Design a Mobile Observatory

Explore engineering design challenges when observing an eclipse

LEGO® Education
Eclipse Collection

Project Overview

Design a Mobile Observatory

Created by Daniel Buhrow

Serving as an educator for ten years, Daniel Buhrow is a 3rd-5th grade STEAM teacher for the gifted and talented program in his district in McKinney, Texas. Over the last few years, he has become an active presenter and instructor for district professional developments, where he advocates for gifted and talented students and the instruction his team provides at the elementary level. Daniel loves to incorporate LEGO® Education solutions into his curriculum as a LEGO® Education Ambassador and share his classroom experiences with others. In his current role, he continues to push the envelope of innovation and engagement by providing meaningful and impactful lessons to his future scientists and mathematicians.

There is a lot of buzz when a total solar eclipse is about to occur! Whether you are a researcher studying space, a scientist working for NASA, or a space enthusiast pondering the mysteries of our universe, there is something exciting for all viewers of a solar eclipse. In this activity, students will be given the opportunity to celebrate the total solar eclipse by exploring an engineering design challenge faced by researchers when observing an eclipse and its totality. This activity enables students to learn about or connect what they already know about the Sun, Earth, and the Moon and what researchers are currently working on in this area.

This activity is flexible and can easily be adapted for the grades and subjects you teach. You can use LEGO® bricks, full LEGO® Education sets, or any materials you already have in the classroom.

Time

45–90 minutes

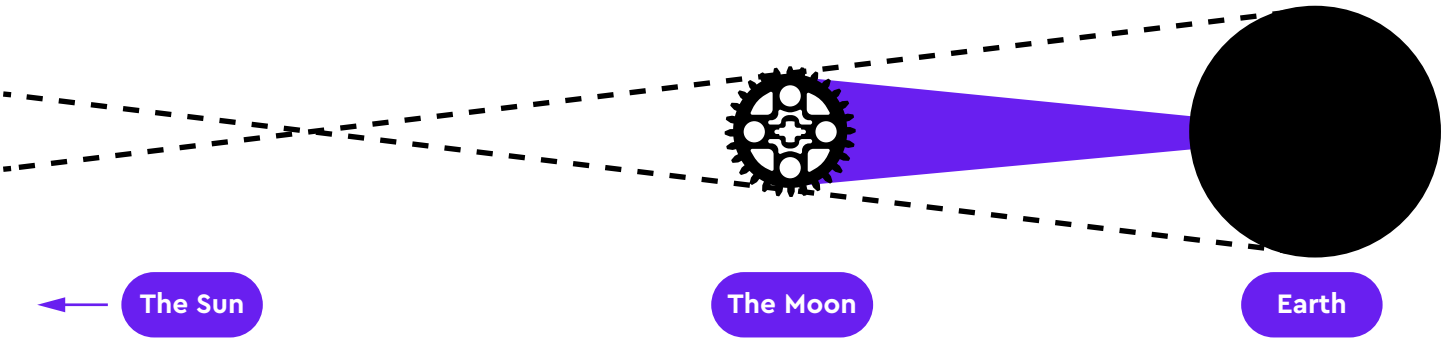
STEAM Practices

- Develop and use models
- Iteratively test and modify designs
- Meet design constraints

Objectives

- Explore the processes of a solar eclipse and what it can tell us about our universe
- Design and build a prototype of a mobile observatory

Getting Started



1. Consider Asking Questions Like

- What is a solar eclipse?
- How do scientists and researchers predict when solar eclipses will occur and where the path of totality will be?
- How do researchers and scientists observe a solar eclipse when the path of totality changes?
- What are different types of tools and equipment researchers and scientists use to observe and study a solar eclipse?

2. Engage Students with the Following Prompt

Let's imagine the Sun, the Moon, and Earth are friends playing hide-and-seek, but they are in space. Earth is the seeker and trying to find the Sun and the Moon. The Sun is so bright, it needs help hiding. A solar eclipse happens when the Moon moves in front of the Sun, blocking its light for a little while. Let's think of the Sun as a big flashlight in the sky, and the Moon as your hand. What happens when your hand goes in front of the flashlight? Do you see a shadow?

