

Reflection – Workshop Plan

Age group: 10-13 years old

Subject: Physics – lights, reflection

Workshop focus and goals:

Aim: To enjoy learning about light reflection.

Objectives:

- To make a successful projection pyramid.
- To use your projection pyramid to observe a Pepper's ghost.
- To learn more about reflection, refraction, transmission, and transparent and translucent materials.
- To learn how we see in 3D.

Materials needed:

- A sheet of transparent material such as acetate (optionally with already printed projection pyramid templates)
- If not already printed, a black marker to trace the projection pyramid on the sheet
- A pair of scissors
- A roll of tape
- A mobile phone with internet access

Workshop structure:

Total duration: 60 min = 1 h

Workshop unfolding:

Set-up: If you are supplying all the needed material, place them on the available tables.

10 min (slides 1-4) – Welcome workshop participants and introduce the topic. Reflection is actually quite common: when we look at ourselves in a mirror, when a scenery can also be seen on the surface of a lake. There are other less obvious uses of reflection, for example when transporting digital information! Reflection is governed by a simple mathematical rule: The incident light ray angle is always equal to the reflected light ray angle.

$$\theta_i = \theta_r$$

10 min (s. 5) – Make the projection pyramids:

1. If needed, trace a pyramid template on the acetate sheet, i.e. four trapeze shapes, three of them linked at their angled edges (see additional pdf for layout).
2. Cut out all the exterior shape.
3. Fold along the three connecting trapeze edges to shape into a pyramid.
4. Tape the two edge trapeze together to close into a pyramid shape.
5. Place the pyramid in the middle of the Pepper's ghost video on the mobile phone when ready.

10 min (s. 6) – Use the projection pyramid: find an appropriate Pepper’s ghost video by searching for “Hologram videos” on YouTube or downloading a specialised app. When the video plays, place the projection pyramid in the centre of the four images on the mobile phone screen. Look at the middle of the projection pyramid to see a Pepper’s ghost appear! It might take a bit of practice to be able to see the ghost. Placing the eyes at the screen level can help.

10 min (s. 7) – Explain how the Pepper’s ghost appears. The source image from the video is projected onto the surface of the projection pyramid. The incident angle is 45° , therefore the reflected angle is also 45° . Since the projection pyramid is made of translucent material, some of the light goes through it towards the centre of the pyramid. Since there are 4 source images, this happens 4 times from each side of the pyramid, which together build the Pepper’s ghost.

15 min (s. 8-10) – Explain other uses of reflection:

1. Optical fibres: light is reflected inside optical fibres to carry digital information.
2. Vision: light is reflected at the back of our eyes which allows us to see.
3. Mirrors: In infinity mirrors, there are 8 placed in a hexagonal shape so that we see our reflection and infinity amount of times.

5 min (s. 11) – Summarise what you learned during the workshop and answer any remaining questions the participants may have.

Assessment:

A short quiz for example could be used to make sure the participants have fulfilled the workshop objectives.