

LESSON 14: What is the potential for life in other star systems?

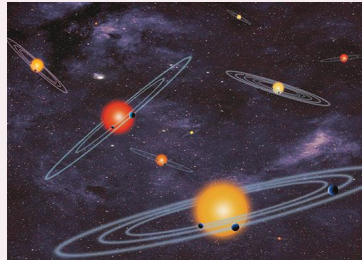
PREVIOUS LESSON

We used our experience with sunsets to think about how the color of light changes as it passes through the atmosphere of a planet. We played with prisms to determine that sunlight is made up of all the colors. We obtained information about how astronomers use color, which told us about the wavelength of light, to learn more about the properties of exoplanets.

THIS LESSON

INVESTIGATION

3 days



We work in small groups to Obtain, Evaluate, and Communicate Information about exoplanets from multiple sources. We create podcasts to share with the class that describe the exoplanet, where this planet is compared to Earth, how the planet was discovered, and create an argument about if this planet could potentially support life.

NEXT LESSON

We will look at a photo taken by the Hubble telescope of the space between stars, showing what we think might be more stars or maybe something else entirely. We will learn that these are galaxies and then watch the movie *Powers of Ten* to visualize how scientists model the universe.

BUILDING TOWARD NGSS

MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, MS-PS2-4, MS-PS4-2



WHAT STUDENTS WILL DO

14.A Obtain, evaluate, synthesize, and communicate information about the discovery, location, and potential for finding life on an exoplanet that is too distant to observe directly, using a podcast format.

WHAT STUDENTS WILL FIGURE OUT

- There is a huge diversity of exoplanets in our galaxy, some of which hold the potential for life.

Lesson 14 • Learning Plan Snapshot

Part	Duration	Summary	Slide	Materials
1	10 min	ASSIGN THE PODCASTS Orient students to where we are and decide to do research on specific exoplanets. Assign the podcasts and go over the rubric as a class.	A-C	<i>Exploring Exoplanets Podcast Project</i>
2	35 min	RESEARCH EXOPLANETS Groups of students work together to obtain and synthesize information from multiple sources about an exoplanet, with a focus on the potential for that exoplanet to support life.	E-I	<i>Exploring Exoplanets Podcast Project, Obtaining Information from Scientific Texts Checklist, Evaluating Information Checklist, internet connected device (for research), Communicating Information Checklist</i>
<i>End of day 1</i>				
3	5 min	NAVIGATION Students complete a self assessment to reflect on their personal contributions to group work.	J	<i>Self Assessment for Collaborative Group Work</i>
4	40 min	PRODUCE PODCASTS Groups produce a podcast to Communicate Information about the characteristics of exoplanets that might signify potential for extraterrestrial life.	K	<i>Exploring Exoplanets Podcast Project, Obtaining Information from Scientific Texts Checklist, Evaluating Information Checklist, Communicating Information Checklist</i>
<i>End of day 2</i>				
5	25 min	PODCAST EXHIBITIONS Groups showcase their podcasts to determine if evidence shows whether or not there could be life on certain exoplanets.	L	<i>Exhibition: Sharing your podcast with/listening to others, 2 devices to play the podcasts</i>
6	10 min	MAKE SENSE OF THE EXHIBITIONS This is a whole-class discussion to build an understanding that there are many exoplanets out there, and several appear to have the potential to support extraterrestrial life.	M	<i>Exhibition: Sharing your podcast with/listening to others</i>
7	5 min	NAVIGATION Decide where to go next.	N-O	(optional: https://www.ted.com/talks/lucianne_walkowicz_let_s_not_use_mars_as_a_backup_planet?language=bn)
<i>End of day 3</i>				

Lesson 14 • Materials List

	per student	per group	per class
Lesson materials	<ul style="list-style-type: none">• <i>Exploring Exoplanets Podcast Project</i>• <i>Obtaining Information from Scientific Texts Checklist</i>• <i>Evaluating Information Checklist</i>• internet connected device (for research)• <i>Self Assessment for Collaborative Group Work</i>• <i>Exhibition: Sharing your podcast with/listening to others</i>• science notebook	<ul style="list-style-type: none">• <i>Communicating Information Checklist</i>	<ul style="list-style-type: none">• 2 devices to play the podcasts• (optional: https://www.ted.com/talks/lucianne_walkowicz_let_s_not_use_mars_as_a_backup_planet?language=bn)

Materials preparation (120 minutes)

Review teacher guide, slides, and teacher references or keys (if applicable).