3. Build Background Knowledge

This is a great opportunity for both you and your students to learn about eclipses. Start with asking the question: What is an eclipse? You might explain how this is all because of the Moon's revolution around Earth, and Earth's revolution around the Sun. There are moments during the Moon's orbit around Earth that put it between us and the Sun. Because of Earth's orbit around the Sun, the tilt of Earth's axis, and the tilt of the Moon's orbit can line-up just right and sometimes the shadow the Moon creates will land right on Earth, causing a solar eclipse.

4. Connect to Current Events and Research

Not only are eclipses stunning to see, but they are also opportunities for research and study. For example, did you know there are multiple layers to the Sun? The one that remains visible during a total solar eclipse is the outermost part of the atmosphere, called the corona. The corona can reach extreme temperatures even hotter than the surface of the Sun itself. Normally we can't see the corona because the Sun's surface below it is so bright, but during a total solar eclipse it becomes visible, and researchers are able to study it. Provide some relevant examples or have students do their own research to create even more real-world connections.

Student Challenge

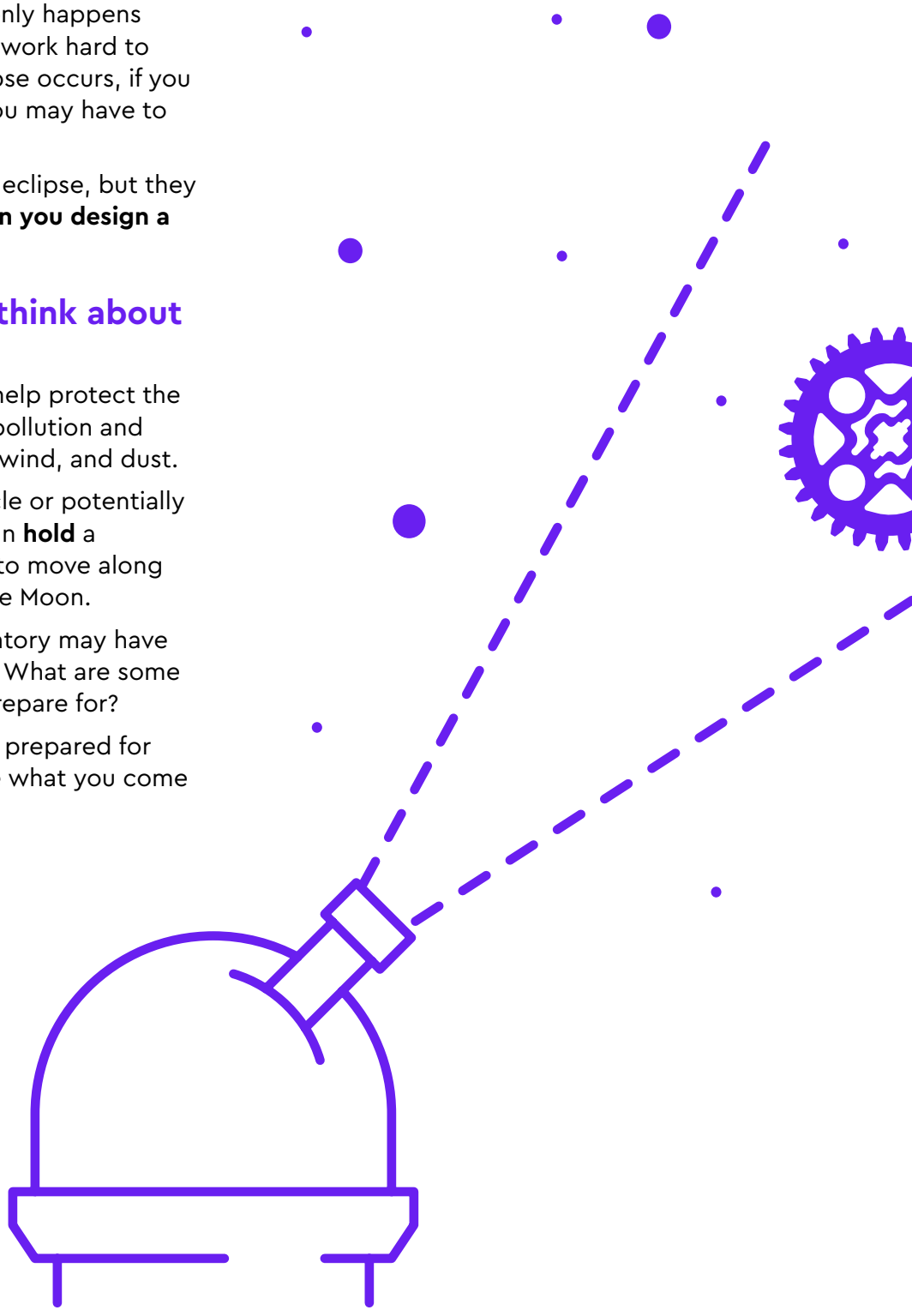
As a space enthusiast, observer, or researcher, one challenge is creating a way to view natural phenomena, like a solar eclipse, on the go! The path of totality for a solar eclipse only happens in specific locations that scientists work hard to analyze and predict. When an eclipse occurs, if you want the best seat in the house, you may have to do some traveling!

