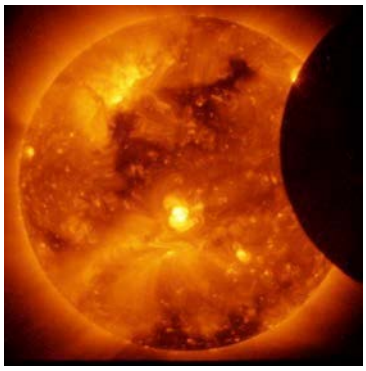


Solar Eclipse Using AR

Overview: Students will learn about the solar eclipse through the use of augmented reality.

Objectives:

The student will:

- ∞ Use AR to view images of the pathway of the solar eclipse
- ∞ Understand how solar activity impacts daily life (communications, etc.)
- ∞ Be introduced to concepts and abilities of Augmented Reality
- ∞ Apply AR skills and discover content potentials related to the solar eclipse
- ∞ Experience the outcomes of combining chemical elements and understand the potential of AR as an active learning tool

Suggested Grade Levels: Middle School (6th- 8th)

Timeline: 30 minutes of hands-on instruction and exploration

Materials:

Tablets (ipad, etc.)
Aurasma app
Spacecraft 3D app
Markers for Spacecraft 3D – need 2 sets, printed and cut out
Elements 4D app
Markers for Elements 4D– need 2 sets, printed and cut out
Aurasma studio downloaded

Procedure:

∞ Introduce safety related to augmented reality including:

- awareness of surrounding

∞ Introduce students to the concept and possibilities of augmented reality.

∞ Aura discovery - There are a number of active triggers within and around the lab that students can find and experience. This will help them understand the concept of what can constitute a trigger (marker).

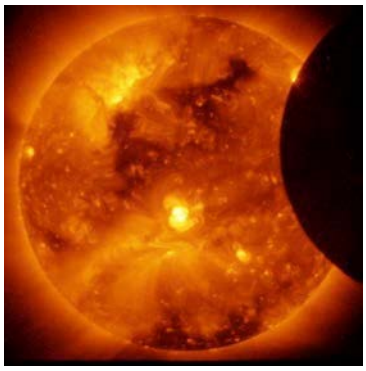
∞ Aura creation – Demo how to create an Aura in Aurasma studio. Provide additional information so students can create their own experiences after they leave (at home or school).

∞ Using Spacecraft 3D, students will apply the AR concepts.

∞ *Marker-Based Activation* – Students will need to activate AR experiences associated with specific markers.

∞ *Content-Based Activation* – Students will need to activate AR experiences related to specific content using a single marker.

∞ Using Element 4D, students will engage in the markers as an active learning tool related to mixing elements to see the chemical reaction.



Solar Eclipse Using VR

Overview: Students will learn about the solar eclipse through the use of virtual reality.

Objectives:

The student will:

Understand how virtual reality works Experience virtual reality

Receive an introduction on how to create their own VR

Suggested Grade Levels: Middle School (6th- 8th)

Timeline: 30 minutes of hands-on instruction

Materials:

VR headsets – Need 4-6
Smartphones – Need 4 -6
Headphones for auditory aspect of experience
Rotating chair – Need 4 to allow safe stationary rotation
Virtual Reality 360 (free demo) Stormrunner VR Rollercoaster
InMind 2

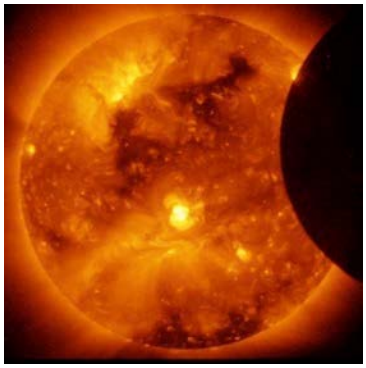
Procedure:

∞ Introduce safety related to augmented reality including:
∞ Introduce the concept of Virtual Reality and how it works with images
∞ Experience a VR activity (Stormrunner VR Rollercoaster)

∞ Discuss the elements they experience in the VR experience
∞ Show an active VR experience for comparison – InMind2

Extensions for this Lesson (take home):

∞ Where to find and download the apps (QR codes)
∞ Safety Sheet – Reflecting all VR precautions and practices identified
∞ Instructions – Explanation of operations and objectives for each



Solar Eclipse Using 2D and 3D Software and Printing

Overview: Students will learn about the solar eclipse through the use of 2D and 3D printing activities.

