Scaling Geometric Shapes

1. Benchmark/Standard: Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
2. Behavioral/Objective
   1. I am going to teach students how to scale shapes using tangrams. They will know how to determine a second shape given a scale factor, and the factor when given two shapes. It is important for students to understand how to compare things and their relation to each other since this is a skill they could use every day in their lives.
   2. Students will be able to determine the scaling of various shapes using tangrams, which will help with understanding of perimeter and area later. They can use this in many fields including architecture, design, engineering, geography, drafting, and more.
   3. Students’ understanding will be measured through their ability to complete a warm-up, participate in class-wide discussion, complete in-class worksheet, indicate understanding using 5-fingers, and complete an exit ticket.
3. Anticipatory Set
   1. Generate Interest: Journal about scaling in everyday life. “What does it mean for something to be similar? Write down three things that are similar. Now, what about shapes? How could they be similar?”
   2. Access Prior Knowledge: Watch a video on drafting and architecture involving scaling. Show students that they already know about how scaling is used and indicate that they will use this knowledge to complete the upcoming task.
   3. Practice something: Identify shapes and find lengths of various shapes by measuring them. They do not need to compare the lengths, just are practicing measuring.
4. Objective/Purpose: Given two figures, identify the scale factor by comparing the measurements you determined. Analyze data you collect to understand that the lengths will change by a factor equal to the product of the two size transformations.
5. Input:
   1. Task Analysis
      1. The learner should be able to make measurements on their own using a ruler and should be able to identify given shapes by looking at them.
      2. Procedure
         1. Students will complete a warm-up exercise involving journaling about what it means for something to be scaled. They will think about the definition, how it is visible in real life, and how it could work with any shape.
         2. Discuss with neighbor what they wrote in their journal. During this time I will put up the YouTube video displaying how scaling is used in real life. The students will watch the video when they are no longer actively discussing scaling.
         3. Students will break into groups of four and choose what role they want to have for this class period, (recorder, measurer, builder (2)).
         4. I will hand out the shapes and worksheets to the groups and allow them to begin exploring.
         5. I will circulate the room, answering questions that arise and assisting students when necessary.
         6. Students will share their results by writing them into a table I will have drawn up on the whiteboard at the front of the room.
         7. As a class, we will discuss what the table is showing and what conclusions we can draw from it. For example, we will notice that when the size changes, both the side lengths and the area also change.
         8. We will generate the definition of scaling as a class by combining all our ideas. I will guide the development of the definition to make it correct.
         9. I will have students do a 5-finger check for understanding where 1 means they do not understand what is going on and 5 means they have it mastered. I will recognize students who raise a 1 and 2 up as students I will need to visit with later for more assistance and those with 5’s as students who will need an extension.
         10. I will ask if any students have questions up to this point and will answer these by rewording my explanations.
         11. Students with a 1 and 2 will be assisted at this time with things they are still struggling with. All their questions related to the worksheet and discussion will be answered through guided questioning.
         12. Exit checks will be handed out to students and they will take a few minutes to fill them out. The check will have a few questions related to scaling and what they were still struggling with.
   2. Thinking Levels: Bloom’s Taxonomy
      1. Knowledge: be able to put shapes together to make new, larger shapes.
      2. Comprehension: understand the scale factor needed to get from small large shapes.
      3. Application: indicate where scaling is used in real life (can relate to the video).
      4. Analysis: define what scaling is and what it does to a particular object.
      5. Synthesis: create new factors and assess the effects they will have on the original shapes.
      6. Evaluation: identify what else changes when something is scaled. Look into the idea of 3-D shapes and how scaling effects them.
   3. Learning Styles and/or Accommodations
      1. Remediation: given shapes and factors, compare what happens when they are applied. This does provide more direct actions for the student and eliminates some of the exploration. Yet, some students need these steps in order to will and work much more comfortably, thus need the remediation.
      2. Extensions: working with 3-D shapes instead of 2-D shapes, the effects of scaling on these shapes and how volume changes with scaling.
      3. Differentiated Curriculum: dictionary provided for definitions at the start of class; deliver a step-by-step process for finding scale factors; availability for more assistance when exploring.
   4. Method and Materials
      1. Warm-up and YouTube video using a projector, exploring with tangrams, open discussion using the white board and markers, tactile learning with a quick demonstration of how to do it on the Elmo
      2. Materials:
         1. 21 tangram sets
         2. Worksheets
         3. Projector and computer
         4. Elmo
         5. Whiteboard and Markers
         6. Pencils
         7. Exit Slips
6. Modeling
   1. Show how to scale a simple square using tangrams. Identify how area and dimensions change with different scaling factors.
   2. How to create a new shape with existing shapes using tangrams and what to do once this is complete.
   3. The initial YouTube video and demonstrations are the inputs, the class discussion regarding the video and about the discoveries the class made are the outputs.
   4. Involvement in exploration activity, writing answers up on the white board, participating in discussion.
7. Checking for Understanding
   1. Questions:
      1. What do you know about the word, “scaling?”
      2. What does it mean for something to be scaled larger?
      3. What do we know about the shape properties?
      4. What happens to the properties as shapes are scaled?
      5. How is this applicable to real life?
   2. Stop and Check: 5-fingers of understanding
   3. Testing Techniques: signal response, discussion, participation, written journaling, writing on white board, worksheet work
8. Guided Practice
   1. Repeated practice of building tangrams to scale
   2. Model to students how to build scaled tangrams
   3. Teacher circulates the classroom and assists students where necessary
9. Independent Practice
   1. Students will look around their homes for objects and see how they relate to one another while still maintaining their shape properties. They must find at least five objects they can scale to create a new object (ie. a card and a computer monitor since both are rectangular and proportional in their dimensions.
10. Closure:
    1. Students: complete the exploration activity worksheet and an exit slip with all the main concepts from the day included.
    2. Teacher: reflect on the lesson with the class during the discussion of the generated table; evaluate the effectiveness of the lesson based on success of students based on the exit slips and class worksheet.