

THE ZOOM ADAPTED

RISING STARGIRLS ACTIVITY

HANDBOOK



Example cover page of the online Rising Stargirls Playbook by Maya Silverman

Adapted by Maya Silverman from
The Rising Stargirls Teaching and Activity
Handbook by Dr. Aomawa Shields

This handbook was created in an effort to make virtual Rising Stargirls Workshops possible. We suggest using Zoom to hold virtual workshops because of the many security features available and have thus made Zoom specific suggestions in this handbook. However, if you are working with a group of girls that are more familiar with another video calling site (eg. Google Hangouts), this handbook may be adapted to work with that site.

Using Zoom Best Practices

We want to mention some tips specific to this Handbook and the activities you will be doing. We suggest requiring that everyone's camera and audio are on, this leads to a more captivating learning experience.

- When you share your screen to show photos and videos, please be mindful of what the girls can see on your screen. We suggest using PowerPoint or Google Slides and closing everything else on your desktop so that the girls only see what you intend them to see.
- For most of the activities, we suggest that you use gallery view (and that you help the girls navigate to speaker view) so that you can see all the girls at once. When girls are giving presentations to the group, we suggest that you use speaker view (this is specified in each activity).
- When you put girls into breakout rooms, we suggest that you check in on each group at least once. Each time that you put the girls into breakout rooms, ask them to first introduce themselves (in case they forgot each other's names, and to get the ball rolling). Let the girls know that when they are in their breakout rooms, there will be a question mark icon in the panel at the bottom of their screen. If they click this, it sends the host a notification that that group has a question, and that you should join their group to talk with them. This is the best way for the girls to communicate with you while they are in breakout rooms. It might be easiest to set your settings such that you "Move all participants into breakout rooms automatically." This way there is less technical work for the girls. You may also want to "Allow participants to return to the main session at any time." Both of these options can be found once you create breakout rooms under "Options^".
- When recording any part of the workshop, please get consent from all of the girls and state when you are recording.
- We suggest that you give the girls a short tour of the technology at the beginning of the workshop to make sure everyone knows how to mute/unmute, turn their video on and off, choose speaker view or gallery view, chat, etc. We also suggest you give the girls a few tips in case their internet connection is unstable and they are dropped from the call. Here are a few tips: rejoin call if dropped or audio/visual is not working, find best wifi connection in the house if on a laptop, and connect to ethernet if possible. Please contact us if you or the girls you work with experience trouble connecting.

Below is a list of resources to help you set up Zoom and use some key aspects. Please pay special attention to making *safe* Zoom meetings. There have been instances of Zoombombing in elementary classes and we want to make sure that doesn't happen to you.

- How to host a secure Zoom meeting: <https://techprep.oit.uci.edu/zoom/zoombombing/>
- Scheduling meetings: <https://techprep.oit.uci.edu/teaching/getting-started-with-zoom-instruction/>
- Recording meetings: <https://support.zoom.us/hc/en-us/articles/206277393-Finding-and-Viewing-Recordings>
- Breakout rooms: <https://support.zoom.us/hc/en-us/articles/206476093-Getting-Started-with-Breakout-Rooms>
<https://support.zoom.us/hc/en-us/articles/206476313-Managing-Video-Breakout-Rooms>
- Screen sharing: <https://support.zoom.us/hc/en-us/articles/201362153-How-Do-I-Share-My-Screen->
- In meeting chat: <https://support.zoom.us/hc/en-us/articles/203650445-In-Meeting-Chat>
- Virtual background: <https://support.zoom.us/hc/en-us/articles/210707503-Virtual-Background>
- Optimized sharing for video clips: <https://support.zoom.us/hc/en-us/articles/202954249-Optimizing-a-shared-video-clip-in-full-screen>
- Etiquette and best practices: <https://www.technology.pitt.edu/blog/zoom-tips>
- Tips for teaching on Zoom: <https://zoom.us/docs/doc/Tips%20and%20Tricks%20for%20Teachers%20Educating%20on%20Zoom.pdf>

Ice Breakers

“What are you doing?” game (10 mins)

The girls are put into a random order which is posted into the Zoom chat where everyone can see it. Ask all the girls to stand up such that most of their body can be seen. The first player says their name and then starts miming an activity. As soon as the activity is clear, player 2 approaches player 1 and asks “Hi [name of girl before her], my name is [name]. What are you doing?”

The first player answers something that has nothing to do with what she's actually doing. For example, if player 1 is pretending to roller skate, when asked what she's doing she might say "I'm reading a book".

The second player starts miming the activity stated by the previous player. A third player comes up to player 2, asks what she is doing, and so on.

Play until everyone has mimed something, and has answered the question.

Note: Saying your name is added to the Zoom version to create a more personal environment, help girls learn each other's names, and make sure girls know who they are going after. It would be best to use "speaker view" for this game so that each girl is seen on a big screen when she is speaking and doing her movements. Additionally, we highly recommend that the host of the session mute everyone and manually unmute the two girls who are interacting at each stage, otherwise, other girls might pop up in the speaker view, and the girl who is doing her action will not be seen.

Activities

Who, what, and where?

Learning Goals: Encourage personal expression and stretch of imagination; provide an opportunity for girls to get to know each other through personal sharing.

Once the girls are warmed up from playing a couple of theater games, have them all sit in front of their computer. There is no specific order this time. Whoever speaks first gets to go. This might leave a few silences or two girls might speak at once but this helps the girls learn to listen as well as speak up.

Have each girl say:

- A. Her name
- B. A favorite hobby
- C. Where she would visit on Earth or elsewhere in the universe if money were no object

Each successive girl must first repeat the 3 facts about the girls before her, followed by her own. The last girl must repeat everyone else's before hers. This encourages girls to volunteer first. It means they have less to remember! It also gets girls to listen to each other share, and learn about each other.

Note: Remind girls not to get discouraged if multiple people speak at the same time. If you don't get to go the first time you wanted to share, try again. We also suggest that the educator keep a checklist of all girls handy to make sure that everyone got a chance to go by the end, and call on any of the girls that are left.

First exploration of how girls view scientists (15 min)

Materials: lined composition books, pen, pencils, colored pencils, and crayons. Distribute these materials beforehand, or ask girls to use materials that they have at home. The composition books can be made out of a stack of paper that is stapled together.

