Lesson Title	CSI Investigation of Congruence and Similarity of Figures Part A (Michael Hamilton – Part B)
Length of Lesson	1 day
Created By	Kylie Nash
Subject	Math
Grade Level	9^{th} -12^{th} (Geometry)
State Standards	Geometry 3e
DOK Level	DOK 2 Geometry
DOK Application	DOK 2 – Distinguish ,Identify Patterns, Compare, Interpret, Make Observations, Name, Prove, Construct,
National Standards	9^{th}- 12^{th} Geometry
Graduate Research Element	None

Student Learning Goal:

State Standards for 9^{th} – 12^{th} Geometry: Geometry

3e) Classify triangles and apply postulates and theorems to test for triangle inequality, congruence, and similarity.

National Standards for 9^{th} -12^{th} Geometry and Algebra Standard:

- Explore relationships (including congruence and similarity) among classes of two and three-dimensional geometric objects, make and test conjectures about them, and solve problems involving them
- Use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture

Students will be able to distinguish if two figures are similar or congruent by comparing similar shapes. They will investigate similarity and congruence by exploring properties and theorems of various geometric figures. Students will be able to identify and name to correct congruent as well as explain and justify they fit a particular name (SSS, SAS, ASA, AAS, HL) Determine whether two triangles are congruent and be able to apply the congruence postulates to explain why they are congruent.

Materials Needed (supplies, hand-outs, resources):

Writing utensils, handouts, construction paper, protractors, scissors, and information about topic and guidelines by instructor.

Lesson Performance Task/Assessment:

Students will learn about congruence postulates and apply the information to figures reinforced by real world applications. Students will be able recognize similar and congruent figures. They will be able to identify prove that how figures are mathematically equal in size and shape. Student should be able to recognize congruent figures and

identify postulates of congruency and similarity. Students should be able to construct congruent figures and physically determine their congruency.

Lesson Relevance to Performance Task and Students:
Allowing students to create 2-dimensional figures and measure their angles to determine congruency and investigate similarity postulates will strengthen their critical thinking skills and enhance their problem solving skills. Simulating real world applications will help strengthen math skills and design concepts to students as well as how math, specifically geometry can be applied to real world applications. Increase understanding the function follows form of how different geometric shapes and designs are similar to each other. Through the use of hands on activities to synthesize and interpret concepts learned in the classroom.

Anticipatory Set/Capture Interest:
Students will be divided into groups of 3 to 4 and told that they are part of a team of CSI investigators in search of finding figures that are congruent and similar. The team who completes the worksheets and activities correctly will be considered super CSI investigators. Students will then be introduced to the concepts of congruence and then on to the similarity of triangular postulates needed to complete their detective tasks.

Guided Practice:
The instructor will give an introduction to types of congruent figures and given examples of each. Then the instructor will pose questions concerning similarity of figures and ask student to identify objects in the classroom that are congruent and similar based on their angles and sides. The instructor will go over the introductory worksheet (congruency_intro_sheet.docx).

Then they will be introduce the concepts of triangle similarity and congruency to the students using the triangle handout (triangle_congruency.docx) teaching them about the postulates for (SSS, SAS, ASA, AAS, HL), so they understand how to identify triangle similarity and congruency. The instructor will then instruct the students work on a triangle cutout activity and apply the postulates to identify and name the different figures using a protractor and or ruler (cm is preferred measurement unit).

The instructor will then provide the guidelines for constructing triangle cutouts for measuring similarity described below.

Instructions:(Reference: Iris Eye Cutouts http://barryscientific.com/lessons/iriseye.html)

1. On a piece of colored construction paper, draw an equilateral triangle with all three sides equal to 2 in or 5 cm.

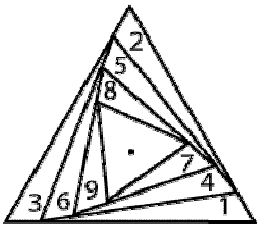
2. Cut this triangle out. Make sure to leave the paper *outside* the triangle intact; you'll be using the paper, not the triangle you cut out.

