Angle Explorations – Grade Three

Lesson Summary:
In this lesson, students investigate angles by exploring their classroom environment. Students make an angle-finder to represent angles they see in real life or drawn on paper. They sort the angles and learn the angle names; acute, obtuse, right and straight. Students compare the relationship of acute and obtuse angles to right angles.

Estimated Duration: Four hours

Commentary:
Although vocabulary is an important part of communicating mathematically, rushing into formal language too quickly is problematic. Allowing students to discuss mathematics using everyday language helps students connect new ideas to their prior knowledge, and encourages student ownership of understanding (NCTM, 2000). As students have more experiences making mathematical arguments and explaining their thinking, the need for more precise language becomes apparent to them. One way to encourage student understanding is to introduce formal vocabulary at the end of a lesson, after students have experienced the concepts using everyday language. Follow-up reinforcement reminds students to use the formal language.

Pre-Assessment:
- Distribute the KWL Chart, Attachment A, to students. Ask students what they know about angles and direct them to write what they know in the “K” column of the chart. After students have completed writing what they know, have them quickly share their information orally with a partner.
- Select students to share one thing they know about angles and write it on chart paper.
- Direct students to think of questions they have about angles and write those questions in the W column of the KWL Chart, Attachment A. If they do not know anything about angles, they may ask, “What is an angle?”
- Select students to read their questions. Write the questions on chart paper. As the lesson progresses, ask students to refer to the questions and note when specific questions are answered. Write additional questions students may ask as the lesson continues.

Ohio Standards Connection

Geometry and Spatial Sense

Benchmark D
Identify and draw right, obtuse, acute and straight angles.

Indicator 2
Identify and describe the relative size of angles with respect to right angles as follows:
  a. Use physical models, like straws, to make different sized angles by opening and closing the sides, not by changing the side lengths.
  b. Identify, classify and draw right, acute, obtuse and straight angles.

Mathematical Processes

Benchmark K
Use mathematical language to explain and justify mathematical ideas, strategies and solutions.
**Scoring Guidelines:**
The pre-assessment activity is an informal snapshot of the students’ understanding of angles. This is an introductory concept for grade three, so do not expect broad background knowledge of angles.

**Post-Assessment:**
In the first task of the assessment, students sort angles into categories according to the angle size: Right, acute, obtuse and straight angles. For the second task, students draw acute, obtuse, right and straight angle.

- Distribute *Angle Explorations Post-Assessment*, Attachment A to each student. Direct the students to complete the two tasks. The angles on the first page of the attachment may be cut apart to allow students to sort and glue them to another piece of paper.

**Scoring Guidelines:**
Use the rubric to determine the level of understanding and needed intervention.

<table>
<thead>
<tr>
<th>Adequate Understanding</th>
<th>Partial Understanding</th>
<th>Limited Understanding</th>
<th>Teacher Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sorts angles into four groups by type of angle (acute, obtuse, right and straight).</td>
<td></td>
<td></td>
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<tr>
<td>• Draws appropriate angle for each type.</td>
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<tr>
<td>• Sorts angles into four groups by type of angle (acute, obtuse, right and straight).  OR</td>
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<td></td>
<td></td>
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<tr>
<td>• Draws appropriate angle for each type.  OR</td>
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<tr>
<td>• Sorts and accurately draws 2-3 of the angle types. Some minor flaws evident in understanding of 1-2 of the angles.</td>
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</tbody>
</table>

**Instructional Procedures:**

**Part One**  What is an Angle?

**Instructional Tip:**
Cut strips of construction paper six inches long by one-half inch wide to prepare for the lesson. Each student needs two strips of construction paper and a metal brad.

1. Tell students that they are going to make an angle-finder. Distribute the construction paper and brads to the students. Have the students lay the two strips of construction paper directly
on top of each other. At one end, punch a hole through the two strips with the brad then fasten the brad. The construction paper strips should rotate to make angles.