These will be called “playbooks” to encourage girls to think of the activities they do inside the books as play, NOT work.

1. Have girls draw what a scientist looks like (Do not give girls any leading or prompting beforehand. Just tell them to draw what they think a scientist looks like).
2. When all girls have finished, ask girls to share adjectives aloud that came to mind when they were doing their drawing. Have girls use the raise hand feature and call on girls as they raise their hands.

Writing exercise #1 (15-20 min):

Writing in online composition books. If any of your girls are not comfortable typing, have them write on a piece of paper and send you (the educator) a photo at the end of the day. You can then either insert this picture into their online playbook, or transcribe it.

Goal: Initial assessment of girls’ exposure to astronomy/astrobiology concepts. Tell girls the rules (Inspired by Writing Down the Bones, by Natalie Goldberg.):

1. Keep hand moving for full 5 min
2. Don’t delete
3. If you get stuck, write the first sentence again: “When I look at the sky at night I think of...I think of...I think of...”
4. You might think of other things not related to the sky during the writing time. That’s great! Write it down. It’s a starting point, but our minds don’t always stay in a straight line (they rarely do). Follow your mind where it goes.
5. If you feel like you’re dancing around something that you really want to say, write a dash --- what I really want to say is_____.

Writing Prompts:

1. Girls open playbooks/journals and write for 5 min “When I look up at the sky during the day I think of...”
2. Girls write for 5 min “When I look up at the sky at night, I think of...”
3. Put girls in breakout rooms of 2 to take turns reading what they wrote.

Writing exercise #2 (15 min):

1. Free writing topic: “When I hear the word “Astronomy”, I think of...” (5 min)
2. Free writing topic: “When I hear the word “Astrobiology”, I think of...” (5 min). Say, “If you don’t know what Astrobiology is, put that down. That’s why you’re here!”
3. *Assessment question: Yes/No response: Girls record in their books if they have ever gone outside at night and looked at the stars, either while camping or stargazing by themselves. (“Write: Been outside and looked up at night sky: (Yes/No)”) ”
4. Divide girls into breakout rooms of 3. Girls take turns reading their writing to each other.
5. Regroup to the main Zoom room. Invite girls to share aloud some of their thoughts on both words.

Writing exercise #3 (10 min) - ASSESSMENT Q’s

Have girls open to a new page in their playbooks, and say: “On scale of 1 (strongly disagree) to 6 (strongly agree) rate your level of agreement for the following statements”:

1. I talk to my family and friends about science.
2. I see myself as a science person.
3. I believe I can do well in science.
4. I like my science classes.
5. Rate your interest in astronomy 1 to 7 (note the different scale here)
1 = “Not interested at all”; 7 = “I want to be an astronomer”
6. Rate your current knowledge of Astronomy 1 to 7
1 = “I don’t know anything”; 7 = “I’m an expert”

[Hint: it helps if you write each sentence on the board, with the numbers underneath. For example:

I talk to my family and friends about science.

1	6
strongly disagree	strongly agree

and tell the girls they can choose any number from 1 to 6 to rate their level of agreement with this statement.]

Who/where/how/what: Introducing yourself to the girls (20 min)

This is an important component of the workshop, especially if the girls are just meeting you for the first time today. Tell them about yourself – who you are, where and who you came from (place and family), how you got here (whatever that means to you), and what nourishes/fuels/supports you in your daily life and endeavors. The girls are going to do this exercise too, so be as open as you can be, as it will help them feel comfortable sharing who they are in a personal way.

I encourage you to use PowerPoint slides (you can use the share screen feature on Zoom for this) showing pictures of you as a young person (like these girls are), your family, favorite places in the world, astronomical images that signify what got you interested in astronomy, etc. Be creative. And be brave. Share your struggles with them, and any other personal challenges, especially if related to academics. And share outside hobbies! This will help the girls start to see that scientists (and other professionals) are regular, three-dimensional people like them.

Decorating Playbooks (1-1.5 hrs)

Learning Goal: Allow the girls time to personalize their playbooks with astronomy pictures they select themselves, along with providing initial exposure to pictures of astronomical phenomena.

Tools (if your girls do not have access to these tools, please reach out to us, as we can help send each girl a “tool box”):

Playbooks

Astronomy magazines (Sky and Telescope, Astronomy, Scientific American, National Geographic) or see the bank of images we compiled

Scissors

Glue sticks

1. Tell girls to flip through magazines and tear out pages with pictures they like.
2. Girls decorate the front and back covers of their playbooks.

Option: You could bring in other magazines as well – maybe travel magazines, home decorating magazines – to give the girls an opportunity for even more personal expression in their playbooks. Be careful with bringing in fashion magazines though, as some of the content in those magazines is adult in nature. If you do decide to bring in fashion magazines, be sure to tear out pages that have mature content in advance (or just bring in age-appropriate pages from the magazines).

Note: Be sure to tell the girls to write their names in the inside cover of the playbook or on the cover, so you know whose is whose.

Homework

Tell the girls it is now their turn to do Who/Where/How/What. They can use PowerPoint or Google Slides if they have them, and put pictures on slides, or share the photos with you, the instructor, and you can share these photos via Zoom. Or if they do not have laptops, they can bring pictures and show them over Zoom. They should answer all four questions (Who are you? Where and who do you come from (place and family)? How did you get here (whatever that means to you)? What nourishes/fuels/supports you in your daily life and endeavors? Tell the girls to aim for 10 minutes, and if they can, to practice at least once before (tell them to practice in front of their family if possible)

Who/Where/How/What (30-45 min)

Learning Goal: Give the girls the opportunity to share who they are with their peers, and enhance their self-esteem through personal expression and communication.

Each girl shares their personal story in whatever way she chooses best. Be sure to tell all the girls at the beginning to listen and pay attention to each other, and to give the same respect to their peers as they would want to have themselves. The girls can share photos either by sharing their screen through Zoom and going through a slideshow, or by sending you the photos and you share your screen for them, or they can bring physical copies of photos and hold them in front of the camera for all to see. If this is the case, make sure to use speaker view.

Constellation activity (30 min)

Learning Goal: Introduce the girls to what constellations are, to their subjective nature, and to the range of cultures that have named constellations and created myths around their origin.