Make copies of handouts and ensure sufficient copies of student references, readings, and procedures are available.

Make sure that you have secured enough internet-connected devices for each student in your class to do their research on day 1.

Consider how you will need to support students in producing their podcasts. Is there an audio-visual specialist at school who can collaborate to help students make this happen? Does at least one student per group have access to smartphones with recording/editing software?

Some smartphone apps for making podcasts include:

- Anchor (free)
- PodBeam (free up to 5G)
- Spreaker (free)

Some online resources for making podcasts include:

- Buzzsprout (free trial)
- Anchor (free)
- Alitu (free trial)

Some desktop software includes:

- Audacity
- GarageBand

Lesson 14 • Where We Are Going and NOT Going

Where We Are Going

In this lesson, students research exoplanets with the goal of establishing the potential for extraterrestrial life in space, and the potential for humans finding it. The goal of the podcast assignment is to get a taste of the enormous diversity of exoplanetary worlds out there and decide that there might be the potential for finding life on several of them, but that none seem to resemble Earth exactly.

Where We Are NOT Going

Do not spend too much time focused on the details of the exoplanets.

LEARNING PLAN for LESSON 14

1 · ASSIGN THE PODCASTS

10 min

MATERIALS: *Exploring Exoplanets Podcast Project*

Orient students to where we are. Present **slide A** and use the prompts below.

Suggested prompt	Sample student response
What did we figure out about how scientists learn about exoplanets?	We can look at what colors are absorbed by a planet as it passes in front of a star to determine what the planet is made of.
What can that tell us about the potential for life?	If we have some data about what the planet is made of, then we will know if there is water or other chemicals associated with life.

Present **slide B**. Say, *If telescopes like Kepler have discovered thousands of exoplanets, maybe they have already discovered an exoplanet that could host extraterrestrial life! What could we do to find out more about what data scientists have collected about all of these exoplanets? Turn and talk to a partner.*

Look for students to suggest searching the internet or doing research at the library. Say, *We should break into small groups and look at different planets, so that we can cover more ground.*

Assign the podcasts. Present **slide C** and say, *Each group is going to look for information that astronomers have discovered about a specific exoplanet. You will then process and communicate that information to the class as a podcast.*

ALTERNATE ACTIVITY

If you want to provide more student choice, and/or if you are worried that the technology demands of creating podcasts will create issues of inequitable access/opportunity, consider giving students the option of creating infographics instead. These can be created digitally using any number of software options (e.g., Adobe Photoshop, Paint, Preview, MS PowerPoint, MS Word) or online tools (e.g., Canva, Prezi, Google Slides), or they can be created by hand on 11x17 paper.

Use the *Exploring Exoplanets Podcast Project* to make explicit what is required. Walk students through the different phases of the project. Students will turn in a copy of the rubric (on page 2) as a self-assessment, after the podcast exhibitions. The teacher does not need to fill in new rubrics, but instead comment on the rubric turned in by the students and adjust scores as necessary.

ADDITIONAL GUIDANCE

Students listened to podcasts in Lesson 1. If you wish to provide further support for how to make a podcast and the qualities of a good podcast, give students time to peruse <https://www.npr.org/2018/11/15/662070097/start-ing-your-podcast-a-guide-for-students>.

Introduce additional scaffolding for Obtaining, Evaluating, and Communicating Information. Display **slide D**. Say, *In the next activity, you and your group members will each have the opportunity to Obtain, Evaluate, and Communicate Information about the exoplanet you chose to look at as a candidate for potential of extraterrestrial life. Scientists spend much of their workdays Obtaining, Evaluating, and Communicating Information. Often that information comes from papers, graphs, images, and other data representations that other scientists publish. Sometimes they read science news articles. Scientists often give talks or create posters to share their ideas and get feedback. They do not just Obtain, then Evaluate, and then Communicate Information. They use all sorts of combinations to do their work.*

Say, Each group will need to Obtain, Evaluate, and Communicate Information from scientific texts. You will use the internet to support your research and need to choose reliable sources of information that include evidence and citations. A good place to start is the NASA Exoplanet Catalog or the list of exoplanets discovered using the Kepler space telescope (Wikipedia). Your group members will later evaluate the reliability of your source.