3. Draw a congruent triangle on a piece of white scrap paper. This will be your "pattern" triangle. Mark the center with a dot. (You can do this by filling in the grommet hole of the protractor.)

4.On the pattern triangle, use the center point and the protractor to make a new triangle, this time with all three sides equal to 4cm. Draw it so that its vertices fall on the line segments of the first (5cm) triangle; on different color construction paper.

5. Inside the 4cm triangle, use the same method to draw a 3cm triangle. Inside that, draw a 2cm triangle. You can point out to your students that all of these triangles are similar. (Make sure that each triangle is rotated the same way, so a spiraling pattern is created.)

6. Number the open spaces on your triangle, as shown below.



7. Place the triangular hole in the construction paper over the pattern triangle so that they match perfectly. Lightly tape the two pieces of paper together so they won't move, but so that they can be taken apart later.

8. Tape one colored strip over the section labeled "1" on the pattern triangle, so that it entirely covers this section and nothing more. Tape a second strip over the section labeled "2", and so on, until you cover all the numbered sections.

9. Remove the paper with the pattern triangle, and turn over the construction paper. You have your colored design?

10. Challenge your students to come up with creative color patterns. For example, a fun pattern is to use the same color strips for sections 1, 4, 7; for sections 2, 5, 8; and for sections 3, 6, 9.

Once the students have finished their design cutouts then they will be given a short 5 to 10 minute quiz (congruency_quiz.docx). The instructor will discuss how this application can be applied to other real world applications. The instructor will also lead the discussion using the questions listed below:

1. What is the sum of the angles of a triangle?
2. What pieces of information are needed to determine similarity of two triangles?
3. What tools are needed to measure angles?

**Students can be given several sheets of colored construction paper.

Independent Practice:
A. Students will first be introduced to congruency and similarity concepts by completing the worksheet with the guidance of the instructor. Then the students will be introduced to topics concerning the postulates of the triangle tests for congruency. They will then complete triangle congruency worksheet with the guidance of the instructor.

B. Once the students have collectively completed both worksheets then they can begin working on their triangle construction activity. This can be completed individually or by team depending on time constraints. Once the students have completed their designs then they can identity any postulates such as SSS, SAS, AAS, etc. They can swap each other's designs and measure the angles of the triangles using the protractor or keep their own and complete the same. They should expect all the interior angles to be the same. Identify what kinds of symmetry the triangles exhibit.

C. Once the students have finished their designs they will complete a five minute quiz, which they can use as a study guide for later.

Remediation and/or Enrichment:
Remediation:
Individual IEP, shorten activity by omitting the test for congruence postulates on triangles (SSS, SAS, ASA, AAS, HL), individual assistance. The quiz after the triangle activity could also be omitted or moved to another day.

Enrichment/Extension
1. Introduce students to an Escher tessellation drawing and discuss the congruence factors that exist.

Check(s) for Understanding:
Day One:
1. Ask students the definition of congruence and similarity.

2. Ask if two triangles are congruent then are each pair of corresponding angles are congruent?

3. Ask if the ratios of the length of corresponding sides of three triangles are equal, then are the triangles congruent?

4. Ask students to list or name the five postulates to test for triangle congruence.

Closure:
Discuss some real world applications (who, what, when, where and how) that would benefit from understanding concepts related to knowing, learning and understanding congruency and similarity in geometric figures. Discuss who this is important ot real life applications.

Possible Alternate Subject Integrations:
Physics- Look at what role that congruent triangles are used in the role of construction, in terms of strength and stability.

Science- Congruency and similarity can be seem in minerals design, rock formations, and crystal formations and may be used to help identify different chemical or compounds, especially in crystals and snowflake formations. The formation of bee hives and, beaver damns is another way congruency measurements can be applied.

Teacher Notes:

******* This activity does not cover teaching students to prove the test postulates of (SSS, SAS, ASA, AAS, HL), it only serves as an introduction so that students can recognize the different postulates not proving that that are true.

Reference Sources:

1. http://www.learningpt.org/pdfs/mscLessonPlans/dotson.pdf
2. http://www.mathopenref.com/congruent.html
3. http://barryscientific.com/lessons/iriseye.html