Note: Before starting this activity, please prepare the Zoom poll. Here are what the polls should look like: Ask the question: “Are the stars we see in a constellation all at the same distance from the Earth or at different distances from the Earth?” Have the answers be: “The same distance from the earth,” and “At different distances from the earth.”

Educator: Say something like, “So I heard [or saw in their writing in their playbooks] the word “stars” mentioned earlier this week. Any particular pattern stars can take?” (Wait for someone to mention “Constellations”).

1. Have girls write down in their playbooks the names of any constellations they've heard of, and whether they've seen them directly (1-2 min).
2. Discussion: Girls share the names of the constellations they wrote down. Note: You will likely hear "big [little] dipper!" This is fine. If you like, you can tell them that technically these are patterns within the larger constellations of Ursa Major and Minor, respectively.
3. Share your screen and show images for the most popular constellations—Ursa Major/Minor, Orion, Cassiopeia, Pegasus, etc. Examples of books that are good to use are:

Constellations: A Field Guide to the Night Sky, by Giles Sparrow

Stars: A Month-by-Month Tour of the Constellations, by Mike Lynch

4. Show map of US with state boundaries. Then show a Celestial map with constellation boundaries (these are in the above books, or a large celestial map poster is great).
5. *Assessment Question: Prepare and administer a Zoom Poll. Ask the question: "Are the stars we see in a constellation all at the same distance from the Earth or at different distances from the Earth?" Have the answers be: "The same distance from the earth," and "At different distances from the earth."
Answer: Different distances. The stars in a given constellation are not actually physically associated with each other.
6. Tell the girls the answer: "Actually, the stars in a constellation just look to us like they're all at the same distance from us. In reality, they're all at different distances, and are not even physically related to each other. For example [show the constellation of Orion in one of the books, or draw it on the board. Many girls are familiar with this constellation.] the star Alnilam in Orion is almost 6x farther away from us than Bellatrix. This pattern of stars looks a certain way to us because of where our planet is in Space. To someone on another planet somewhere else in the universe, they might see an entirely different pattern of stars.

A few things about stars...

Educator: Tell the girls, "I want to cover something important about stars. Stars come in many colors. There are yellow stars, like our Sun, and blue stars, and red stars too (if you have a large blue ball, a medium-sized yellow ball, and a small red ball, this is good to use while you're explaining). There are also orange and white stars too. Blue stars are really big, yellow stars are mid-sized, and red stars are really small. Most of the stars in our galaxy are small, red stars. Planets have been found orbiting all colors and sizes of stars."

“Anybody know why stars shine? They shine because they’re working hard. They’re like big factories, converting a chemical called hydrogen into another, heavier chemical called helium (like the helium in balloons at b-day parties!). That process releases energy, and that energy makes the star shine. Stars shine in many colors. Stars are like you. You are all shining brightly here on Earth, and you shine in many colors.”

“Stars also are born, live, and die, just like us. Anybody run track? Or have you ever had friends who ran around a lot and were always busy, going here and there, doing this and that? Is that you? If so, do you have friends who seem to move slowly – walk slowly, talk slowly, and take longer to eat? Stars are different like that too. The big ones are the sprinters, giving everything they’ve got for a really short amount of time, and then they’re done, and they die. The small ones are the long distance runners, conserving their energy so they can last the whole race. Big, blue stars don’t live very long, a few million years (not that long for stars), and small, red stars live for billions or trillions of years!”

Make Your Own Constellation (45 min)

Developed by Professor Kelsey Johnson for the organization “Dark Skies, Bright Kids” at the University of Virginia (dsbk@virginia.edu). Reprinted here with permission from Kelsey Johnson.

Description: Students are given an introduction to some constellations in the night sky and are taught some of the constellation creation myths. Students create their own constellation and write their own story that explains the creation of the constellation. Students share their constellations and their stories with the class.

Materials:

- Educator
 - Slideshow of constellations to show the girls through Zoom
- Each student needs
 - Constellation template (either made by the student by punching holes randomly in a black piece of paper, or prepared by educator and sent to the student, or the online version in the Google Slides Playbook)
 - Dry erase crayons or chalk or ability to use tools in Google Slides

Goals:

- Demonstrate that constellations are cultural constructions
- Create a new constellation and its origin story
- Share their work with their peers

Introduction to Topic

Constellations are patterns of stars in the night sky that resemble objects, people, or animals. Different societies have created their own constellations in the night sky. In the United States, we are most familiar with the constellations of the Greco-Roman tradition, but nearly every culture has their own constellations and a set of corresponding myths that explain the origin of that constellation. We present some references for constellation stories in the Resources section. There are several ways to teach this lesson depending on your goals. Some examples are:

1. Encourage students to observe the night sky; present a set of constellations and stories that are visible in your area for the current time of year.
2. Demonstrate that constellations are cultural a phenomenon; present constellations that are represented in multiple cultures. Some constellations that appear in both Greco-Roman and Native American mythology are Orion, Taurus, Ursa Major, and Ursa Minor
3. Write original stories;
Present a set of constellations that tell a complex story.
 - a. Andromeda, Pegasus, Perseus, Cepheus, Cassiopeia, and Cetus are related in Greco-Roman mythology.
 - b. Ursa Major, Ursa Minor, Canis Major, Canis Minor, and Orion are related in both Native American and Greco-Roman cultures.

Pre-Activity Instruction:

Explain what constellations are and how constellations are created. Ask students if they know any constellations and/or their origin myths.

Preparation:

1. Pick at least two constellations to show students and learn their associated origin myths. Some excellent books for this are:

Dot to Dot in the Sky: Stories of the Stars, by Joan Marie Galat

Dot to Dot in the Sky: Stories of the Zodiac, by Joan Marie Galat

Sharing the Skies: Navajo Astronomy, by Nancy C. Maryboy, PhD and David Begay, PhD

Stars of the First People: Native American Star Myths and Constellations, by Dorcas S. Miller

2. Punch holes in the construction paper (we find that half-sheets work well) randomly to serve as stars, and send them to the girls. If your girls have access to black construction

paper and a hole punch, they can do this preparation step themselves. If you are using the Google Slides Playbook, there is an online version of the constellation template there.