Scientists will be able to study the eclipse, but they will need a way to collect data. **Can you design a mobile observatory?**

Here are a few things to think about in your design:

- **Protective enclosure** that can help protect the telescope from potential light pollution and environmental factors like rain, wind, and dust.
- A **platform** on top of your vehicle or potentially being pulled by a trailer that can **hold** a telescope **securely** and **rotate** to move along with the path of the Sun and the Moon.
- **Durability:** Your mobile observatory may have to travel over different terrains. What are some obstacles you might need to prepare for?

Observing space is all about being prepared for anything, so we cannot wait to see what you come up with!



Conclusion

Reflections

Ask students to reflect on their designs:

- What does the model do well?
- How could you improve it?
- What limitations does it have when representing scientific phenomena (scale, proportion, tilt, etc.)?

Modify and Accommodate

Meet your students where they are. Hands-on, playful learning by nature provides entry points for students and lends itself to giving opportunities to iterate and ask questions for those who need more.

Here are a few ideas to consider:

- Simplify or advance the language to explain the concept of a solar eclipse.
- Use visual aids to illustrate the relationship between the Sun, Earth, and the Moon.
- Simplify or increase the design requirements of the mobile observatory design challenge. Focus on creative and imaginative aspects. For example, have students build a simple structure that represents a mobile observatory without the emphasis on specific features. To advance it, throw an extra design constraint into the mix or add a new barrier to the challenge mid-stream.
- Use visual aids, charts, and diagrams to support understanding. Provide visual step-by-step instructions.
- Consider grouping based on individual needs. Allow students to work in pairs or small groups, where they can receive peer support and collaboration.
- Provide opportunities for one-on-one guidance and support during hands-on activities and discussions.
- Modify materials as needed, such as larger or easier-to-handle bricks.
- Allow extended time for tasks and activities. Break the lesson into shorter segments, allowing for breaks or adjustments based on individual needs.

Share your students' builds with #LEGOeduEclipse

LEGOeducation.com/eclipse

Using LEGO Education Sets

Need inspiration? Explore these lessons to get started building and try these model modifications.

- Cave Car: Students can remove the Light Matrix from the front and add a motor to the driving base and use the other motor for the rotating platform. Students can also use a motor for the rotating platform and the color matrix to represent the Sun disappearing behind the Moon.
- Taxi! Taxi!: Students could modify to only use one motor on the taxi and then use the other motor for the rotating platform.
- Driving Around: Students can use the simple driving base from Training Camp 1 as the base for the mobile observatory.

Other Activities

- Channel your inner storyteller and create a stop-motion animation or video showing the events of a solar eclipse. Create the scene with LEGO bricks or showcase the sequence of events during a solar eclipse with a storyboard or creative writing piece.
- Use LEGO bricks or other materials to show the relationship between the Sun, Earth, and the Moon.
- Create an observation journal leading up to and during the solar eclipse. Record data such as the weather, temperature, and any changes you may notice in the environment during the eclipse. (If it is clear skies, look at shadows on the ground.)
- Create artwork inspired by the solar eclipse. This could include paintings, drawings, or sculptures that capture the essence of the celestial event. Host an art gallery within the school to showcase your creations.
- Write and illustrate a storybook that explains the science behind a solar eclipse.