TEACHING WITH PRIMARY SOURCES—MTSU
Lesson Plan: Identifying Angles and Lines in Historical Photographs

Grades: 3rd - 4th
Subjects: Mathematics: Geometry - Attributes of Shapes
Time required: 1-1.5 hours
Author: Jesse Neugebauer, Sylvan Park Paideia Center, (Metro Nashville Public Schools)

OVERVIEW
Students will apply their knowledge of geometric attributes by identifying acute, obtuse, and right angles and parallel, intersecting, and perpendicular lines in historic photographs. Students will extend their understanding that the world is built out of geometric figures.

UNDERSTANDING GOAL
Students will explore the geometric features of historic architecture by identifying angles and lines in photographs.

OBJECTIVES
- Given photographs, students will collaboratively identify angles and lines in the photographs.
- Using a projector, student groups will describe their photographs in terms of lines and angles and receive peer feedback.
- Given a photograph, students will correctly identify at least one example of each type of angle and line set independently by the end of class: “I can identify lines and angles in a historical photograph by the end of class today.”

INVESTIGATIVE QUESTION
How is our world built out of lines and angles?

MATERIALS
- Printed photograph resources (model image and either 1 image per group or enough copies of each image so that each group member has a copy of the same photograph)
- Highlighters or color dry erase markers if photographs are laminated (class set)
- Assessment document (class set)

1. WEST ELEVATION - Beebe Windmill, Hildreath Lane & Ocean Avenue (moved several times), Bridgehampton, Suffolk County, NY Photos from Survey HAER NY-67

CURRICULUM STANDARDS
TN State Standards
- 3.G.A.1 Understand that shapes in different categories may share attributes and that the shared attributes can define a larger category. Recognize rhombuses, rectangles, and squares as examples of quadrilaterals and draw examples of quadrilaterals that do not belong to any of these subcategories.
- 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse, straight, reflex), and perpendicular and parallel lines. Identify these in two dimensional figures.
- 4.G.A.2 Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles.
### DAY 1

**Prior to Lesson**
Print all lesson materials. Laminating the photographs used for group work will allow them to be reusable. All students will need highlighters for the lesson, or color dry erase markers if the documents are laminated. Group students into groups of 3-4, and assign group roles.

**Background Knowledge**
Students should already be introduced to acute, obtuse, and right angles and parallel, intersecting, and perpendicular lines prior to the lesson. If students are not familiar with primary resources, set aside time to discuss the primary and secondary sources and their added value to understanding the past.

**Step 1**
Review angles and lines with students. What are some ways that we have represented the angles before? How do you remember the difference between intersecting, parallel, and perpendicular lines? How are lines and angles related?

**Step 2:**
Tell students that today you will be stretching what they have previously learned about lines and angles by exploring where lines and angles appear in the world around them. Ask investigative question: How is our world built out of lines and angles?

**Step 3:**
Review primary sources. Project Center of Town image. Tell students that the class will be using primary sources as resources for exploring the investigative question. How might primary sources like this photograph be useful in answering the investigative question? Accept student responses, and then, explain that the class will be using the photographs to research how the world is built out of lines and angles. Model identifying a set of intersecting lines and the resulting acute and obtuse angles by highlighting the objects on the photograph. Explain how finding the lines led also to finding the resulting angle. Invite students to provide other examples of angles and lines hidden within the photograph.

**Step 4:**
Divide students into groups, and assign roles. Suggested roles include leader, recorder, and presenter. For groups of four, the fourth member can serve as the teacher ambassador whose role it is to be the groups’ liaison to the teacher if the group has a procedural question. Pass out copies of photographs, a different photograph for each group. Everyone in the group may receive a copy or the group can receive one to share between them. Students examine the photograph for lines and angles, highlighting them on the text and labeling them. Circulate and provide support where needed.

**Step 5:**
Presenters from each group will present their images using a projector. Pointing to each geometric figure they identified in the image, presenters should name each angle or line set and provide a brief explanation of how they knew which feature it was.

**Step 6:**
Following each presentation, students from other groups should be given a few minutes to provide feedback to the presenter that affirms the group’s work and/or suggests other features in the image that the presenting group overlooked. Repeat steps five and six for each group. If students are not accustomed to providing constructive feedback to other groups, model providing feedback to the first group, and then gradually release feedback responsibility to the students.