Procedure

1. Show the constellations to the students. Do they “see” the picture in the stars?
2. Instruct the students to get out their construction paper constellation template, or instruct them to scroll to the page in the Google Slide. Tell them to pretend that the holes in the paper are stars and to use them to create their own constellation.
3. Have the students name their constellation and write their own origin myth.
4. Have the students share their story with the class.

Post-Activity Discussion

- *Can anyone create constellations?*
Yes! And they can share their constellation story with their friends and family.
- *Summarize what constellations are and encourage the students to go out one dark night to see if they can find anything up in the night sky. They might even be able to find their own constellation!*

Extensions and Related Activities: Observing

Resources

- Dot to Dot in the Sky is a series of books that show common solar system objects and gives their related creation stories at an appropriate level for elementary school classrooms.
<http://www.whitecap.ca/Detail/1552851826> (sky)
<http://www.whitecap.ca/Detail/1552858057> (zodiac)
- Several astro-photographers offer series of real night sky images that show common constellations as they appear to the naked eye or with amateur telescopes.
<http://southernskyphoto.com/constellations/constellations.htm>
Note: These are often “upside-down” compared to how girls in the Northern Hemisphere would typically see them. Be sure to mention that, especially if you are working with girls in the Northern Hemisphere!
- *Stars of the First People* is an excellent book that compiles a number of myths from Native American peoples.
- *Sharing the Skies* is a book about Navajo Astronomy.
- Ian Ridpath is a professional astronomer who has created an online book
- that gives a detailed history of constellations and their related mythology. See especially chapter 3.
<http://ianridpath.com/startales/contents.htm>

- Stellarium is free, open-source planetarium software that can be used on most personal computers and operating systems. It contains overlays of constellations from many cultures and contains links to their origin myths. <http://www.stellarium.org/>

Glossary

- *Constellation* – A group of stars perceived as a figure or design, most notably those from classical mythology, common animals, and objects.
- *Myth* – A traditional story, especially one concerning the early history of a people, the world, or a natural phenomenon.
- *Origin Story* – A story that explains how something came to be.

Art and the Cosmic Connection (1.5-2 hrs)

<https://eurekus.org/nasa-art-cosmic-connection>

Created by Monica & Tyler Aiello, Artists & Educators for NASA’s Discovery and New Frontiers Programs

Credit: NASA’s Discovery and New Frontiers Programs

(<https://www.nasa.gov/planetarymissions/discovery.html>) and Eurekus (<http://www.eurekus.org/>).

Art & the Cosmic Connection is designed to engage students in space science education by becoming artist explorers. Using the elements of art – line, color, texture, shape, and value – students learn to analyze the mysterious surfaces of our rocky celestial neighbors - planets, moons, comets and asteroids – as well as our beautiful Earth.

Goals: Fusing art and science education inspires students to explore both disciplines. Students create art inspired by planetary images, and their understanding of planet surfaces deepens when observing them through an artist’s lens.

For the Educator:

- Educator Guide
(<https://drive.google.com/file/d/1hNi38WRTGyzJtaQqgJoFl3DS6o5hLNDc/view?usp=sharing>)
- PowerPoint Presentation
(<https://drive.google.com/file/d/1Xm8yX28x84wjZ3N8ii7v4orimL8xRY7I/view?usp=sharing>)
- Presentation Notes (http://www.jpl.nasa.gov/edu/pdfs/cosmicart_notes.pdf)
- NASA Space and Earth Images
(https://drive.google.com/file/d/1kHEv_YmtYlCmzCI0RGesnKV_oMQSrZkp/view?usp=sharing)

Tools for the girls:

- NASA Space and Earth images (see above)
[Share the link to these with the girls so they can take their time looking through them. Alternatively, the educator can print out a copy of these images for each girl and send them to her before this activity. These can be part of a “tool kit” that the girls get.]
- Soft pastels or any type of coloring utensil that the girls have access to
- Large (at least 9”x11”) drawing paper
- Hand wipes (optional)
- Fixative spray (optional)
- Q-tips (optional)
- Gummy erasers (optional)

Go through the PPT presentation, introducing the girls to the elements of art and how they manifest in planetary surface geology. The beginning of the PPT provides an excellent intro to the planets in general, and you can involve the girls by asking them to name the planets before you tell them, etc.

Then direct the girls to the NASA space and earth images, and have the girls each select an image and do her own artistic interpretation of the image. Be sure to tell them their drawing does NOT have to look exactly like the image. That’s why it’s an interpretation!

If time permits at the end of the day, go around the room and have each girl share why they chose their particular NASA image, and what aspects (if any) of the image they focused on while making their artistic interpretation.

Introduction to the planets (1-1.5 hrs)

Learning Goals: Introduce girls to the different planets that make up our Solar System, and basic aspects about each planet; encourage girls to listen to their first instincts, and to begin to accept their creative minds and how they could be connected to what they learn about astronomy; encourage the girls to think about the significance of a planet’s atmosphere; give the girls a basic understanding of scale, and the distances between the inner vs. outer planets.

Planets

- Show slide images of different planets.
- Also can show and direct the girls to this set of solar system lithographs and discuss each solar system body:

https://www.nasa.gov/sites/default/files/files/Solar_System_Lithograph_Set_h.pdf

- Go through each planet
 - Ask girls “what do you notice about each planet?”
 - Then show actual image of planet in PowerPoint (images of Solar system planets can be found here: <http://spaceplace.nasa.gov/gallery-solar-system/en/>)
Note: You may have already shown some of the terrestrial planets in “Art and the Cosmic Connection”.
 - Tell girls to write down in their notebooks the first word that comes to mind when they see the planet.
 - Say, “What do you notice about the Earth here? Anything (colors, oceans, continents)? [girls answer out loud]”
 - Talk about the Earth. Ask “What makes it different from other planets in the solar system? (has oceans, life, blue sky, etc.,)”
 - Share the Earth planetary pal (if you have it)
 - Ask the girls to imagine a Ritz cracker (or any other cracker they like). “Write down the first thing that comes into your mind when you imagine looking at or touching or tasting the cracker. This doesn’t have to make sense. It can be totally random, and that’s fine. Wonderful even.”
 - Ask, “Is there anything about the crackers that reminds you of some aspect of the Earth?” (Ask girls to volunteer to share if something comes to mind.)
 - Show Venus. Write down the first word that comes into your head when you see it. “What have you heard about Venus? Where does it get its name? What does it mean? Is Venus a hot or cold place?” Administer a poll asking the question “Do you think Venus is a hot or a cold place?” Let the girls respond before moving on.
 - Talk about Venus (“it could melt lead!” “You couldn’t breathe”, etc.)
 - “Venus is really hot. Does anyone know why?” (They might say because it’s so close to the Sun. Give ample time for any other answers.)
 - “Venus is closer to the Sun than Earth, but it’s much hotter than it would be based on that distance. It’s so hot (almost 900 degrees F (almost 500 C)!) because it has a REALLY thick atmosphere.”
 - Talk about how an atmosphere is like a thick sweater. Ask the girls “Has anyone ever gone outside when it’s really hot, and worn something much too warm, like a big sweater or coat? What does that feel like?” (Let girls answer.)
 - “Well that’s how Venus is. It’s wearing a really heavy coat. And that’s what makes it so hot.”
 - “Have humans ever set foot on Venus? [Answer: No.]”
 - Show Venera lander image:
<https://nssdc.gsfc.nasa.gov/image/planetary/venus/venera13-left.jpg>
 - Go through each planet, and the Sun, like this. You could also talk about comets and asteroids too. Be sure to mention when you get to Mars that Mars actually has

