a table or graph.
- Find a pattern.
- Work backward.
- Use a formula or equation.
- Use a model.

UNDERSTAND: Rewrite the problem in your own words.
UNDERSTAND: Make a guess, and explain your reasoning.
DEVISE A PLAN: Choose one of the problem-solving strategies listed above.
CARRY OUT THE PLAN: Use the strategy to solve the problem.
LOOK BACK: Create a similar problem.

Wordsmithing

WHAT? Description

A *smith* is someone who makes or works at something specified. A *wordsmith* is a person who makes and experiments with new words. Often these words are new terms to the reader, or they might be a corruption or an unusual restating of the original term. For example, a wordsmith might refer to a graphing calculator as a *graphulator*. A geometric wordsmith must have a good grasp on the definition and features of the related geometric term in order to change the term in an appropriate or revealing manner.

In the following wordsmithing activity, students use a three-column matrix and search the text for new geometric terms, which they write in the first column of the matrix. Then they guess what each term means and write this guess in the second column. Next, they look in the text for the definition of the term and write it in the last column. Finally, they choose at least one of the new terms and rewrite it in an interesting or unusual fashion, using words or parts of words that uncover or reveal the often unspoken meaning of the term.

WHY? Objectives

Wordsmithing asks geometry students to:

- Learn the definition of new geometric concepts or terms.
- Self-assess their ability to define new geometric terms.
- Gain confidence in learning new geometric terms.
- Think of themselves as geometric wordsmiths.

HOW? Examples

See the lessons for wordsmithing matrices.

Wordsmithing: Matrix

NAME _____ DATE _____

ASSIGNMENT: Guess what each term means, and write your guess in column 2. Then use the text to find the correct definition, and write it in column 3.

New Term	Your Definition (a good guess)	The Text's Definition
rectangle		
parallelogram		
trapezoid		
rhombus		
kite		
quadrilateral		

Now try your hand at wordsmithing. Two examples are given.

rectangle = _____
parallelogram = pairs-o'-parallel
trapezoid = _____
rhombus = _____
kite = _____
quadrilateral = four-of-sides

Wordsmithing: Matrix

NAME _____ DATE _____

ASSIGNMENT: Guess what each term means, and write your guess in column 2. Then use the text to find the correct definition, and write it in column 3.

New Term	Your Definition (a good guess)	The Text's Definition
sphere		
the shell of a ball		
all points in 3-space equidistant from a center point		
prism		
pyramid		
cylinder		
cone		

Now try your hand at wordsmithing. Two examples are given.

sphere = ball-points or ball-shell
prism = _____
pyramid = _____
cylinder = rectangle round
cone = _____

Wordsmithing: Matrix Template

NAME _____ DATE _____

ASSIGNMENT: Guess what each term means, and write your guess in column 2. Then use the text to find the correct definition, and write it in column 3.

New Term	Your Definition (a good guess)	The Text's Definition

Now try your hand at wordsmithing.

_____ = _____

_____ = _____

_____ = _____

_____ = _____

_____ = _____

_____ = _____