Objectives:

The student will:

Design and print their own eclipse glasses on the 2D printer.
Students will learn how Tinkercad software for 3D objects works
Students will search the 3D library for shapes related to space science

Suggested Grade Levels: Middle School (6th- 8th)

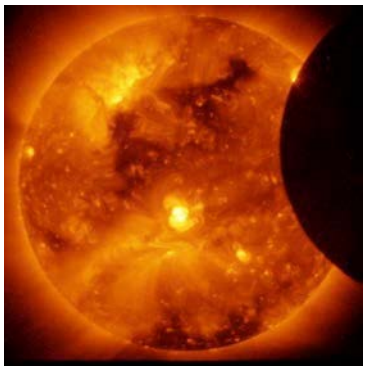
Timeline: 45 minutes of hands-on instruction

Materials:

Safety sheet hand-out
Silhouette printers
Card stock – multiple colors
Cutting mat
Tinkercad (free online software)
3D printer and filament

Procedure:

- ∞ Introduce safety of the 2D and 3D printers (handout)
- ∞ The students will be introduced to the software for the silhouette printer (2D) and will design a pair of solar eclipse glasses with given specifications.
- ∞ Introduction to the 3D printer and how it works and the types of files used by 3D printers.
- ∞ Introduce the 3D software (Tinkercad) and sites that have shapes libraries. Find shapes related to the solar eclipse.



- ∞ Students will also be using objects printed out on the 3D printer as they study the model and scale of the solar eclipse.

Solar Eclipse Using String and Solar Body Models

Overview: Students will learn about the solar eclipse by placing representational objects for the sun, moon and earth in proper proportion to each other and produce a shadow with a flashlight representing of a solar eclipse.

Objectives:

The student will:

- ∞ Select among common objects to represent the Sun, Earth and Moon in proper proportional size to each other
- ∞ Use string to approximate the proper distance from the sun to the Earth

∞ Use a ruler to approximate the proper distance from the Earth to the Moon
∞ Use a flashlight to project a shadow like an eclipse on the Earth, produced by light being blocked by the moon.
∞ Understand how small the Earth is compared to the Sun, and how far away
∞ Comprehend how the moon and sun can cause a total solar eclipse on a part of the earth, and how the path of the eclipse will move over time **Suggested Grade Levels:** Middle School (6^{th}- 8^{th})

Timeline: 40 minutes of hands-on instruction

Materials:

Tape measure (25 ft or greater)
100 feet of string or twine
Several balls such as: Exercise ball (2-3 feet diameter; 1 meter preferred) for Sun, basketball or soccer ball, tennis ball, ping pong ball, small marble or bearing ball (1 cm) for earth, 1 BB or small bead (1/4 CM) for moon
Scissors to cut string at proper length for Sun to Earth (93 ft = 93 million mi.)
Ruler to approximate proper distance Earth to Moon (284K miles = 3-4 in.
Flashlight to shine light so that Moon representation (eg tennis ball) makes shadow across part of Earth (eg. Basketball or globe)

Procedure:

∞ Safety - Introduce safety related to being in public area such as hallway and using cutting tools such as scissors
∞ Introduction - Introduce students to the concept of models, proportional size and distance
∞ Solar system discovery – Which of the balls in the basket would be the best choice to represent the Sun and the Earth for this exercise. (exercise ball = largest and small marble or bearing = smallest)
∞ Model creation – How long should the string be to represent the proper distance from the Sun to the Earth?
∞ Location and Size of the Moon – How large should the Moon be, and how far should the Moon be from the Earth to be in proportion with the distance from the Sun to the Earth and the proper sizes.
∞ Simulate a Solar Eclipse – Find two balls in the basket that are larger than a small marble but in proper ratio to each other in size (Moon = 27% diameter of the Earth); Use a flashlight to shine a light on the Earth while passing the Moon between the light and the Earth; Note the shadow on the surface of the Earth, like during a Solar Eclipse. ∞

Reflection – Study the handout of the path of the August 21, 2017 Solar Eclipse on the map provided; how wide will the path of total eclipse actually be (in miles)? How much of the Sun will be blocked if you are using your solar glasses to look up during the eclipse from Sanger, Texas (approximately same as Dallas)?

Facts and Figures for this Lesson:

1. Distance Sun to Earth = 93 million miles
2. Suggest students use 1 ft = 1 million miles, then the string from beach ball representing sun to the earth is 93 feet long. That is easy to do in a hallway.
3. The diameter of the sun is 109 times the diameter of the earth. Call it 100 times bigger. If the exercise ball (or blow up beach ball) is one meter across then the earth is 1CM; about the size of a frozen English pea, small marble, or medium size jewelry bead.

5. The diameter of the moon is 27% of the diameter of the Earth. Call it 1/4 of the Earth. Then the moon is about as big as a small bead or BB pellet (.25 CM). 7. The moon is normally 239,000 miles from the Earth. Call it 1/4 of a million miles. Then the string connecting the moon to the Earth in our scale model is about 1/4 foot = 3 inches. ... not very far.

8. Can the kids shine a flashlight over a small jewelry bead when it is placed between the light and the earth (pea) and cast a shadow on the surface of the earth? Maybe we need a larger moon and Earth at this point to see the shadow?

9. Recommend using a tennis ball and ping pong ball, or basketball and tennis ball, to have a group of 4-6 clearly see the effect. LED flashlights seem to make better shadows.