an atmosphere that's too thin ("So it's wearing a light, wispy tank top, when it should have on a jacket!"). You can also say, "Because its atmosphere is so thin, its temperatures are all over the place, from pretty warm to REALLY cold. An atmosphere helps keep the temperatures on the surface of a planet from getting too hot or too cold. This is why the Earth has a climate that's pretty pleasant for the most part."

- Discuss the order of the planets from the Sun.
- Go over planet order – Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
- Discuss why Pluto is no longer a planet
 - Can find two good summaries here:
<https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-pluto-58.html>
<https://www.universetoday.com/13573/why-pluto-is-no-longer-a-planet/>
- Talk about where else in the Solar System life might exist (generally, we'll get into this in more detail later)
(Hint: Moons of Jupiter (Europa), and Saturn (Enceladus))
- 1: 10 billion scale "Walk" (inspired by this activity:
<https://solarsystem.nasa.gov/docs/voyagescalemodelss.pdf>)
 - Ask the girls to get up and walk 6 paces backwards. Tell them that this distance times 10 billion is the distance between the Sun and Mercury.
 - Do the same for as many of the following distances as possible.
 - Sun to Mercury: 6 paces
 - Mercury to Venus: 5 paces
 - Venus to Earth: 4 paces
 - Earth to Mars: 8 paces
 - Mars to Jupiter: 55 paces
 - Jupiter to Saturn: 65 paces
 - Saturn to Uranus: 144 paces
 - Uranus to Neptune: 163 paces
 - Neptune to Pluto: 142 paces
 - Ask the girls: "What do you notice about the spacing between the inner vs. outer planets?"
Answer: They are much more closely spaced than the outer planets.
 - Ask the girls: "On this 1:10 billion scale, how far away do you think you would have to walk to get to the nearest star?"
Answer: The length of the entire United States. [If you are on the East Coast of the US, you could say, "California!", or say, "New York!" if you're on the West Coast.] This will usually garner lots of "Ooohs" and

“Ahs”. [**Note:** If you and the girls are in/on a different country/continent, pick a familiar region of similar distance.]

Make your own planet mnemonic (20 min)

Learning Goal: Get girls to develop their own creative way to remember the order of the planets in the solar system.

Have girls work in groups of 2-3 (this can be administered using the Zoom breakout rooms feature) to create a mnemonic to remember the order of the planets. Have them write them in their playbooks.

Example: **My Very Educated Mother Just Shouted Uphill Nicely**

After 15-20 min, have girls share aloud the mnemonics they came up with.

Name That Planet (~30 min)

Learning goals: Encourage girls to absorb what they have learned so far about different solar system planets through having to communicate that information to their peers using creative methods; encourage the girls to explore different modes of communication – visual, verbal, and kinesthetic.

1. Divide girls into two teams. Have each team come up with a name for themselves that is related to one of the planets (ex. Miracle Martians, Neighbors of Neptune, etc.)

Put up on screen:

Mercury – Mercurians

Venus – Venusians

Earth – Earthlings

Mars – Martians

Jupiter – Jovians

Saturn – Saturnians

Uranus – Uranians

Neptune – Neptunians

Part 1:

1. Select a member from each team.
2. Give them each the name of a planet.

3. One at a time, both of the selected girls draw clues on a shared whiteboard (or on a sheet of paper and then holds the drawing up to the camera for everyone to see) to get their teammates to guess the name of the planet without writing the name of the planet or any other words. If their team guesses within 30 seconds, the team gets one point. [**Note:** Encourage girls to only guess from the clues they see in the drawings, not to just call out a list of planets until they hit the right one.]

Part 2:

1. New team members get selected.
2. Get name of new planet
3. Member has to get team to guess using words (no drawing), but can't say name of planet (of course).

Part 3:

1. New team members get selected.
2. Get name of planet.
3. Now they can't draw or speak, but must "act" out the planet in some way.

Note: Use speaker view for this activity. It may be challenging to see/hear girls while they are drawing/speaking/acting as well as hear all the guesses, so be patient and ask the girls to be patient and try their best. You may also choose to get rid of the time constraint and give girls as much time as it takes to guess the planet.

Distance calculation (~1.5 hrs)

Learning Goal: To get the girls to understand the distance to the planets using a unit of measurement that is personal to them – themselves!

Tools:

- Poster board, or any large paper that the girls have access to
 - Markers, crayons, pencils
 - tape measure
 - Calculator
1. Say, "Yesterday we talked about the planets in our own Solar system, and even walked the distances between the planets after shrinking the distance down by 10 billion. What are some of the things you learned about the distances between the planets?" (**Possible answers:** distances between inner planets are smaller than distances between outer planets; Inner planets are rocky, outer planets have a lot of gas in their atmospheres; The nearest star is REALLY far away. The distances between the planets don't even compare.)