2 · RESEARCH EXOPLANETS

35 min

MATERIALS: *Exploring Exoplanets Podcast Project*, *Obtaining Information from Scientific Texts Checklist*, *Evaluating Information Checklist*, internet connected device (for research), *Communicating Information Checklist*

Choose research groups and assign roles. Display slide E. Divide your class into groups of 3 students. Each group will need to choose a different exoplanet from the list on https://en.wikipedia.org/wiki/List_of_exoplanets_discovered_using_the_Kepler_space_telescope in the *Exploring Exoplanets Podcast Project*. Explain that each group will go through three rounds of Obtaining, Evaluating, and Communicating Information.

Round	Job		
1	Student A fills out the <i>Obtaining Information from Scientific Texts Checklist</i> for one source.	Student B fills out the <i>Obtaining Information from Scientific Texts Checklist</i> for one source.	Student C fills out the <i>Obtaining Information from Scientific Texts Checklist</i> for one source.
2	Student A fills out the <i>Evaluating Information Checklist</i> for C's source.	Student B fills out the <i>Evaluating Information Checklist</i> for A's source.	Student C fills out the <i>Evaluating Information Checklist</i> for B's source.
3	All together: Fill out the <i>Communicating Information Checklist</i>		

Round 1: Obtaining Information from different sources. Display slide F. Handout the *Obtaining Information from Scientific Texts Checklist* to each student. Make sure that each student has an electronic device that can connect to the internet to find and obtain information from various sources on exoplanets. Each student will need to find information from a source different from the other group members and fill out the *Obtaining Information from Scientific Texts Checklist* individually. Give students 15 minutes to find their source and complete the *Obtaining Information from Scientific Texts Checklist*.

Round 2: Evaluating Information from each source. Display slide G. Handout the *Evaluating Information Checklist* to each student. Each group will have 8 minutes to jigsaw their sources between students. Each student will hand their *Obtaining Information from Scientific Texts Checklist* to another student. The other student will use the *Evaluating Information Checklist* to evaluate the other student's source from *Obtaining Information from Scientific Texts Checklist*.

1. Student B evaluates Student A's source.
2. Student C evaluates Student B's source.
3. Student A evaluates Student C's source.

Round 3: Preparing to Communicate Information from all of the sources. Display slide H. Hand out a copy of *Communicating Information Checklist* to each group. Give groups 7 minutes to work together to fill out the *Communicating Information Checklist* using the information from each member's *Obtaining Information from Scientific Texts Checklist* and *Evaluating Information Checklist*.

Groups work together to synthesize the information to address the categories in the rubric. Display slide I. Give each group 5 minutes to use the rubric on *Exploring Exoplanets Podcast Project* to begin to synthesize the information needed for their podcasts. Remind students they will have time in the next class to continue to synthesize the information and create their podcast.

ALTERNATE ACTIVITY

If your circumstances allow, students and groups can bring home the *Exploring Exoplanets Podcast Project*, *Obtaining Information from Scientific Texts Checklist*, and *Evaluating Information Checklist* and continue to synthesize the information for their podcast as home learning.

End of day 1

3 · NAVIGATION

5 min

MATERIALS: *Self Assessment for Collaborative Group Work*

Self assessment. Display **slide J**. As they are entering the class, hand out a copy of the *Self Assessment for Collaborative Group Work* to each student. Give students 5 minutes to individually reflect on their contributions to small group collaboration. Collect *Self Assessment for Collaborative Group Work* or have students tape it into their notebooks.

Say, *I want you to focus on your two areas of greater contribution today while you are working in your small group to produce your podcast. You can ask your group members to help you focus on those areas of growth throughout the day.*

4 · PRODUCE PODCASTS

40 min

MATERIALS: *Exploring Exoplanets Podcast Project*, *Obtaining Information from Scientific Texts Checklist*, *Evaluating Information Checklist*, *Communicating Information Checklist*

Students finish up what they were doing the previous day. Tell students to finish their research and synthesis if they need to, but to move on quickly to writing a podcast script.

Present **slide K**, with the following directions:

1. Consider with your group - what will be the best way to communicate this information? What story do you want to tell?
2. Write a script using the information you obtained and decide who will say what.*
3. Figure out if there are any other production decisions you want to make (such as sound or music).
4. Record the podcasts.

* ATTENDING TO EQUITY

Some students do not feel comfortable having their voices recorded. To ensure equitable participation, encourage students to feature multiple voices, but do not require it. Keep your eye on all groups to make sure that students are participating in the production of the podcasts in other ways.

End of day 2

5 · PODCAST EXHIBITIONS

25 min

MATERIALS: *Exhibition: Sharing your podcast with/listening to others*, 2 devices to play the podcasts



Producers exhibit their podcasts. Display **slide L**. Break the class into two sections, so that each section consists of 5 groups that will be hearing 4 podcasts from other groups. For each podcast, students will fill out *Exhibition: Sharing your podcast with/listening to others*. Make sure that each section has a way to play podcasts in a way that does not disturb the other section playing podcasts.

Exoplanet	Do you think there could be life on this planet? If so, what do you think this life would be like?	What evidence do you have to support this claim?

Collect *Exploring Exoplanets Podcast Project* from each student. If you are looking for additional assessment opportunities you may also wish to collect the *Obtaining Information from Scientific Texts Checklist*, *Evaluating Information Checklist*, and **Exhibition: Sharing your podcast with/listening to others at this time.**

ASSESSMENT OPPORTUNITY

Building towards: 14.A Obtain, evaluate, synthesize, and communicate information about the discovery, location and potential for finding life on an exoplanet that is too distant to observe directly, using a podcast format.

What to look for/listen for: See the rubric found on page 2 of *Exploring Exoplanets Podcast Project*.

What to do: If students are struggling to Obtain, Evaluate, or Communicate Information, direct them back to the *Evaluating Information Checklist* and the *Communicating Information Checklist* where they initially gathered and evaluated their information in preparation to communicate. If students are struggling to synthesize their information to explain whether or not they think their exoplanet could support extraterrestrial life, refer them back to the exoplanet and system descriptions on page 2 of *Exploring Exoplanets Podcast Project*. Ask them what evidence they gathered about the characteristics that could potentially support life.

6 · MAKE SENSE OF THE EXHIBITIONS

10 min

MATERIALS: *Exhibition: Sharing your podcast with/listening to others*

Make sense of the podcasts. Project slide M. Hold a whole-class discussion to build an understanding that there are many exoplanets out there, and several appear to have the potential to support extraterrestrial life.

Suggested prompt	Sample student response
What can we take away from our exoplanet podcasts about the potential for life in the universe?	<p>There are so many exoplanets.</p> <p>Many exoplanets have some characteristics that make them suitable for life.</p>

Suggested prompt	Sample student response
<i>What were some of the characteristics you found that made some exoplanets more suitable for life?</i>	<i>(Students should cite specific characteristics from specific exoplanets from Exhibition: Sharing your podcast with/listening to others, such as the presence of water, not being too hot or too cold, having an atmosphere, etc.).</i>
<i>How has your thinking changed about the potential for extraterrestrial life?</i>	<i>I think there could be life on _____ exoplanet because it has the potential for water. My evidence is that _____.</i>

7 · NAVIGATION

5 min

MATERIALS: science notebook, (optional: https://www.ted.com/talks/lucianne_walkowicz_let_s_not_use_mars_as_a_backup_planet?language=bn)

Decide where to go next. Say, *Wow, there are so many different exoplanets around other stars! There could definitely be life out there among the stars!*

Present **slide N**. Say, *We were able to discover so much in the sky that seems invisible at first glance. What else is out there that we can't see? Could there be something even beyond the stars we see in our sky? Let's do a quick Stop and Jot to answer: What could we do to figure out if there is more to explore (such as planets, star systems, etc.) beyond the stars we can see?*

As students share out, look for students to suggest looking beyond the stars we can see. Maybe we could use a telescope to zoom in on the space beyond the stars we can see.

Suggested prompt	Sample student response
<i>What could we do to figure this out?</i>	<i>We could look to see what is beyond the stars we can see.</i>
<i>Beyond the stars we can see is really, really far! What instruments could we use to look that far away?</i>	<i>We have looked at data from telescopes before. Maybe there are teloscopes that can look even farther.</i>

Say, *We are wondering if we could use a telescope to look beyond the stars we can see. Let's look into this more next time.*

Reflection Exit Ticket (optional). Display (optional) **slide O**. Say, *Even though we think there might be some kind of life on some of these planets, none of these places looked like we could live there. What can we learn from planets that we will never live on, other than if there is life out there? Turn and talk to a partner for a minute.*

Then say, *I found a video I wanted to show you considering this question.*

Play https://www.ted.com/talks/lucianne_walkowicz_let_s_not_use_mars_as_a_backup_planet?language=bn .

Ask students to respond to the Turn and Talk prompt as an exit ticket.