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Research on Mathematics and Literacy

Meeting Needs in Today’s Classrooms

More than ever before, there is a need to boost students’ understanding of mathematics in all grade levels. “We must expect all of our students to learn mathematics well beyond what we previously expected. We need all students to be more proficient than in the past, and we need many more students to pursue careers based on mathematics and science” (Seeley 2005). There is also great need for more effective instruction in reading comprehension using nonfiction texts. In a study published in 2000 by Michigan State University education researcher Nell Duke, it was reported that first graders were exposed to an average of 3.6 minutes of informational text per day. Students in low socioeconomic groups were exposed to less than two minutes of informational text per day (Collier 2006). Today’s world is focused on information. The advent of the Internet has put countless informational resources at our fingertips. Students will be ill-equipped in the real world unless they are exposed to informational texts in schools. Nonfiction texts are also prevalent on high-stakes tests. “Reading nonfiction materials would increase students’ depth of knowledge in the content areas, and probably help students score higher on the standardized tests that are of such concern to teachers and administrators” (Ivey and Broaddus 2000).

Current research by the National Council of Teachers of English shows that students have difficulty learning when subjects are taught in isolation (NCTE 1993). “When language skills are embedded in meaningful contexts, they are easier and more enjoyable for children to learn. In the same way, numbers and their operations, when embedded in meaningful real-world contexts, give children the opportunity to make sense of mathematics and to gain mathematical power” (NCTM 2000).

Mathematics Readers is a mathematics-based reading program. It combines effective instruction in nonfiction reading-comprehension strategies with standards-based mathematical content. Although literacy continues to be the primary focus in today’s schools, it is essential that teachers do not decrease instructional time spent in other crucial content areas. This program efficiently integrates instruction in mathematics and reading comprehension with a collection of engaging readers that focuses on mathematical concepts. Nonfiction writing assignments are also provided as extensions to what is being taught in the mathematics and reading lessons. Each reader is written around real-life situations that are applicable to the students. The readers include captivating photographs, interesting facts and captions, engaging questions, problem-solving scenarios, and leveled text. Nonfiction features, such as tables of contents, glossaries, and indices, are also included. All of the readers are organized by mathematical content strands to give the students a base of vocabulary and understanding on which to build more comprehension.

The teacher’s guide offers lesson plans and teaching suggestions for both the reading and mathematics components. As a result, the teachers are able to engage students, address different learning styles, and develop student understanding that leads to higher-level thinking. This program will support teachers’ effective mathematics instruction while boosting general reading skills.
How to Use This Product (cont.)

Components of the Product

Timeline for the Unit

- This chart provides information to help you organize your scheduling of the unit. It estimates how long each part of each lesson will take to complete with your class.

Objectives

- Listed here are the mathematics, reading, and writing objectives for the lesson plans. Each pair of readers has the same objectives so that students are focused on learning the same skills and concepts.

Introduction to Mathematics Vocabulary

- Each set of lessons has an introductory activity for the mathematics vocabulary. This activity introduces the key mathematics words for the unit and is completed as a class.

Using the Readers

- This section begins the actual lesson plan for working with students as they read the readers. This is the first page of the lesson plan. In total, there are three sections: Before Reading, During Reading, and After Reading. Many of the activities and questions can be used in any order that you would like. You do not need to follow the step-by-step directions to be successful with these activities.
Components of the Product (cont.)

Student Reproducibles

- There are many student guided practice pages throughout the unit. These pages can be completed individually as seatwork, in small groups at centers, or as homework.

- Every reader has a page like this one, which relates directly back to the Let's Explore Math boxes in the reader. Students may want to refer back to the reader to get further information to solve the problems.

Focused Mathematics Lesson

- As students finish with the reader, move into the whole-class mathematics lesson. The lesson focuses on key mathematical skills and concepts. These activities can be completed during mathematics time in support of what you have done during your reading block.

Using the Problem-Solving Transparencies

- Each lesson has a problem-solving overhead transparency. Use these transparencies in small group lessons or for whole-class activities. The real-life problems on the transparencies support the mathematical concepts of the readers.

- There is a total of 16 transparencies. Eight of the transparencies match the problem-solving activities in the readers. The other eight were created to support this integration of mathematical skills and problem-solving strategies.
How to Use This Product (cont.)