2. Today we're going to calculate the distances between the Sun and the different planets in the solar system, in units of YOU!
3. Tell each group to measure the length of themselves (have them hold a tape measure up to their head and lower the tape measure until it reaches the ground). Have the girls record the length/height of themselves in feet in their notebook.
4. Ask each girl to type their height into the Zoom chat along with their name, or have them say their height out loud (let them know that if they would prefer not to have their name next to their heights in public, that is ok. They can just have the information for themselves).
5. Help the girls convert feet and inches to feet only. Ex. 5 ft., 5 inches ~ 5.4 ft.
6. Have PPT slides projected on a shared screen with the distance from the Sun to different planets in miles and ft.
7. Example: The distance from the Sun to Venus is: 67.24 million miles 1 mile = 5,280 ft.
67 million miles X 5,280 ft./mile = 354 BILLION ft.
8. Make sure the girls know how many zeros come after the 1 in 1 billion (Answer: 9). Then let girls choose their favorite planet to do their distance calculation and poster.
9. Help the girls calculate the distance to their chosen planets in units of themselves. (Ex. Sara = 5.4 ft. The distance from the Sun to Venus is 354 billion ft./ 5.4 ft. = 66 billion Saras!)
10. Once girls have calculated their distances, ask the girls to get out poster board, pencils, crayons, and markers. Have them draw their planet (you can put up PPT slides of the different planets or the plush planetary pals too), and the sentence "The distance from the Sun to _____ is (example) 66 billion Saras." They can draw themselves if they want, and decorate the posters however they want.

Note: You may also (or instead of) choose to calculate the distance from Earth to different planets.

Introduction to Extrasolar Planets & Artist impressions of exoplanets

This activity can be done remotely with no changes from the activity in the original Teaching Handbook. It would be best to prepare slides with the images included and as you talk about exoplanets, share your screen to show the images.

Design your own exoplanet (1.5 hrs)

Learning Goal: Provide an opportunity for the girls to think creatively and critically about the types of exoplanets that may exist, what planets might look like and why, and what elements of a planet might be conducive to life or detrimental to life.

1. Direct each girl to a large sheet of construction paper or poster board, pencils, markers, crayons, and colored pencils.
2. Have each girl design their own exoplanet
 - a. Things to think about:
 - i. Is the planet a rocky world like Earth, or a gas giant like Jupiter?
 - ii. Is it cold or hot?
 - iii. If it's rocky, does it have oceans and land? Just land? Just oceans? Does it have mountains?
 - iv. How many stars does the planet orbit? One, two, or three? Four?
 - v. Does the planet have life on it? What does that life look like? How does it breathe? If the planet doesn't have life, why not?
 - vi. What is the name of the planet (you get to make it up!)

Which is bigger? (30 min)

Learning Goal: Deepen an understanding of astronomical scale with the girls, using objects familiar to them as a jumping off point.

Educator: “So now that we’ve talked about planets and stars and exoplanets, and a little about galaxies, we’re going to do an exercise. I want you to collect five items around your house that range in size from small (for example a penny) to large (maybe even something as big as you!).” Wait until all the girls have collected five items. “Now put them in order of smallest to largest in terms of size.”

Ask each girl to share with the class their objects from smallest to largest.

Educator: Ok, now I’m going to show you pictures of a bunch of objects, and I want you to put them in order of smallest to largest.

Educator presents the girls with slides of the following objects (you can take these pictures yourself if you can’t find them online):

A mug with someone’s hand around the handle
A penny

A car with someone in front of it

The ocean

The Earth

The continent of Africa

A middle-school girl of color (try to find a picture of a girl who is African-American, Hispanic, Native American, or Hawaiian/Pacific Islander to foster connection).

When the girls are finished putting the pictures in order of smallest to largest, invite them to share reflections on this exercise (some might mention how it's more difficult to do this exercise when you don't have the objects there themselves).

Educator: "Ok, now we're going to arrange something else in order of smallest to largest. Look at these pictures, and put them in the order of smallest to biggest."

Educator shows the following pictures on a slide projector, or brings printed photos to show. Afterwards, again invite the girls to share their reflections.

Create and perform your own poem (~ 1-1.5 hrs)

Learning goals: To encourage girls to think about what they've learned about astronomy and astrobiology in the context of their own lives, and to continue exploring different forms of creative expression.

1. Read poems aloud written by boys and girls of similar age to your girls. If the poems have an astronomy theme (subject is the Sun, moon, stars, universe, etc.) this is especially good.

Examples: *Turning into Stars: California Poets in the Schools Statewide Anthology 2012* (see excerpts in Rising Stargirls Teaching Handbook); *My Mouth the Galaxy: California Poets in the Schools Statewide Anthology 2015*. These can be copied and distributed to the girls to read aloud. Ask for a volunteer to read each poem. Full publications can also be purchased here: <https://www.californiapoets.org/publications-and-anthologies> .

2. Ask girls "How could parts of this poem be expressed using the body?" (hint: have girls choose words that stood out to them in the poem, and then encourage them to stand up and use their bodies to depict that word)
3. Have girls choose an astronomical object (other than the Earth) to put into their poems. Could be the Sun, a planet, a galaxy, Moon, stars, an asteroid, etc.
4. Tell the girls they are to write their own astronomically-themed poem.
5. Important to tell the girls the rules:
 - a. Poem must include: At least one astronomical object, an object or memory from their daily lives (notebook, toothbrush, day at the park, family dinner, cell phone, iPod, walking in the woods, on the bus, eating a PB&J sandwich), and a color of their choice.
 - b. Poems do NOT have to rhyme.

- c. Poems do NOT have to make logical sense. But they do need to be deliberate (make a choice, don't just throw words together randomly).
 - d. Write the poem down in their playbook.
6. Girls divide into teams of 3-4 (use Zoom breakout rooms). Have the girls each read their poems aloud to the group. Then the group as a whole decides which poem would lend itself well to acting out. The girl whose poem is chosen becomes The Director. The other girls are The Actors. The director then helps the other girls "act" out her poem.
Note: It mtreefile = '/data25/rouge/tkelley1/simulations/zooms/halo_848/sidm/disk/'
mtreefile = 'zoom_Z13_disk_cat.hdf5' may be more challenging to act something out in a group via Zoom than in person. Ask the girls to get creative. Maybe they take turns acting parts of the poem out. Have the girls be specific about using their hands, arms, legs, or feet (making sure all of these can be seen on camera) as part of acting out their poem.
 7. Each girl in the group must choose at least one body movement or expression to use in the performance of the poem (in the spirit of "Show, don't tell).
 8. Girls are given ~30 min to practice the poem.
 9. Each group performs their poem for the other group. (Turn off everyone's video except for the girls who are acting, this will move these girls to the top of the page so it is easier to see all of them. Use the Zoom record feature to film these performances).
 10. After all groups have performed, ask the girls to share their experiences writing a poem and developing a poem into a performance piece.

