Lesson Title	Laser Tag: Capturing the Sun!
Length of Lesson	50 minutes
Created By	Corey Ladner
Subject	Geometry
Grade Level	10^{th} – 12^{th}
State Standards	3.c, 4.a
DOK Level	DOK 2
DOK Application	Cause/Effect, Infer, Interpret, Distinguish, Make Observations, Relate, Compare.
National Standards	Geometry Analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships. Use visualization, spatial reasoning, and geometric modeling to solve problems.
Graduate Research Element	In my research, solar energy is used to power stationary stream monitoring equipment. A solar panel with the necessary energy capacity is mounted in the optimal direction to the sun, and then attached to an interface module that continuously records rainfall, stream water level, and stream water temperature. It is important to know the optimal orientation North – South and East – West to position the solar panel that absorbs the most solar energy. This incorporates the consideration of geographical location of the solar panel as well as the current Earth and Sun orientation.

Student Learning Goal:
Students will identify, classify, and apply angle relationships and properties to find missing measures. This lesson will focus on the application of angle relationship to develop the students' skills of manipulating and measuring angles of objects; then, observing their effect in the process of solving a real-world problem.

National Standards:
Geometry:

- Analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships.

- Use visualization, spatial reasoning, and geometric modeling to solve problems.

Materials Needed (supplies, hand-outs, resources):
Handheld mini- lasers, 4" x 4" mirrors, angle protractors

Lesson Performance Task/Assessment:
The students will be assessed on their understanding of angle relationships. As the assessment, Students will be presented with the task of determining the proper horizontal and vertical angle to position a mini-laser so that it strikes a mirror perpendicularly. The mirror will be mounted at a known angle in an elevation position on the classroom wall. This task will present a simulation of mounting solar panels to capture the Sun.
Refer to independent practice for details.

Lesson Relevance to Performance Task and Students:
The lesson provides the students with real world problems involving the practice manipulating angle relationships to achieve a desired outcome, while incorporating useful scientific applications.

Anticipatory Set/Capture Interest:
The teacher will capture the students' interest by asking the students:

- Is it possible to capture the Sun? If so, how so?

Guided Practice:
Following a short discussion initiated by the anticipatory set, students will be introduced to the use of solar panels and what things are required for them to function at their optimal potential. (i.e. daily sunlight exposure, vertical and horizontal angle positioning that allows the sunlight to strike solar panel perpendicularly). Next, the teacher will explain and guide the learning activity called "Laser Tag: Capturing the Sun." Refer to independent practice for details.

Independent Practice:
The independent practice will be the learning activity called "Laser Tag: Capturing the Sun." This activity will consist of the following:

- Several small mirrors will mounted at elevated positions on the walls and angled downward at varying known angles.
- Handheld mini-lasers will be mounted onto apparatuses that allow the students to change the lasers' light projection angle vertically and horizontally, while resting at specific assigned locations on the classroom tables.
- Student groups of two will be tasked with the competition of positioning the laser angle (vertical and horizontal angle) so that the laser light "tags" the mirror perpendicularly, in the least amount of attempts.

- With each attempt, students must choose a probable vertical and horizontal laser position before shining the laser light and testing its projection.
- Student groups, will record their chosen vertical and horizontal angle of each attempt.
- Student groups with the least amount of attempts at each station will be declared the winners.

Remediation and/or Enrichment:

Remediation:

In the case that remediation is needed the student can meet with the instructor for individual tutoring. The student can also be grouped with a higher performing student that understands the lesson.

Enrichment:

In situations where there is complete understanding and performance, the lesson can be extended by having the students to set up several mirrors adjacent to each other on a flat surface and experiment with positioning the laser and mirrors so that the light will shine onto the first mirror and be reflected into the other mirrors.

Check(s) for Understanding:

The teacher will check for understanding by asking the students the following questions:

- How does angle positioning of solar panels affecting their productivity?
- What are some other situations in which angle relationships and positioning is used in real-world business? (e.g. television satellite installation)
- What happened when the laser light "tagged" the mirror surface perpendicularly?

Closure:

The teacher will close the lesson be reiterating the use of solar panels in stream research and the importance of angle positioning. The teacher will also discuss how angle positioning is used in television satellite installation.

Possible Alternate Subject Integrations:

This lesson can be easily incorporated into high school physics and physical science courses.

Teacher Notes: