

THE RISING STARGIRLS

TEACHING ACTIVITY SUPPLEMENT



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About the author:

Jessica N. Howard is a graduate student at the University of California, Irvine and a National Science Graduate Research Fellow. She graduated with a B.S. in Physics and a minor in Mathematics with highest honors from the University of California, Davis.

While growing up, Jessica had a passion for both art and science but she often felt torn. Science satisfied curiosity and art satisfied creativity. But it seemed like she would ultimately have to choose. This dilemma continued into college where she nearly pursued a degree in theater costume and set design after working as a seamstress in the University of California, Davis' theater costume shop. However, while taking a physics course as a sophomore Jessica knew this was the path for her. Physics helped her realize that science and creativity are not mutually exclusive. In fact, they are one and the same!

Since then she has tried to combine art and physics wherever she could. She also has strived to make physics more accessible to those who, like her, had limited exposure while growing up. She hopes that combining art and physics might help girls, particularly those who are not often exposed to such fundamental sciences, realize the extent of possibilities that exist from a young age.

When matriculating to the University of California, Irvine she discovered Rising Stargirls and immediately wanted to help this fantastic mission in whatever way possible.

Note to the educator:

Thank you for your interest in Rising Stargirls activities!

This document is meant to serve as a supplement to the main Rising Stargirls Teaching and Activities Handbook created by the founder of Rising Stargirls, Dr. Aomawa Shields. This supplement contains activities to use in addition to those in the Teaching and Activities Handbook. The Teaching and Activities Handbook also contains many more instructions and resources for actually bringing these activities to life in your classroom.

With that being said, I hope you find that the following activities help instill a love of science, art, and the creative process in your girls.

Enjoy!

Jessica N. Howard

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Activity 1: S.C.I.E.N.T.I.S.T Acrostic Poem

Learning Goal:

To encourage girls to identify characteristics of themselves as characteristics of scientists.

Supplies:

- Paper
- Colorful pencils, markers, and crayons

Instructions For the Educator:

An acrostic poem uses the first letter of a word or a short phrase to spell out an overall theme word. The words and phrases within the poem relate to the theme word. For example, if the theme word is “candy” an acrostic poem might read

Crunchy chewy
Awesome
Nice and sweet
Delightful and delicious
Yummy treat

Variations on acrostic poems allow you to use letters in the middle or end of words. For example, if the theme word is “poem”

Pick u**P** a pen
Think of a t**O**pic
Be cr**E**ative
Use your i**M**agination

This strategy is particularly helpful when the theme word contains letters that are uncommon to find at the beginning of words (such as X).

Source of the above examples:

<https://examples.yourdictionary.com/acrostic-poem-examples.html>

Activity:

- As a group, discuss what characteristics are important for scientists to have. Science can often be seen as empirical and cold. But science is really about telling the stories of the universe. Creativity and discovery are essential to making these stories come to life.
- Introduce the format of an acrostic poem. As a group write an acrostic poem with the theme word “scientist”. Use words and phrases that describe the characteristics of a scientist.

- Have each girl write an acrostic poem with the theme word being their own name. Challenge them to think of words and phrases that describe characteristics of themselves that they have that a scientist should also have.

For difficult letters, here are some possible words:

Q

- Quirky
- Quality
- Questioning

X

- Xenoblast - fragile crystal that has turned into a solid rock
- Xerophyte - plant that can survive harsh conditions by storing water
- Xyloid - resembling wood: having the qualities or nature of wood
- Xyresic - razor sharp, cutting, keen

Z

- Zealous

Activity 2: Dark Matter: Hidden Messages of the Universe

Learning Goal:

Introduce the girls to the concept of dark matter and discuss how it affects the motion of galaxies. Have the girls learn that things you cannot see directly can still be present and have profound effects on the universe. Show the girls that even if you cannot see things directly at first, you can often reveal them through other means. That kind of creativity is what science is all about!

Supplies:

- White watercolor paper
- White crayons or clear wax
- Watercolor paints and brushes
- Small cups of water

Activity:

- You and I are made of matter. But not all matter in the universe is visible the way you and I are. “Dark matter” makes up about 27% [1] of the matter in the universe, but we cannot see it the way we see stars and planets because it does not interact with light. That is why we call it *dark* matter.
- Pause here to discuss the name “dark matter” as it may spark mixed feelings for some girls with darker skin. Provide an opportunity for them to discuss this. They can discuss their feelings out loud if they feel comfortable. After this group discussion, have each of the girls write a poem about the dual meaning behind “dark matter”.
- Astronomers have to be creative in developing new methods to look at the universe that allow us to see this hidden dark matter.
- Even though we cannot see dark matter, it has significant effects in our universe. Dark matter helps glue galaxies together. Without it our universe would look very different and we might not even be here.
- Using the white crayon, have the girls each write or draw a secret message of encouragement. Be sure to tell the girls that these messages must be G-rated. No swear words or otherwise inappropriate language please!
- Have them notice that they cannot see what is written/drawn the way they normally would.
- Collect all the messages from the girls and randomly redistribute them.
- Using the water color paints, have each girl paint over the paper they just received. Notice that the paint will not stick to the parts of the paper with crayon on them. The

girls thus reveal the secret messages of encouragement that were not initially visible.

- Discuss how scientists need to look at problems in many different ways. Therefore, it is vital for scientists to be creative and imaginative. Your unique experiences are assets because they mean you look at the world in a different way than anyone else.

[1] <https://science.nasa.gov/astrophysics/focus-areas/what-is-dark-energy>

Activity 3: Gravity Wave Soundbath

Learning Goal:

Introduce the girls to the science behind gravitational waves. Like in the previous activity, show that scientists often have to think outside of the box when designing experiments. Reinforce the concepts of large distance scales. Even for events that happen very far away scientists were creative and found a way to detect them.

