**Math Inquiry Project – Lesson Plan**

**Curriculum Expectations**

Math – Geometry – Location and Movement

Grade 4

* Identify, perform, and describe reflections using a variety of tools

Grade 5

* Locate an object using the cardinal directions (i.e., north, south, east, west) and a coordinate system
* Identify, perform, and describe translations, using a variety of tools

**Learning Goals:**

To move a two-dimensional shape (a rectangle) from a starting position (the “figure”) to an ending position (the “image”) and to describe the movement of the object as a series of reflections and/or rotations.

**Lesson Components:**

Materials:

* Masonite rectangle tablet, approximately 20cm x 30cm (9inches x 12inches)
* In advance, create two masking tape rectangles on the floor to mark the starting position and ending position.
* Paper and pencil.

**Activity:**

**Before (15min):**

1. Divide the students in to six groups with four students in each group.
2. In advance, create six identical stations, with masking tape rectangles on the floor that show a starting and ending position. The size of the rectangle is the same as the masonite tablet.
3. Around the room, label the cardinal directions as reference points.
4. Provide instructions for what they are to do. Keep the instructions open ended, and purposefully vague – it’s an inquiry. For example: “Move the tablet from the start to the finish, using only reflections and rotations.”

Start

Finish

East

West

South

North

**During (1 hour or more):**

**Minds On:**

Describing a rotation requires three pieces of information:

1. a rotation point (labeled or described);
2. a direction of rotation (cw or ccw);
3. an amount of rotation (in degrees or fractions of a circle).

Describing a reflection requires two pieces of information:

1. an edge or a line, labeled as “mirror line.”
2. a direction.

**Hands On:**

1. Students work on the floor. They perform a series of reflections (flips) and/or rotations (turns) but NOT translations (slides) with their tablet to move from the starting position to the ending position.
2. Students experiment with as many ways as possible.
3. Students write out the instructions, using cardinal directions as reference, for their series of transformations.
4. Instructions are shared with others in the class to determine if the directions can be followed.

Questions to prompt students during the activity:

Some students may not interpret the problem accurately. For an inquiry activity such as this, ask open-ended questions that encourage a student to think of their own solution.

For example, “How might you describe a rotation so that someone else will understand what to do?” “What information do you need to make that reflection work?” “Where is your reflection line?” “Describe the vertex (NE, NW, etc) to use for the rotation.”

Anticipated Student Response:

* An example of Level 4 instructions, created by a student:

Step 1: Reflect along the east edge once to the east.

Step 2: Rotate 90° clockwise, using the SE vertex.

Step 3: Reflect along the south edge once to the south.

Step 4: Reflect again along the south edge once to the south.

**After (20- 30 min):**

Have a follow up discussion with class. Share solutions on a screen. Discuss successful solutions, as well as unsuccessful solutions. Have students describe what worked, and what they needed to know from others.

**Assessment:**

Review the written directions from each student, plus the written opinions from other students regarding the success of the instructions.

The detailed and explicit nature of their instructions will directly relate to their understanding of the task.