Mathematics: The Language of STEM

Shape Attributes (2-D Shapes)
Miss Jennifer Goshert

CONTENT AND TASK DECISIONS

Driving Question: How many ways can we draw 2-D shapes?

Grade Level(s): 2

Description of the Task: Students will classify two-dimensional shapes based on their attributes. Students will use a basic definition/description of a shape to both create and identify two-dimensional shapes based on their attributes. Students will conclude that shapes do not always have to appear in a traditional ways, but can still be classified as a two-dimensional shape based on definition and attributes.

Indiana Mathematics Content Standards:
- 2.G.1 Identify, describe, and classify 2 and 3 dimensional shapes.
- 2.G.2 Create squares, rectangles, triangles, cubes, and right rectangular prisms.

Indiana Mathematics Process Standards:
- PS.3: Construct viable arguments and critique the reasoning of others.
- PS.4: Model with mathematics
- PS.6: Attend to precision
- PS.7: Look for and make use of structure

Language Objectives:
- Students will be able to correctly use the academic vocabulary terms: vertices, angles, and sides within mathematical contexts to describe the attributes of two-dimensional shapes.
- Students will be able to communicate their ideas and learning to their peers using appropriate vocabulary, partner supports, and graphic organizers.

Mathematics Content Goals:
- Students will be able to classify two-dimensional shapes based on attributes and definitions/descriptions.
- Students will use reason to justify their thinking and conjectures about two-dimensional shapes.

Materials: (Used throughout all lessons)
- Large paper sheets/posters (One large paper sheet/poster for each small group)
- One ruler per student (to use to create lines)
- Coloring materials (markers would work best) and pencils (for drafting)
- Anchor charts (whole class or individual containing definitions of sides, vertices, horizontal, diagonal, and vertical lines)

- Anchor charts for each shape that include the definitions/descriptors of each shape (You might want a piece of paper containing individual definitions of assigned shape that students can include on their poster. These are included in attached file)
- Student reflection sheets (titled "Two Dimensional Shape Anchor Chart")
- Student independent proof exit slip (titled "Proof Exit Slip")

Classifying Shapes Based on Attributes Using 2-D Shapes

Before: (Assign students into small groups of two or three. Students should be in mixed ability groups, so that students can demonstrate their expertise. Student groups should have access to mainpulatives, and coloring materials)

Day One

- Prep students for the challenge of creating multiple representations of shapes by exposing students to two-dimensional shapes. Make sure to provide background knowledge about what makes a shape two-dimensional and the attributes of two-dimensional shapes (lines, vertices, angles).
  - It might be helpful to teach motions/gestures that demonstrate academic vocab. An example of a helpful motion/gesture to teach side and vertex would be using your forearm as a side/line and elbow as a vertex.
  - It also might be helpful to have anchor charts available of both examples and non-examples of each attribute.

Day Two

- Complete a class proofs together as a provocation for divergent thinking. Have students work with a partner to complete a series of proofs (included in the PowerPoint link below).
  - Provide students with definitions of each two-dimensional shape. I suggest using whole group anchor charts and individual concise list (attached)
  - Complete basic proofs first that ask entry level questions (This shape is a(n) _____. Do you agree or disagree? Why?)
    - You can complete these tasks together or have students work with partners and report out thinking.
    - Model ideal response– I agree or disagree because _____ (with a reason that uses the shapes definition/attributes as support).
  - Complete more complex proofs next that ask more probing questions with varying formats (This shape is a(n)_____. Do you agree or disagree? Why? or _____ is an example of a(n) _____. Do you agree or disagree? Why?)

- Make sure to have students share out thinking using sentence frame (I agree or disagree because _____.)
        - Focus heavily on questions that show shapes in nontraditional ways
- Prep students for next day's challenge by giving work a purpose. Students will have the purpose of demonstrating what they know about shapes to their peers, school, and/or a younger buddy. Students will be challenged to create as many representations of an assigned two-dimensional shape as possible in a time constraint with a small group. We will keep a tally as a class of how many ways we showed our thinking (you might want to throw into an incentive that if you class finds over 50 ways, they receive a prize/thinking reward) to encourage students to keep coming up with ways to represent the same shape.

Day 3– Project Day ☺

- Review expectations for small math squads (take risks, respectful treatment of others and opinions, persevere through challenge, mistakes are learning, take care of math tools)
- Distribute materials (concise definition sheets, coloring materials, rulers, and large piece of paper) to small groups of students.
- Review assignment then assign student groups a two-dimensional shape. I would suggest giving students who struggle triangles or quadrilaterals. Students will experience great success with these shapes as they have many representations. I would also make sure that each group has a different shape if possible to add variety to later discussion.
- Have students write shape's name on the top of their page in bold lettering. Also, have students write their names on their group page and create a box to tally the amount of ways/representations they create.

During: Allow students ample time to work. You can adjust your schedule as needed for your particular group of students. I suggest spending at least 15 minutes working in teams.