Supplies:

- An audio recording device - An app on a phone works just fine!
- Things that make sounds: rain sticks, sturdy cups, sticks, bowls, and of course voices (singing or humming).

If computers are accessible, you also have the option of using sound-mixing software. A few examples of free sound-mixing software: GarageBand (MacOS only), AudioTool, and LMMS. The last two require you to create a free account and log in. Note though that this will most likely add time to this activity so that the girls can become familiar with the software.

Note to educator:

Perform this activity after introducing the concept of large distances in the “Distance Calculation” activity on Day 5 of the Rising Stargirls Teaching and Activities Handbook.

Activity:

- First discuss how the universe is full of waves. Ask, “when I say ‘wave’, what comes to mind?” You will probably hear things like “water”, “sound”.
- Waves are rhythmic, traveling fluctuations. Water waves happen when something displaces water; this displacement travels. When I speak, my vocal cords vibrate the air. These fluctuations in the air travel through the room and arrive at your ears. Sound is a wave. Light is also a wave, and changing its rhythm (frequency) changes its color.
- Gravity can also create waves. When extremely heavy objects in our universe interact they produce waves, just like my vocal cords. But these gravitational waves do not fluctuate the air, they fluctuate the space-time fabric of our universe.
- Scientists made a very precise “ear” to listen for these interactions, called LIGO.
- LIGO heard the merging of two black holes 1.3 billion light-years [1] from earth. Take a moment to remind them how big that number is.

- These waves are too small for you or I to “hear” them, but the scientists at LIGO translated these waves into sounds that we can hear.
- Show the LIGO chirp video: <https://www.youtube.com/watch?v=TWqhUANNFXw> and the animation of two merging black holes found in [1].
- Again, emphasize how far away this event was and how small the waves were (how closely we have to listen).
- Imagine a cosmic event happening somewhere in the galaxy. Have the girls write what that event would be in their playbook/journal.
- Allow the girls to play around with the sound supplies so that they are familiar with the sounds.
- Using at least two sound supplies, have the girls create what it would sound like if they translated the gravitational waves made by their cosmic event into sound. They can be as creative as they want with it.
- After some time has passed, walk around with the recording device to record the sounds each girl has made.

[1] <https://www.ligo.caltech.edu/page/what-are-gw>

Activity 4: Personify A Planet

Learning Goal:

Personification is a literary tool that encourages an empathetic connection between the reader/writer and the object/idea being personified. Personifying a planet will allow the girls to assign emotions and personality traits to the exoplanet. They will be able to imagine what a planet is like in a more holistic sense than just how it looks. Similarly, turning themselves into a planet deepens their connection to the possible undiscovered planets out there.

Supplies:

- Pens/pencils/markers/any writing or drawing tool
- Paper or their playbooks/journals

Note to the educator:

Perform this activity after introducing the concept of large distances in the “Design Your Own Exoplanet” activity on Day 6 of the handbook.

Activity:

- Begin by getting them used to the idea of personification. Explain that personification is the idea of describing an object/idea as if it was a person. As a group, ask them to imagine what Venus would be like if it was a person. First list off things about Venus: e.g. what is its atmosphere like? What kinds of traits do you think that would translate into?
- Provide an example of personification in the form of a short poem or other piece of writing. For example, “Winter” by Olivia Kooker [1]

If winter were a person, she would be a girl with frosty hair.

Winter would wear snow pants, snow boots, gloves, a hat, and scarf.

Winter would smell like hot chocolate and peanut butter and

Hershey Kiss cookies baking in the oven.

*Winter would spend the day eating cookies and drinking hot cocoa
by a lake.*

*Winter would spend the night by sitting in the snow waiting for
morning so children could come out to play.*

- Take the planet you made in the “Design Your Own Exoplanet” activity, or think of a different planet, and think about what it would be like if it was a person. What would they look like? What kind of clothes would they like to wear? What would their

personality be like? What would be their favorite things to do? Their favorite flavor of ice cream? The girls can write about or draw their personified planet, whatever medium feels the most natural.

- Now, go in the opposite direction. Ask the girls to imagine themselves as a planet. What planet characteristics would traits about them (likes, dislikes, personalities) translate into? They can write or draw their personified planet, whatever medium feels the most natural.

[1] <https://www.familyfriendpoems.com/poem/winter-4>

Activity 5: A Conversation Between Exoplanets

Learning Goal:

Encourage the girls to imagine other planets' place in the universe. Not only should they imagine what the exoplanet behaves like but also what surrounds the exoplanet. What is nearby? What does the universe look like from that exoplanet? This will help to fully build images of far-off places in the girls' minds. Hopefully this will inspire their imaginations to run wild about what could be out there.

Supplies:

- Pens/pencils/markers/any writing or drawing tool
- Paper or their playbooks/journals

Note to the educator:

Perform this activity after doing Activity 4 in this supplement.

Activity:

- We have talked a lot about what exoplanets may look like but that is a small piece of the story.
- Ask the girls to think about a typical day in their life. All of the things they see, sounds they hear, smells they experience, people they interact with. These all build their environment. Exoplanets have good and bad interactions like they do. There may be neighboring planets, stars, moons, etc.
- Ask the girls to imagine a fictional or real exoplanet and the other cosmic objects around it.
- Write a story about this exoplanet where the exoplanet has a conversation with the objects around it.
- What does the planet see? How do these objects interact? Try to tie this in with real-world characteristics. For example, if the planet is far away from its star it would most likely feel cold, unless it has a thick atmosphere (a fuzzy jacket). But if it tried to talk to its star it would have to yell loudly.
- Additionally, have them recall the personifying the planet activity. Have them think about how real-world characteristics of the exoplanet and surrounding objects help shape their personalities and interactions.

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