Lesson Title	Triangle Tango: Special Right Triangles
Length of Lesson	1 day
Created By	Kylie Nash
Subject	Math
Grade Level	9^{th} -12^{th} Geometry
State Standards	Geometry: 3i
DOK Level	DOK 2: Geometry
DOK Application	DOK 2 – Identify, Relate, Use Contest Clues, Make Observations, Predict, Show, Measure
National Standards	9^{th}- 12^{th} Geometry
Graduate Research Element	None

Student Learning Goal:

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

3(i) Given the pre-image or image, find figures obtained by applying reflections, translations, rotations, and dilations; describe and justify the method used (DOK 2)

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

- 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 introduced to the idea of applying geometry concepts to others areas of application such as science. Students will be able to be able to apply and practice implementing geometry concepts learned in the classroom to pre-processed images from a microscope. Students will get exposure and experience using handheld microscopes to identify different patterns, symmetry and patterns for real world applications and objects.

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

Writing utensils, salt, sugar, penny, any other objects with distinct geometric shapes, rulers, protractors, Pro-scope microscopes and software, microscope images (either physical electron microscope or images in PowerPoint Presentation) and handouts of microscope images, laptops or one main laptop connected to projector.

Lesson Performance Task/Assessment:

Students will use microscopes to look at the geometry of a variety of objects. Students will measure different angles, identify rays segments and other concepts learned to demonstrate their understanding of the concepts learned during the first nine week term. They will get an opportunity to implement topics in the classroom on real world applications as well as another area such as science. They will be able to discuss aspects of symmetry and science as well as how the structures help the function of the object. Students get to apply geometry concepts to real world scenarios.

Lesson Relevance to Performance Task and Students:

Students will measure angles, lines and identify shapes of different objects. Students learn the major concepts of recognizing patterns and inductive reasoning, segments, rays, parallel lines and planes, and measuring angles. Students will be able to take an image and apply these concepts together in a single activity. They should be able to identify congruency properties and make predictions on how the shape or structure is dependent on these properties of geometry.

Anticipatory Set/Capture Interest:
Students will be told that CSI investigators use microscopes and geometry to help police solve crimes and identify suspects. A good lead in to this lesson is to show the students an image of an ant and ask them to identify the insect based on the parts that they can see from the image. Students will be given an overview of the magnifying properties of a microscope and how a microscope allows the basic or underlying geometry of objects to be seen easier by the human eye.

Guided Practice:
Instructor will discuss information on the magnification and power of the SEM microscope and as well as the ProScopes handheld microscopes that they will be using for the activity. Teacher will provide handouts of microscope images and ask students to calculate different measures learned in the classroom. The instructor will show students either using actual microscope or images and discuss the amount of magnification used to see the amount of intricate detail shown for the object in terms of micrometers and other small measuring units.

The discussion may be led by asking students why this level of detail can't be seen by the human eye, which will lead into the units of measurement and microscope levels of magnification. The instructor will also lead the discussion using the questions listed below:

1. How big is a micrometer?
2. What is smaller than a micrometer?
3. What patterns or shapes do you see on the objects?
4. Are the patterns uniform or random? Why?

Students will then get an opportunity to look at the geometry of different objects brought under the ProScope microscopes. Instructor will set up two-to-three ProScopes on laptops with software already downloaded so students will be able to divide into two or three large groups and explore the ProScopes using items already in the classroom (e.g. clothes, hair types, skin types, purse, jewelry, shoes, plants, under finger nails, scars, etc.) anything that the students want to see. Examining the back of a penny, students can see President Lincoln sitting in his chair.
The instructor will mix salt and sugar particles together and give to students to look at under the ProScopes and they should be able to identity which particles are which and be able to discuss how they arrived at their conclusion. Discussion questions are below:

1. Can you distinguish the salt from the sugar? How?
2. What are physical properties of salt? Describe in terms of geometry.
3. What are the physical properties of sugar? Describe in terms of geometry.

After the students have finished exploring they will be given the handouts to measure angles, and find patterns on the worksheet.

Independent Practice:
Students will get an opportunity to see one specimen under the SEM microscope and ProScopes, such as salt and sugar, insects or whatever time permits. Students will explore in groups different objects seen by the ProScope for about 15 -20 minutes depending on time. Then students will complete a handout calculating and identifying line segments, angles, complementary, supplementary, segments, rays, etc.

Remediation and/or Enrichment:
Remediation:
Individual IEP, shorten activity by eliminating handouts for calculating geometric properties and just let students explore different objects with the ProScopes.

Enrichment/Extension:
Students could get an opportunity to place objects under the SEM microscope and adjust the settings themselves and analyze the different geometric patterns in different objects.

Check(s) for Understanding:
Day One:
1. Name any noticeable geometric patterns.

2. Are there any repeating patterns, if so how does this affect the makeup of the object

3. How does the pattern or geometric affect the function of the object. Does it enhance or decrease the functionality?

4. What parts of the presentation and activity did you feel was the most important to complete the worksheet and why?

5. What parts of the presentation and activity did you feel was the least important to complete the worksheet and why?

Closure:
Discuss with students what types of objects/specimens were best viewed under the microscope and why. Answer any questions from students about the microscopes and how

can using a microscope in different engineering fields. How could a microscope help build better structures? Engineers may not use the microscopes themselves but could benefit from seeing different structures and material at their basic property levels especially in material engineering.

Possible Alternate Subject Integrations:
Art- Looking at different objects under a microscope can be applied to abstract art designs, paintings, drawings, and could potentially use to make collages etc.

Sciences- (Biology, Physical Science, Chemistry, Earth Science, etc.)Looking at different properties under the microscope could help students learn about chemical properties and see various structures and growth of objects/specimens and apply concepts learned in class.

Teacher Notes:

- Different geometric shapes can be taken from the Internet. Images include here were taken at Mississippi State University (MSU) Scanning Electron Microscope (SEM) lab.

- Microscope equipment (tabletop SEM) was checked out from the Electron Microscopy Center at local university (MSU).