Components of the Product (cont.)

Assessment Strategies

Assessment is an integral, important part of this unit of study. You can gain insight into students’ learning through written pre-tests, small-group observations, analysis of written assignments, the diagnostic test, and the culminating activity. These frequent formal and informal assessments provide the data needed to make informed decisions about what to teach and how to teach it. This is the best way to know who is struggling with various concepts and how to address the difficulties that students are experiencing with the curriculum.

There are several points throughout each lesson where useful evaluations can be made. Depending on the results, you can decide to continue with the lesson as planned or change gears to reteach or reinforce concepts.

- **Before the Focused Mathematics Lesson**—By giving the lesson pre-test, you can determine on which aspects of the lesson to focus. You can also use this assessment to differentiate instruction. Students who do well on the pre-test can complete the enrichment challenges, while students who do not get all of the questions correct should participate in the lesson and may need some reteaching opportunities.

- **After Assessing Prior Knowledge**—The warm-up mathematics vocabulary activity provides opportunities to assess students’ prior knowledge. During these activities, you may realize that students have a strong understanding of the concepts being introduced. Or, it may become clear that students are weak in these concepts. Analyzing students during these introductory activities will help you adjust lessons as necessary.

- **During Guided Practice**—Within these lessons, practice problems are provided for teacher modeling as well as student practice. Use this time to assess whether students have comprehended the lesson concepts and are on their way to mastery.

- **Diagnostic Assessment**—Use the Diagnostic Test as a **pre-test** and as a **post-test** to gauge students’ overall progress. If used as a post-test, the pre-tests from the individual units are great study guides. Have students review their pre-tests and re-solve the problems in preparation for the final test. A **Diagnostic Test-Item Analysis** is included on the CD (testitem.pdf; testitem.xls).

- **Final Authentic Assessment**—A culminating activity has been included in this unit. The activity allows students to apply what they have learned throughout the unit in an engaging, interactive way. Students can take what they have learned and use that information to create new ideas in a real-life context.
Understanding Angles Teacher Resources

The Winning Angle and Basketball Angles

Timeline for the Unit

<table>
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<th>Day</th>
<th>Mathematics</th>
<th>Language Arts</th>
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</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>Complete the Introduction to Mathematics Vocabulary and the Before Reading activities. (30 min.)</td>
<td>Complete the Before Reading activities. (30 min.)</td>
</tr>
<tr>
<td>Day 2</td>
<td>Begin the During Reading activities. Assign the student activity sheet. (30 min.)</td>
<td>Begin the During Reading activities. (60 min.)</td>
</tr>
<tr>
<td>Day 3</td>
<td>Finish the During Reading activities. Complete the After Reading activities. (45 min.)</td>
<td>Finish the During Reading activities. Complete the After Reading activities. (45 min.)</td>
</tr>
<tr>
<td>Day 4</td>
<td>Do the Focused Mathematics Lesson. (60 min.)</td>
<td>Have students reread the readers or do the extension activities.</td>
</tr>
<tr>
<td>Day 5</td>
<td>Complete the Problem-Solving Lesson. (45 min.)</td>
<td>Reread, if necessary, or complete the extension activities.</td>
</tr>
</tbody>
</table>

OBJECTIVES

- **Mathematics:** Students will understand and be able to determine the different types of angles.
- **Nonfiction reading:** Students will make inferences about the text.
- **Nonfiction writing:** Students will create biographical sketches of famous athletes.
The Winning Angle and Basketball Angles (cont.)

Materials
- paper and pencil
- various angles (acute, obtuse, and right) drawn on construction paper
- protractors

Introduction to Mathematics Vocabulary

1. Draw the three angles on the board: a right angle, an obtuse angle, and an acute angle. Explain the differences among the three angles to students.

2. Next, present the vocabulary words to students, explaining how each word is related to the three angles. You may also wish to measure the angles using a protractor.

3. Divide students into small groups. Give each group a different angle that has been drawn on construction paper. Have students identify the types of angles on their papers. Also have them identify other vocabulary words associated with their angles, as well as measure their angles using a protractor.

