

Phases of the Moon

Lesson Plan

Overview

Lesson Overview Video

https://youtu.be/JOlj_7_ywhI

Objectives

- Students will model why we see the phases of the moon.
- Students will use message events to trigger another character's sequence.

Computer Science Explanation

This program's characters will use messages to trigger other characters' sequences. These messages are a type of event.

Standards

- Science (NGSS):
 - **1-ESS1-1** Use observations of the sun, moon, and stars to describe patterns that can be predicted.
- Computer Science (CSTA):
 - **1A-AP-10** Develop programs with sequences and simple loops, to express ideas or address a problem.
 - **1A-AP-11** Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions.

Example Program

- This [finished program](#) shows the phases of the moon.

Prerequisites

- Students should have familiarity with sky patterns, particularly the phases of the moon.
- Students should have experience with ScratchJr sequences and events.

Materials & Tools

- [Slides](#)
- Flashlight (optional for review activity)
- ScratchJr, for full-class demonstration and individual work

Lesson Preparation

- If you are not very familiar with why we see different phases of the moon, check out this [recommended video!](#)
- Prepare a space for 3 students to model the movement of the sun, moon, and earth.
 - You can prepare simple paper signs that say “Sun”, “Earth”, and “Moon.”
 - If you have the space in the room, all students can get into groups of 3 to do the model.
- For the program, students can draw their own phases of the moon and specifically identify which parts of the moon are visible and when, or use the simplified version that only makes use of the existing ScratchJr characters (which depicts fewer phases of the moon). Decide which version is a better fit for your students.

Vocab

Word	Definition
Event	Something that causes something else to happen in a program
Rotate	To spin on an axis
Revolve	To spin around an axis [technically interchangeable with “Rotate”]

Agenda

- Review Earth/Moon Movement (10 mins)
- Program Preview (5 mins)
- Program Creation (15 mins)
- Showcase & Closing (5 mins)

Lesson Details

Review Earth/Moon Movement (10 mins)

(Slide 2) Start by introducing Computer Science vocabulary.

(Slides 3-4) Review with students why we see sky patterns:

- The earth rotates on its own axis, the earth revolves around the sun, and the moon revolves around the earth.
 - You can have all students group up and model these movements, or you can just have three students come to the front to model them for everyone else.
 - Students may know that the moon rotates as well, but that will not be a focus of this lesson.

(Slide 5) Have 3 students come to the front of the room to try to model the movements of the earth and moon around the sun. Or, if your room allows, you may choose to have all students get in groups of 3 to model this.

- This activity is optional if time permits.
- The student modeling the sun can just stand still. The Moon student should revolve around the earth student. The Earth student should carefully rotate and also revolve around the sun.

(Slide 6) Review how the moon goes through phases (a “sky pattern”) depending on where it is in its revolution of the earth.

- Students may need to study the picture very carefully to see why the moon has phases.
- You can use a flashlight and the 3 students to model this (as much as your room lighting allows).

Program Preview (5 mins)

(Slides 7-9) Introduce the program that students will be creating.

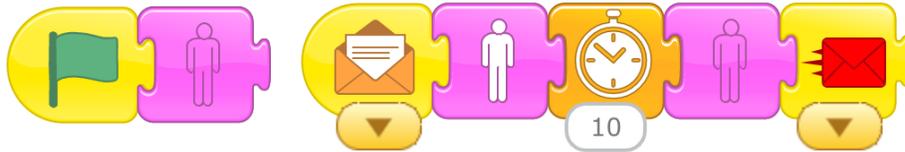
- (Slide 7) Today we will be creating a program in ScratchJr that will show some of the phases of the moon!
- (Slide 8) Take a look at this program - does anyone have any ideas about how we create this program?
 - We can use a picture of the moon and cover parts of it in black to show the phases.
 - We can't change the image of the moon in ScratchJr, so instead we will create 4 moons that will show up one after the other. Because they show up in order, it looks like an animation of the moon revolving around the earth!
- (Slide 9) “Messages” are a type of Event in ScratchJr that will allow one character to send a message to tell another character to start its instructions. Each moon will send a message to the moon that will show up after it. [Explain the blocks in the pictures and how they fit in the code]
- (Slide 10) The Purple-colored blocks are called “Looks” blocks - they change the look of the characters. The blocks we will be using are the Hide and Show blocks, which allow characters to appear and disappear when we program them to.