- Students will work with groups to come up with ways to represent their assigned shape. Students will share "the pen" to write down their thinking. If you notice that one student is doing all the writing for their group, you may limit the group to one coloring material or marker and require students to pass around the marker with each way/representation of the number. You may also want students to write down their thinking on a whiteboard independently before meeting with groups or have students work on whiteboards while their partners are writing. This will eliminate wait time for students.
- Students will record their thinking and conjectures on paper. Optional: You can also use technology instead of paper if you choose. A student presentation app such a Poplet would also allow students to communicate their thinking as well. You could have students record their thinking on video to add voice to their project.
- Stop throughout work to ask groups how many new representations they have come up with. Add that amount to a classroom tally chart and count up new number of tallies. This will

encourage students to keep coming up with ways/representations, and encouraging one another to pursue more.

- Encourage students to use resources (charts) throughout to prove and guide their thinking.
- Monitor student progress throughout this time period. If a group is struggling, prompt students to try various methods that were explored by other groups. You may also have a student leader visit another squad to observe how the other group is tackling the problem. Make sure that students honor one another by thanking a group or complimenting a group that they borrowed ideas from. It may be beneficial to discuss the difference between cheating and resourcefulness.

After: Students will meet to present their findings to others. Students will celebrate their work as independently and as a group.

- Have students complete the attached reflection page independently (in other file: shape reference materials). Students will use this page to guide their group discussion and presentation. Give students at least 15 minutes to complete this reflection sheet.
- Allow students time to work as a team to discuss how to present their thinking to their peers or younger buddies. Students should use their reflections to guide their presentation. Students will also fill in scripts (in other file: shape reference materials) to use for their presentation using their group's reflection sheets and their group's discussion. Students will each complete a script for the presentation, but take turns sharing information.
- Have students present their work to other students (you could present to peers or younger buddies). I suggest when presenting to peers having half a group stay back to present, while the other half goes around to listen to other groups. Then, presenters and audience will trade rolls.
  - o In presentation, students must communicate the definition of their shape using academic vocabulary: side, vertices, and angles. Students must also test the validity of each shape using their definition.
  - o After presentation, have students turn in script and reflection sheet for your review.
- After all students have presented, have students complete a gallery walk to complete a new shape chart. This chart will include basic information about shape (i.e. number of sides, vertices, and angles), a drawing of a traditional model, and two other representations of each shape as created by other students. This chart will be used then turned in along with their reflection piece.
- Students will then complete an independent proof using either proof format: This shape is a(n) _____ or _____ is an example of a (n) _____. (in other file: shape attribute practice pages). Students will write a proof using the format and draw a corresponding picture. Students will then answer their own proof independently using the practiced sentence frame (I agree or disagree because_____). Finally, students will staple their proof to their created anchor chart and turn it all in for your review.

- Revisit guiding question <mark>(at the beginning of lesson plan)</mark> together in a whole group discussion
  - You may want students to bring group posters, scripts, reflections, and your anchor charts to add supports to this discussion
  - Ask the following questions to prompt discussion. The end goal of the discussion should be that students understand that shapes can be created in a lot of ways that follow their attribute definitions. These representations do not always have to look like the "traditional" models that are widely taught in primary classrooms.
    - How many ways can you represent 2-D shapes?
    - How did you create the different shapes?
    - What information was important in creating your shapes?
    - What strategies did you use?
    - What was your biggest struggle as a team?
    - What was your favorite representation of a shape?
    - Do you understand how to create 2-D shapes better than before our exploration? Rate your understanding.
    - Why do you think that we typically show shapes in one way in school?

Assessment: Students will be assessed on participation within math group, during presentation, and through both group and individual reflection pieces.

- Students will be asked to communicate their thinking/process through both an application and a written reflection. Students will turn in their completed independent gallery walk chart, completed independent proof, completed group script, and group reflection sheet.

Optional Extension:

- Have class complete a whole class poster. Put up a large poster (or posters) in a hallway and give students each their own color marker (that way you can see who does what work).
  - Students will write name in a corner of the paper with their color.
  - It may be helpful to assign students to a general area or have more than one large paper as well.
  - Students will then write down as many ways they can think of to represent any two-dimensional shape on the large piece of paper in a given amount of time (maybe 5 minutes)
  - When completed, your class can count how many ways that they represented two-dimensional shapes. You can have teams count up the number of each shape. For example, one student team can count up the number of rectangles and another the number of triangles.
  - This information can be included on an additional page as a scavenger hunt for your students or another classroom. You could also take a picture of this chart and have

students circle/color examples of each shape as an exit slip, or pass it along to another class to complete as a challenge.

- Have students draw a picture using different representations of the same two-dimensional shape. Students can use only that shape to create an original picture or create a picture and hide the shapes within. Students should tally up the number of shapes hidden, and their picture can be photocopied to use in a small group math center, partner work, or even an exit slip.

- Have students grade the completed proofs of other students. They can grade using a student created rubric that mirrors the expectations of the assignment.

- Collect student proofs to create an additional proof powerpoint to use for review or create a scoot using their proofs for independent/partner review.