Middle School Retro-Reflectivity and Pedestrian Safety

INTRODUCTION:

Objective/Learning Targets

Understand the importance of reflective material and how it relates to pedestrian safety.

RESOURCES

Materials:

- Index Cards
- Scissors
- Flashlights
- Colored Paper and Reflective Materials which should be spread across the room
  - Place colored paper on one table. Then place reflective and retro-reflective paper/materials such as mirrors, construction signs, and CD on another table in a different area of the room.

- Pencils and Paper
- A device to play videos

Amount of Time: 45 minutes
Age Range: 6th grade and above

Warm-Up / Before Activity

1. **Optional:** use the following PowerPoint to guide you through the warm-up activity. Retro Reflectivity- Middle School.pptx

2. **Ask the students what they know about reflection.** Where are places they see their reflection (mirrors, lakes, shiny surfaces like coins, road signs)? How do they think reflections work?

3. **Share a short lesson on light waves and how they bounce back to us on reflective surfaces.**

   Light itself is invisible until it bounces off something and hits our eyes. If an object does not emit its own light (which accounts for most objects in the world), it must reflect light in order to be seen. The walls in the room that you are in do not emit their own light; they reflect the light from the ceiling "lights" overhead. A beam of light incident on the metal surface is reflected.

   Reflection involves two rays - an incoming or incident ray and an outgoing or reflected

ray. Just as images are reflected from the surface of a mirror, light reflected from a smooth water surface also produced a clear image. When the surface of water is wind-blown and irregular, the rays of light are reflected in many directions. The law of reflection is still obeyed, but the incident rays strike different regions which are inclined at different angles to each other. Consequently, the outgoing rays are reflected at many different angles and the image is disrupted. Reflection from such a rough surface is called diffuse reflection and appears matte.

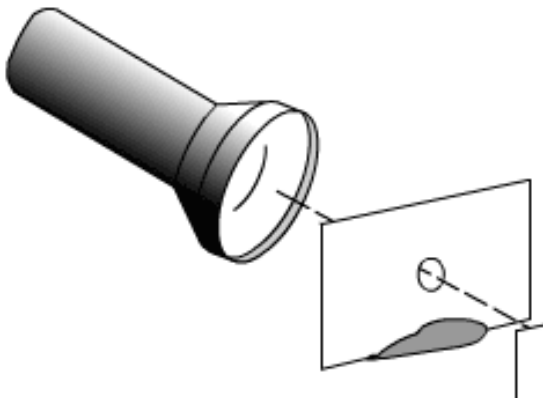
4. **Share with Students a Video by 3M explaining visibility at night:**

   ✓ https://www.youtube.com/watch?v=3u-HmsfsPRY

ACTIVITY/PROCESS

1. Have students make a reflectivity tester:
   A. Have students take an index card and cut a small hole in the center that is big enough to fit the circumference of a flashlight.

   B. Make sure that the flashlight is able to fit into the hole of their index card.



2. The reflectivity tester works by flashing the flashlight at different surfaces and seeing what color/brightness level appears on the index card on the side that faces you directly.

3. Have the students rotate through several testing stations to use their tester on different types of surfaces. Surfaces will consist of different colors and reflective finishes. At each station, students will record brief observations on what the reflection looks like: bright, dim, or medium? What color?

4. When all rotations are complete, ask students to work together to rank all of the surfaces' reflections from brightest to dimmest. Ask them to share their ideas about why some reflections are brighter than others.

5. Shift the conversation from the classroom to the real world: ask students how reflectivity and visibility are relevant to everyday life. Are there times or places where it's really important to have reflective or highly-visible surfaces?

6. Discuss things that students can see in the dark when they are out walking around. Are there things that are easier to see than others in the dark? (Animal eyes, light- or dark-colored cars, different colors of clothing, road signs, elements of nature)

7. Experiment with what makes people visible in dark places. Ask students to "model" different types of clothing/fabric (dark, light, and reflective). Darken the room and ask the group how well they can see each model in the darkness.

8. Have the students turn on and aim their flashlights at the models. What types of fabric are easiest to see? Why is that? Test the fabrics at different distances.

9. Invite students to tell stories about being out in the dark, especially near cars. Have there been close calls when someone didn't see you or you didn't see someone else?

10. Ask students how reflectivity can be applied to this problem. What would be ideal clothing to wear when walking in the dark? Is there anything they will do differently in the future when they are outside?

For the older student groups: Activity Variation

1. Explore how the angle of the light source impacts the angle of reflection. Have the students experiment with mirrors, aiming their flashlights at different angles and observing where the reflected light goes.
    a. ***Share with Students Once Finished Testing:*** The law of reflection says that when a ray of light hits a surface, it bounces in a certain way, like a tennis ball thrown against a wall (demonstrate). The incoming angle, called the angle of incidence, is always equal to the angle leaving the surface, or the angle of reflection.

2. Test these angles with a retro-reflective road sign. Do the sign behave differently than the mirror? Why might that be?
    a. ***Share with Students Once Finished Testing:*** Explain that retro-reflective surfaces contain many different tiny angled surfaces that bounce light around between themselves. This will direct light back to its source no matter the angle of the flashlight.

CONCLUSION

Conclusion: Describe the objective for the lesson and point students forward by connecting your objective to their own writing.

- The objective of the lesson is to introduce students to the subject of Retro-Reflectivity and how that is important. Likewise, to explain the difference between Retro-Reflectivity and Reflectivity.