(Slides 11) Start the program together as a class because this is a fairly complex program:

- Add a sun with rays (using the paintbrush), earth, and 4 moons. [Adding sun rays can be skipped if time is limited]
- Show students how to modify a character using the paintbrush - shade one of the moon phase's shadows. (They will do this for the two shadowed moons, you can choose to do one or both together).
- Program the first moon (the New Moon - completely dark):
 - Adding the Wait block is optional if time is limited. The animation will still work without it - it will just be a lot faster.



- Program the second phase of the moon (note that all moons except the first need to “hide” at the beginning):



- At this point, decide whether you want to continue demonstrating, or if students are ready to continue on their own programs.

Program Creation (15 mins)

Give students time now to finish their own programs in ScratchJr. Use the relevant set of slides depending on if your students will be drawing their own moon phases (Slides 12-14) or if they will only be using ScratchJr characters (Slides 15-17).

(Slide 12) First, have students create all of their characters. They can continue to watch the animation to see the different phases.

(Slide 13) Next, show students the code for the first character - the New Moon.

(Slide 14) Optionally, you can show students the code for the second moon as well if that support is needed.

(Slides 15-17) The process will be the same if students will only be using ScratchJr characters, except they will use the same crescent moon for two partial phases of the moon. As shown in the slides, they are angled to show why different parts of the moon will be visible from the earth.

- For the New Moon, use the paintbucket tool  to color in white sections of the ScratchJr moon.

- For one of the crescents, you can drag the Turn block  and click it to rotate it to the correct position.

Common Challenges and Questions

Question/Challenge	Answer
Why are all the characters “Full Moon”?	“Full Moon” is the default name of the character - it can be changed in the character editing mode.
How do I edit the moon?	Students may click the checkmark out of habit instead of a paintbrush. They can still tap the paintbrush on the character in the character list on the left.
Why do we need to make 4 different moons?	ScratchJr cannot change the appearance of a character, so we are using four different characters to make an animation of a changing moon. Scratch will have the ability to change the appearance, however!
My moons are out of order.	Students might accidentally connect the message colors in the wrong order. Remind them that the message colors need to be connected in the right order, and to check the flow of colors.
Can I copy code to another character?	At this point, it’s better that they get practice adding the right code blocks, but it is possible to drag code to copy it to another character if time is limited!

Extensions

- Students can make the background black and even add small stars. They need to create a new background in order to do this.
- Students can continue adding more phases of the moon, but will not be able to complete a full cycle because there are not enough different colored messages.
- Students can make the earth rotate with the turn block and a loop.



Showcase & Closing (5 mins)

(Slide 18) Allow students to share their programs with one another. If any students have done any of the extensions, you may want to showcase that for the class.

(Slide 19) Discuss challenges that students faced in this program, as it is fairly complex. Acknowledge that programming complex animations will get easier as they practice more!

Resources

Phases of the Moon Video

This is a [video](#) that can help you and/or students understand why we see the phases of the moon.

Assessment Rubric

Category	4	3	2	1
	Advanced: demonstrates superior performance	Proficiency: demonstrates consistent performance	Moving toward proficiency/expectations	Experiencing significant difficulty
1A-AP-10 Develop programs with sequences and simple loops, to express ideas or address a problem.	Student creates a program in which characters successfully trigger one another, and each one shows and hides themselves in order.	Student creates a program in which characters successfully trigger one another in order.	Student creates a program in which at least one character successfully triggers another character.	Student needs significant support to program a character to trigger another character.