Life's Must-have's (~1-1.5 hrs)

Content adapted from the "Life on Earth...and elsewhere?" astrobiology teaching guide, courtesy of the NASA Astrobiology Institute

<https://astrobiology.nasa.gov/nai/media/medialibrary/2013/10/Astrobiology-Educator-Guide-2007.pdf>

Learning goals: Encourage girls to explore the requirements for life on Earth, and think about how we use this information to look for life elsewhere in the universe.

Educator: Ask students "What makes a planet or a moon a good home for living things?" Have the girls write down an answer in their playbooks.

Ask girls to share some of their answers. Show a photo of Earth.

Educator: "What is the one thing about the Earth that's different from all of the other planets in the solar system?"

(Girls might say "it has life/oceans/water/trees/humans", etc.)

Educator: “Yes! And what do we as humans have to have every day for us to live?” (Wait for someone to say “water”.)

Educator: Right. There are so many different types of life on this planet, from huge elephants to the smallest microscopic bacteria. But they all use water. So water is one of the things that life on Earth needs to survive. What is another thing?

Educator: “Food is also important – life needs this. Why? How do you feel when you haven’t eaten in a while?” (Listen for someone to say “tired.”).

Educator: “Food gives us energy! And it gives our bodies the nutrients they need to grow. How do we as humans get food?” (Answers may include: Go to the store, cook the food, pick crops, animals like cows, chicken, fish, etc.).

Educator: “Yes! Humans get our food in certain ways. But not all life eats the same kind of food. For instance, do trees go to the store to get their food?” (“No!”)

Educator: “No! But trees are alive, and they grow. What do they use for food?” Hint: “What’s something that happens every day at dawn?”
(wait for someone to mention sunrise)

Educator: “The sun comes out! Plants, trees, flowers all need sunlight as their energy source. They use that sunlight to make their food and they use it to make oxygen that we as humans need to breathe. Now, here’s a tough question: Does all life need sunlight for its energy?”

Hint: “Is there life down at the bottom of the ocean? There is! And do you think that sunlight reaches all the way down to the bottom of the ocean? No. Sunlight only penetrates a little ways down. But at the bottom of the ocean, there wouldn’t be any sunlight for life to use for its energy. So if there’s life down there, what does it use for its energy?”

Show this image: <https://microbewiki.kenyon.edu/images/d/d4/Hydrothermal-vent.jpg>

Educator: “This is a picture of something called a hydrothermal vent. Hydrothermal vents are way down at the bottom of the ocean, often near volcanically active places, where the Earth’s surface has broken open slightly, and heated water and minerals and chemicals escape through the vents. There are all sorts of life living down at these vents.”

Show the short (3-minute) video here:

<http://ocean.si.edu/ocean-videos/hydrothermal-vent-creatures>

Note: When you share your screen to share the video, make sure to check the boxes for “Share computer sound” and “Optimize Share Screen for Video Clip” at the bottom of the Share Screen page.

Educator: “So as you saw, there are many forms of life that use different types of food for their energy, including sunlight, and also chemicals from deep within the Earth, to survive and grow. So what things do we know life needs?”

Water

Food/Energy

Educator: “What’s another thing that’s important for life?”

Hint: “Are you comfortable right now in this room? Not too hot? Too cold? That’s good, right? Remember how we talked about the importance of an atmosphere for keeping temperatures pretty comfortable for life? Something else an atmosphere does is keep harmful light from the Sun from hurting us. Our atmosphere does a pretty good job, but not a perfect job. How do you think I know that Earth’s atmosphere doesn’t keep all of the harmful light out?”

Hint: Take out a bottle of sunscreen and show the girls.

Educator: “Ever put any of this stuff on before you go to the beach or school? Well, you should! Because there is light called ‘ultraviolet or UV light’ that comes from the Sun, that gets through the atmosphere and could be harmful to our skin and us. That’s why we need to wear sunblock when we’re outside. And even when it isn’t sunny, the Sun’s rays still reach us.”

Educator: “Some planets and moons don’t have any atmosphere to protect the planet from the harmful light from the Sun, or to keep temperatures from getting too hot or too cold. Would those planets and moons be good places to look for life?”

(Answer: Probably not.)

- Direct the girls to the online versions of “Habitability Cards” and worksheet “What makes a world habitable” from the NASA Astrobiology Institute “Life in the Universe...and Elsewhere” astrobiology teaching guide. You can find it here:
<https://astrobiology.nasa.gov/nai/media/medialibrary/2013/10/Astrobiology-Educator-Guide-2007.pdf>.
- Divide girls into 2-3 teams and put them in breakout rooms.

Have teams look through each planet/moon habitability card, have one of the girls read the information on the back of each card about the temperature, water, atmosphere, energy and nutrients available on that planet/moon.

Within each team, have each girl fill out the back of the worksheet, assessing the likelihood of being a habitable planet/moon for each planet/moon card. Then each team should decide on the planet/moon (other than Earth) that they would choose to look to search for life. When each team has decided on their best planet/moon for life, the team members can click the “Question Mark” icon at the bottom of the page to signal that they are done.

A Public Service Announcement (PSA) for Life (~45 min)

Learning Goal: Nurture a stronger relationship between each girl and a particular planet/moon; develop and strengthen communication skills while working together as a team in a low-risk environment; solidify the concept of what life needs to survive, by pursuing an in-depth study of a particular planetary environment and its prospects for life.

Once all of the teams have come up with their first choice planet/moon to look for life, have the teams work together for ~30 min to come up with a public service announcement (aka “commercial”) for their chosen planet/moon. The rules:

PSA:

1. Each team member must participate
2. Must include some fact about everyday life in the PSA
3. Speak directly to the camera/audience.
4. You are speaking to NASA. They are going to fund one mission. You want the mission to go to your planet or moon!