2. Give students a minute to manipulate the angle-finder. Have them discuss with a partner how the angle-finder works. Talk about rotating one of the sides to make the angle bigger or smaller, similar to the hands on a clock.

3. Discuss the angle-finder with students. Ask questions about the characteristics and behavior of the angle-finder. Practice making angles by having students close the angle-finder and then open one side to make a corner. Close the angle-finders again and make an angle smaller than a corner.

**Instructional Tip:**
In demonstrations, orient the angle-finder in different ways and encourage students to orient the angle-finder in different ways, such as these.

This helps students understand that angles are not always oriented with one side parallel to the bottom of the paper or the floor, such as:

4. Ask students to explain anything new they know about angles. Have students write these new ideas in the L column of the KWL chart started in the pre-assessment. Include in the discussion a description of angles as being two sides joined at a vertex.

5. Ask students to explore angles in the classroom using the angle-finder. Ask students what angles they can find at their desk (e.g., corner of desk or table, corner of a book, the angle an arm makes when bent at the elbow). Then ask students to find other angles in different parts of the room. Allow students approximately five minutes to explore the room.

6. Ask one student to use an angle-finder to show an angle in the classroom. Demonstrate how to draw that angle on the overhead. Do several examples.

7. Pair students and ask one partner to make an angle with the angle-finder while the other draws the angle on paper. Partners take turns making an angle with the angle-finder and drawing the angle on paper. Circulate and encourage students to make angles with the angle-finder oriented in different directions.

8. Ask students to summarize what they learned about angles and write those ideas in the L column of the KWL Chart, Attachment A. Discuss the writing as a class or in small groups. Have students write their names on their angle-finders and collect the angle finders.
Part Two  Are There Different Types of Angles?
9. Distribute the angle-finders and investigate types of angles.
   a. Have students make an angle and share with the class.
   b. Ask students:
      • What makes an angle?
      • How are your angles the same?
      • How are your angles different?
   c. Conclude that all angles have one vertex and two sides. Students should also understand
      that angles may be different in size by how far the two sides are opened up or rotated
      from one another.
   d. Ask students to use the angle-finder to show what a corner of a book looks like using the
      angle-finder.

Instructional Tip:
When students first explore angles, they sometimes develop the misconception that the length of
the sides determines the classification of the angle. Help students focus on the necessary
characteristics for classification by varying the lengths of the sides in the remainder of the lesson
(i.e., some angles should have long sides and others short sides.)

10. Have students make an angle smaller than an angle of a corner of a book. Observe and
    identify students to want to make the sides of the angle longer or shorter, not by rotating the
    sides. Have students share their angles with a partner. Draw an acute angle on the board. Ask
    students to make the angle with their angle-finders and talk with a partner about how that
    angle is different from the angle showing a corner of a book (a right angle).
11. Repeat by drawing several different angles on the board. Have students identify which are
    smaller than the angle of a corner of a book.
12. Summarize the differences between corner angles (right angles) and the smaller angles (acute
    angles). Share the mathematical names of right angles and acute angles, and then have
    students develop a personal clue for remembering the names and angle characteristics.
13. Ask students to find some examples of right angles and acute angles in the classroom. Allow
    students to explore the room for two or three minutes and then ask them to share with the
    class the examples they found. As students share, have the class demonstrate the angles with
    their angle-finders. Encourage students to use the language of right and acute angles. Listen
    for descriptions that show understanding that acute angles are smaller than right angles.
14. Draw a straight angle on the board and ask students to make the angle with their angle-
    finders.
15. Ask students what they might call this kind of angle. Introduce the term straight angle. Also
    ask them to describe how this angle is different from acute and right angles.
16. Draw an obtuse angle on the board. Ask students to make the angle with their angle-finders.
17. Ask students to describe to a partner how this angle is different from a right angle or an acute
    angle. Discuss possible names for this type of angle and then introduce the term obtuse angle.
18. Have students explore the classroom looking for examples of straight angles and obtuse
    angles. Have students select two examples of each kind of angle and place a sticky note on
    the location. The sticky note contains the student’s name and type of angle. Students then
draw those angles in a journal and label where in the room they found the angles. Remind
students to draw only the angle and not a picture of the object. Collect the papers and look for misconceptions about drawing angles or misconceptions about obtuse and straight angles.