4. The groups should then share their angle information with the rest of the class.

Vocabulary
- **acute**—an angle that measures greater than 0 degrees but less than 90 degrees
- **angle**—the opening or amount of turn between two line segments or rays
- **degrees**—the term of measurement of an angle; an angle is measured using degrees
- **line segment**—a part of a line that has two endpoints
- **obtuse**—an angle that is greater than 90 degrees but less than 180 degrees
- **protractors**—tools used to measure angles
- **rays**—straight lines that begin at a certain point but extend forever in one direction
- **right angle**—an angle that measures 90 degrees
- **vertex**—the point where two line segments or rays meet

Differentiation
Provide **English language learners** with picture cards that show examples of each of the vocabulary words. Find a place around the room to display a larger version of the cards. Keep the cards up for the duration of the unit.
Focused Mathematics Lesson: Understanding Angles

Learning Objective

- **Mathematics**: Students will understand and be able to determine the different types of angles.

Materials

- copies of *Understanding Angles Pre-test* (page 94, page094.pdf)
- *The Winning Angle* and *Basketball Angles* readers
- copies of *Outside Angles* (page 98; page098.pdf)
- copies of *Angles at Home* (page 99; page099.pdf)
- protractors
- basketballs
- paper and art supplies

Assessment

- This mathematics lesson has a pre-test (page 94; page094.pdf) of the mathematical objective. Use the pre-test to determine the skills on which your students need to focus the most. This pre-test can be administered at any time prior to the teaching of this lesson so that results can be used to differentiate instruction. Also included is a *Diagnostic Test* (pages 224–231; page224.pdf) to assess student learning.

Reader Warm-Up

- Review the vocabulary words from the above list with students. Then, distribute *The Winning Angle* and *Basketball Angles* readers to students. Have them look through the readers, finding examples of obtuse, right, and acute angles. Also have them write the page numbers for their examples. Then, ask volunteers to share their examples with the class.

Vocabulary

- **acute**—an angle that measures greater than 0 degrees but less than 90 degrees
- **angle**—the opening or amount of turn between two line segments or rays
- **degrees**—the term of measurement of an angle; an angle is measured using degrees
- **line segment**—a part of a line that has two endpoints
- **obtuse**—an angle that is greater than 90 degrees but less than 180 degrees
- **protractors**—tools used to measure angles
- **rays**—straight lines that begin at a certain point but extend forever in one direction
- **right angle**—an angle that measures 90 degrees
- **vertex**—the point where two line segments or rays meet
Using the Problem-Solving Transparencies:

Understanding Angles

Materials
- *The Winning Angle* and *Basketball Angles* readers
- *Angles in Triangles* overhead transparency (triangles1.pdf)
- *Looking at It from a New Angle* overhead transparency (looking1.pdf)
- copies of *No Tools Allowed* (page 102; page102.pdf)
- copies of *A Room with a New View* (page 103; page103.pdf)
- protractors

Angles in Triangles

Summary
For this problem, students are challenged to prove that all interior angles of a triangle equal 180 degrees. However, they are not allowed to use a protractor.

Problem-Solving Steps
1. Display the *Angles in Triangles* transparency. Have students read the problem silently while you read it aloud. Explain that they have been challenged to prove the statement to be correct.

2. Then, distribute copies of the *No Tools Allowed* activity sheet (page 102) to students. Have students see if they can prove that all interior angles of a triangle equal 180 degrees.

3. Once all students have had time to test the theory, come together as a class to discuss their test results.

Differentiation
For below-grade-level students, an in-depth version of the problem-solving transparency is provided (triangles2.pdf) on the Teacher Resource CD. This version includes step-by-step directions for solving the problem.
Name __________________________________

**No Tools Allowed**

**Directions:** Answer the questions in each of the sections below.

**Think About It!**

1. Do you think it is possible to accurately measure angles without using a protractor? Why or why not?

   ___________________________________________________________________
   ___________________________________________________________________

**Solve It!**

2. Solve the problems from the problem-solving activity, *Angles in Triangles.*

   How can you prove that the sum of the interior angles of a triangle will always equal 180°? *Hint:* As with Jada and her class, you may not use a protractor.

   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

**Describe It!**

3. Describe how you solved the problem.

   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

**Extend It!**

4. Write three things that you have learned about triangles and their angles.

   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________