**Step 7:**
Instruct students to return to independent work spaces. Review the lesson objectives and investigative question. Pass out assessment for evaluation of student learning.
EVALUATION

Use the assessment as a check for understanding of lesson content at the end of the lesson. The assessment will assess the identification and categorization of angles and lines and the generalization of skills to other settings in the reflection. Total Assessment value: 10 points.

Criteria For Success on Identification and Categorization: Students receive up to 6 points for identifying and labeling lines and angles independently within an image. To receive full credit, students must identify and label each of the following for up to 1 point each: intersecting lines, parallel lines, perpendicular lines, and acute angle, an obtuse angle, and a right angle.

Criteria For Success on Written Reflection: Students receive up to 4 points for generalization of skills through the written reflection. Students receive up to 1 point for each of the following in the written reflection: response answers the question with a clearly stated opinion or topic (1 point), response includes at least one example of an angle from the student’s personal experience (1 point), response includes at least one example of lines from the student’s personal experience (1 point), and all examples are connected back to the opinion or topic with a conclusion (1 point).

Suggested Differentiation Options:

- **More Support**
  - Pre-highlight an example of each line set and angle in the image and require student only to identify the appropriate name of each item.
  - Reduce the required number of items to be found or labeled.
  - Have students identify lines and angles by pointing and naming the features orally.
  - Read aloud.
  - Scribe the student’s oral reflection for them.
  - Provide additional prompts.

- **Less Support**
  - Require students to identify more than the 6 items in the photograph.
  - Prompt students to find which line sets always pair with certain types of angles.
  - Prompt students to find whole polygons within the image and then decompose the polygons into its lines and angles.
**RESOURCES**

- Beebe Windmill, Hildreath Lane & Ocean Avenue (moved several times), Bridgehampton, Suffolk County, NY
- Kābul
- Robinson’s aeroplane map of Sydney
- Menokin, Richmond County, Virginia
- Fotheringay, Elliston, Montgomery County, Virginia
- Roadside stand near Birmingham, Alabama
- Liberty Fire House, Gold Hill, Storey County, NV
- **DETAIL OF SPIRAL STAIRWAY - Captain Charles L. Shrewsbury House, 301 West First Street (High & Poplar Streets), Madison, Jefferson County, IN**

**Teacher Model Image**

- Center of town, Woodstock, Vermont. "Snowy night"

**Assessment Image**

- West Martingham, St. Michaels, Talbot County, Maryland

**EXTENSION**

- Unused images can be used during math centers as an extended learning opportunity.
- Send students on a scavenger hunt in the room, in the cafeteria, or in the playground, looking for lines and angles in their immediate context.
- In class or collaboration with the art teacher, prompt students to draw pictures that include angles and lines.
- Invite students to bring pictures, books with pictures, or photographs from home to share that include angles and lines.
- Assign students a homework task to identify angles or lines at home or at their afterschool programs and to journal about their findings to share the next day.
- Challenge students to make self-portraits using only angles and lines. Then, have students “write to talk” about why they chose the angles and lines that they did to exhibit their different features.
HOW IS OUR WORLD BUILT OUT OF LINES AND ANGELS?

“I can identify lines and angles in a historical photograph by the end of class today”

Directions: Use a highlighter and pen to identify, highlight, and label lines and angles in the historical image below. To receive full credit you must identify at least 1 of each of the following: intersecting lines, parallel lines, perpendicular lines, acute angle, obtuse angle, and right angle. There may be more than one of some items. However, only 1 example of each must be highlighted and labeled.

Checklist

Did you highlight and label a/an...?

__acute angle
__right angle
__obtuse angle
__set of parallel lines
__set of perpendicular lines
__set of intersecting lines

Reflection: Answer the investigative question using complete sentences. Your answer should include a topic and conclusion and should provide at least one example of an angle and one example of lines that you encounter in real life. Be specific in naming the angle and line set.

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West Martingham, St. Michaels, Talbot County, Maryland

Checklist

Did you highlight and label a/an...?

__acute angle
__right angle
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__set of intersecting lines