**Part Three - Looking at All of the Angles**
19. Prior to the lesson, create a set of 12-15 angles, including acute, right, obtuse, and straight angles. Draw each angle on a separate piece of paper, using the same color paper for all the angles. Make the angles large for clear display in the classroom.

**Instructional Tip:**
When drawing the angles, orient the angles in different directions. Some examples of angle orientations are:

- **Straight angles**
- **Right Angles**
- **Acute Angles**
- **Obtuse Angles**

20. Post the angles in the front of the room. Tell students to think about sorting the angles into categories. For approximately two minutes, then have them talk to a partner about sorting the angles. Allow partners about two minutes to share, then share as a class. After that, have the class sort the angles. Encourage them to label the categories, but do not suggest labels.

21. Distribute construction paper and crayons or markers to each student. Explain that students are going to draw a picture using only acute, right, obtuse, and straight angles. There must be at least one of each kind of angle in the picture, but they may use more than one of each. They will then trade pictures with another student to circle and label the angles in the picture. Provide five to 10 minutes to create the drawings and an additional five to 10 minutes for students to circle and label the angles in the picture.

**Instructional Tip:**
If drawing pictures is problematic, create a picture prior to the lesson and have students identify the angles.

22. Pair students and have them answer the following questions. Remind students to add new ideas or questions to the *KWL Chart*, Attachment A.
- What are the names of the types of angles explored in class?
- How would you recognize each type of angle if you were at home?
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Differentiated Instructional Support:
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).

- For students struggling to identify angles, provide additional pictures of real-life objects with the angles highlighted or bolded in the picture. Have these students identify the type of angle and then show the students a similar object in the classroom. Have each student run a hand along the angle in the picture and then along the angle of the real object.
- Have students explore interior and exterior parts of the angle, and adjacent angles.

Extension:
Have students take pictures of acute or obtuse angles that appear in their homes. Display those pictures in the classroom with the angle outlined in permanent marker.

Materials and Resources:
The inclusion of a specific resource in any lesson formulated by the Ohio Department of Education should not be interpreted as an endorsement of that particular resource, or any of its contents, by the Ohio Department of Education. The Ohio Department of Education does not endorse any particular resource. The Web addresses listed are for a given site’s main page, therefore, it may be necessary to search within that site to find the specific information required for a given lesson. Please note that information published on the Internet changes over time, therefore the links provided may no longer contain the specific information related to a given lesson. Teachers are advised to preview all sites before using them with students.

For the teacher: construction paper cut into strips six inches long and one-half inch wide, brads to connect the strips

For the student: two construction paper strips, one brad, construction paper, crayons or markers.

Vocabulary:
- acute angle
- obtuse angle
- right angle
- rotation
- straight angle

Technology Connections:
Students can use dynamic geometry software to draw angles and compare measurements.

Research Connections:
Angle Explorations – Grade Three


**Attachments:**
Attachment A, *KWL Chart*
Attachment B, *Angle Exploration Post-Assessment*
## Angle Explorations – Grade Three

### Attachment A

### KWL Chart

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>What I Know</em></td>
<td><em>What I Want to Know</em></td>
<td><em>What I Learned</em></td>
</tr>
</tbody>
</table>

Name ________________________
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Attachment B
Angle Explorations – Post-Assessment
Name_______________________________ Date__________________________

**Directions:** Draw an angle in each box.

<table>
<thead>
<tr>
<th>Right angle</th>
<th>Acute angle</th>
</tr>
</thead>
</table>

| Obtuse angle | Straight angle |