Instructional Task

*The Task below offers instruction related to the content you observed in the vignettes. Feel free to make any changes required to address other instructional needs of your students. (You may wish to preview the **Instructional Notes** and **What If? Scenarios**, also found in the Toolkit, to help you tailor your instruction to specific needs.) Print out the Task and use it to guide instruction.*

Student Learning Goals

- I understand that congruent figures remain congruent through the rigid motions of translations, rotations, and reflections.
- I understand that justifying my conclusions, communicating with others, comparing plausible arguments, and asking useful questions help to clarify mathematical reasoning.
- I understand that using clear and precise definitions help to simplify and strengthen the mathematical reasoning process.

Student Success Criteria

- I can use a series of rigid motions to show that two triangles are congruent.
- I can justify that there is more than one series of rigid motions to show two triangles are congruent.
- I can define congruence in terms of rigid motion to construct arguments explaining why two triangles are congruent.
- I can extend my knowledge of rigid motion transformational congruency by solving real-world design problems.
- I can use the properties of rigid motion preserving measurement as justification for my argument.

Common Core State Standards

- Understand congruence in terms of rigid motions
    - CCSS.MATH.CONTENT.HSG.CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
    - CCSS.MATH.CONTENT.HSG.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
    - CCSS.MATH.CONTENT.HSG.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
- Apply geometric concepts in modeling situations (applies to Act on Evidence)
    - CCSS.MATH.CONTENT.HSG.MG.A.3 Apply geometric methods to solve design problems (e.g., congruence and rigid motions to design an object or structure to satisfy physical constraints).
- Mathematical Practices
    - CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique reasoning of others.
    - CCSS.MATH.PRACTICE.MP6 Attend to precision.

Launch

- Display and read the learning goals with the students.
- Display and read the success criteria.
    - Have the students jot down the bold words in their notebooks.
    - Emphasize that mathematical arguments have reasons and justifications.

  - Emphasize the importance of preserving measurement.
  - Clarify that preserving measurement means keeping the same segment length and same angle measurement.
- Display and read:
  - Congruent figures are important figures in our practical world.
  - In your small groups, brainstorm where we might find congruent figures in our practical world, think about everyday objects.
- During the brainstorming:
  - Walk around listening to small groups and their ideas.
  - Provide support to students by helping them come up with ideas, such as tables, ceiling tiles, and cupboards.
  - Once the students have the idea, then suggest to them to think about ideas outside of the classroom.
  - Have the students think what their classroom might be like if shapes were not congruent.
- After the brainstorming:
  - Solicit ideas from small groups.
  - Prompt class to consider what their world might be like if shapes were not congruent.
  - Display and reference different examples of real-world congruent items.
  - Acknowledge the examples the students offered.
  - Prompt the students again to consider what their world would be like if shapes were not congruent.
  - Activate prior knowledge.
  - Display the following question and instruct students to write the answers in their notebooks: Previously, you learned about rigid motions. What are some rigid motions that you have learned about?
  - Display the following question and ask: What is particularly interesting about rigid motions and the properties they share?

Explore

- Students will work on computers to use Geogebra to explore congruent figures and rigid motion.
- In the first part of this exploration, students will explore how we can use rigid motions to prove that two triangles are congruent.
- Students begin with the pair of triangles in the dynamic geometry software file provided along with a worksheet. This worksheet will have the following instructions and questions:
  - In the dynamic geometry software file provided, you will find two triangles that are labeled such that two pairs of corresponding sides are congruent and one pair of corresponding angles is congruent.
  - Use a sequence of rigid motions to prove that the two triangles shown are congruent. Note: You must record the steps that you take to show the two triangles are congruent. Along with this record, include one or more reasons why the images formed after each step are congruent to the original triangle.
  - Compare and contrast your work with your peers. Are their steps the same as yours? If not, are their steps valid? If so, can you find a different sequence of steps that illustrate congruence?
- In the second part of the exploration, students will create their own pair of congruent triangles to share with another group.

Directions to Students

- Step 1: Open a new file.
- Step 2: Using the construction tools, construct a new triangle.
  Note: Label the vertices of the triangle. You must record how you constructed your triangle. In particular, which sides/angles did you use to construct the shape? Did you just use three sides? Did you use two sides and an angle? If so, which sides and which angle did you use?

- Step 3: Use a series of rigid transformations on your triangle to create a congruent triangle.
  Note: Record the steps you use using mathematical language.

- Step 4: Label the sides and angles you used to construct your original triangle. You should also label your congruent triangles so that the correct parts correspond back to your original triangle.

- Step 5: Trade the construction of your two triangles with another group. For the other group's triangles, describe a sequence of rigid motions that could be used to prove that the two triangles are congruent. Record the steps that you take and include reasons why the image formed after each transformation is congruent to the original triangle.
  Note: It may be possible that the labeled pairs of corresponding parts do not, in all cases, prove the triangles are congruent. If you think this is the case, you will need to come up with a valid argument to provide the other group.

- Step 6: Compare and contrast the steps used by the other group to your steps. Did the other group come up with the same series of rigid motions for your triangles? If not, are their steps valid?

Summarize

Students use their prior knowledge about congruence to explore using rigid motions with triangles. They work in groups, using manipulatives, drawings on paper, and a computer program. The teacher circulates, listening to the oral discourse while asking probing questions to keep students on track. As an extension, students can think about and design real-world examples of congruence.