Example: Titan PSA

“Saturn’s moon Titan may not look like much of a place to live, but consider this: It is the only moon that has its own atmosphere. It has lakes. Sure, they’re not lakes of water, but they’re still liquid! Any life we find there will be very different than life as we know it on Earth, since all life here needs water. But there are lots of ways to do things, not just one way. **My sister loves to eat her dessert first, and then her dinner. I read magazines back to front.** So maybe there are many ways for life to exist in the universe, including in ethane lakes on Titan!”

After 30 minutes writing the script and practicing, have each team show their PSA to the other teams. (**Note:** If you can, record this part of the meeting. Make sure to let the girls know if and

when you are recording. It will be great to show the girls their teams' PSAs on the final day, perhaps with parents invited).

Note: Use speaker view so that it is easier to see the girls that are presenting.

My universe

Tools: Large poster board, pencils, colored pencils, markers and crayons, pens and playbooks, astronomy books.

Learning goal: To allow the girls to choose their own astronomical object or concept and explain it to the rest of the group in their own personal way, using any medium (or multiple media) we have been using throughout the workshop.

Educator: "Ok, so today is our last full day of activities before we invite your parents to come and see what we've been doing and attend the Rising Stargirls graduation ceremony. You've all been doing such incredible work this past several weeks, and I would like for your parents to get a chance to see it! So for the rest of today, we're going to focus on a project that YOU would like to do on your favorite astronomy object that you've learned about so far. "

"I would like for you to take your object – whether it's a type of star, a particular planet or moon, a constellation, some aspect of a planet like its atmosphere, an exoplanet, a galaxy – and tell us about it, either through drawing a picture that you explain to us, or writing a poem or story that you read to us, or creating a science communication piece (like the public service ads you did before) about it."

"The most important thing is that you communicate to your audience in ways that they can understand. Don't assume that they know any more than you knew when we started. Use things that might be familiar to them, from everyday life, to get them to understand something about your object. We'll do these individually. You can use poster board, markers and other colored crayons and pencils, astronomy books and magazines in case you need some inspiration, and you have your playbooks to write in if you choose to write something. You may also choose to make a presentation on Google Slides."

Give girls ~ 1.5 hrs to work on their piece. Make sure to tell them to include at least 3 facts about their object in their piece or explanation, and also at least one analogy from their everyday lives that other people in the audience could possibly relate to (ex. Taking a shower, eating, riding the bus, sleeping, getting on an airplane, riding in a car).

Note: If you want to work one on one with a girl on her project for a little bit, you can make a breakout room and manually add just her to it so you can speak with her in a more personal and private way.

At the end of the time, have everyone get back together and show each other their pieces! Then decide which pieces to show at parent's day.

[**Note:** If some of the girls do not want to share their pieces on parent's day, that's ok. They could share some of their artwork from earlier in the workshop (Soft pastel drawings from Art and the Cosmic Connection, exoplanet drawings from "Design Your Own Exoplanet", constellations and origin myth stories from "Make Your Own Constellation", group poems or PSAs from "Make Your Own Poem" or "A PSA for Life". Ask the girls if they are comfortable sharing any of these, or if they would be comfortable if they had another girl with them while they explained their piece to the audience. Try to make sure every girl is represented in some way on parent's day.)]

IMPORTANT NOTE: On this last day before the graduation ceremony and presentations, be sure to leave time at the end to conduct the assessment questions from Day 1 again, and have the girls record their answers in their playbooks. Collect them and record their responses before the final day and ceremony. Then you can give the playbooks to the girls to take home and keep on the last day.

Parent's visit day, final presentations sharing, and graduation ceremony

Prepare a certificate with each girl's name on it signifying her graduation from the Rising Stargirls program. Show these on a slide show to celebrate each girl. You may also choose to mail a printed form of these to each girl. Make sure that she understands that she is a Rising Stargirl forever, and encourage her to continue to shine!

You may also elect to raffle off astronomy themed prizes during the party. And be sure to give the girls their playbooks back to keep (make sure you have recorded anything for your documentation purposes in advance!)

Encourage each girl to share one of her projects from the workshop. Keep the atmosphere casual. You may display artwork from earlier in the workshop via slides, or ask girls to show their physical copies (Constellations and origin myths, exoplanet drawings, soft pastel artistic interpretations from "Art and the Cosmic Connection", planet mnemonics). Try to immerse the parents in the work of their daughters, including the theater pieces and poems that some of the

girls will present. Perhaps during Day 9, decide to have one of the girls “Emcee” the event, and introduce each girl to share. Or you as the Educator can be the emcee.

Enjoy the day of celebration!

Appendix

Playbooks

Converting the playbooks to an online friendly version is challenging since each group of girls participating in the Rising Stargirls activities will have access to different resources. Here we present a few options and we leave it up to the educator to decide which version works best for your group of girls. We want to remind you that the purpose of the playbooks is for (a) the girls to have a creative outlet, (b) the instructor to check in on the girls and make their own assessments on how they are doing.

Google Slides: The girls will make an online version of the playbook using Google Slides. If all of your girls have access to a gmail account (preferably their own, for privacy purposes), this is a good option for you. We have created a Rising Stargirls Playbook template in Google Slides which we shared with you at the workshop (please contact us if you have trouble accessing it). We suggest that you make a copy of this template for each of the girls that you will be working with, and share them with each girl (making sure that only she and you have access to each copy to ensure privacy). For the writing based activities each girl will type in her online playbook instead of writing on a piece of paper. For the drawing based activities ask each girl to draw using any materials she has access to (paper, pencils, crayons, etc.). At the end of the day, ask each girl to take a picture of all of her drawings either insert the images directly in the online playbook, or email them to you so you can insert the images into each girl’s playbook. In order to decorate the covers of the online playbooks, you can let the girls use the bank of images that we gathered from the web, or ask the girls to google astronomy/astrobiology related images themselves.

Self Made: Your girls will make physical versions of a playbook using the materials that they have access to. The materials needed are: composition book (or blank paper, stapler), pencil/pen, colored pencils/crayons/markers, space themed magazine, glue/tape. If the girls do not have access to any of these materials, please reach out to us as we can provide funding to distribute materials to each girl. If the girls do not have access to composition books, the first activity should include stapling a stack of papers together that will be used as the playbook. As the girls fill in their playbooks, ask them to share photos of each page with you, either through email, text

or any other available method. Tell the girls that they will NOT be graded on their work, but that you want to get to know them better, and that you find their work very valuable.