EDUCATOR'S GUIDE
LASC PLANETARIUM
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What Does it Mean to Explore?

Exploration might seem like a scary task, but the truth is that we all explore our surroundings every day. We explore when we look outside the window, dig holes in the ground, or even when we play pretend with our friends. Exploration simply means to travel with the purpose of discovering and remembering what we see. Can you think of a time when you and your parents or a friend explored? What did you do? What did you see, hear, touch, taste, smell, and feel?

Activity: Turn to a partner and tell them about a time you explored.

What is Space?

There’s space between people. Turn to your neighbor and look at the space in between you. How far apart are the two of you—arm’s length, a few inches? Look at objects near or far from you. Notice the space between you and these objects. Think about how space can be found between you and everything around you. Space also refers to what lies beyond our planet and is sometimes called outer space!

What is Outer Space?

Often we think of space as being completely empty, but it is actually full of objects like planets, stars, asteroids, and even satellites that we have put up there ourselves.

Space is a vacuum, sort of like what you clean with at home, meaning you wouldn’t be able to breathe in space or even hear music.

This vacuum also means there is no gravity. Gravity is what holds us to the surface of the Earth. If you were to go up into space, you would float around everywhere! In other words, you would be weightless.

Activity: Talk like you’re here on Earth. Now talk like you’re in space. You should just be pretending to talk the second time because due to the vacuum no one would be able to hear you talk!

How Have Humans Explored Space?

Since the beginning of time, humans have been interested in the night sky. However, as time has passed, our interests have changed, and with the advances in technology, we have been able to learn new things. Look at the timeline below (p. 3) to see some important events that have occurred.
How We Fit into Space

We’re a very small part of space. We live on Earth, which is a planet. Can you name any of the other planets?

The other planets in our neighborhood, or solar system, include Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune.

Compared to everything out in the universe we, humans, are very, very small. Earth is not even the biggest planet. (The biggest planet in our solar system is Jupiter!)

If you want to learn more about this, visit http://www.scaleoftheuniverse.com/ to see how big we are compared to everything else.

The Future of Space Exploration

We believe we will eventually find life on other planets. This means aliens! Scientists are also trying to understand Dark Matter. Can you guess what this is? Your guess is pretty good because even scientists are still trying to find an answer to that question! Try to imagine what life on other planets would be like.

How You Can Explore Space

There are a lot of different ways for us to explore space. We can pretend with our friends, go outside and star gaze, or we can even visit a planetarium or museum.

See the Pre- and Post-visit activities below for ways to further explore space.
30,000 BCE The first people carve lines into bones to track moon phases

350 BCE A Greek scientist named Aristotle argues the world is round, not flat like everyone had originally thought

250 BCE A Greek mathematician uses geometry to find the circumference of the Earth

140 BCE A Greek astronomer named Hipparchus creates a map of the brightest stars

100 CE Ptolemy publishes a book called The Almagest about how the stars and planets move

140 CE Ptolemy says that Earth is the center of the universe

1543 CE Nicholas Copernicus says that the sun is the center of the solar system

1608 CE Hans Lippershy makes the first refracting telescope
Timeline
Some key moments in space exploration

1609 CE *Galileo Galilei* makes the first *astronomical telescope* and begins making important observations of the night sky

1665-7 CE *Isaac Newton* discovers the Law of gravitation

1905 CE *Albert Einstein* publishes his Theory of special relativity

1923 CE *Edwin Hubble* proves that there are *galaxies* outside of the *Milky Way*

1957 CE Laika the dog is the first animal launched into space

1957 CE The world's first satellite, *Sputnik 1*, goes around the Earth

1961 CE The Soviet Union sends the first manned flight into space

1963 CE Valentina Tereshkova is the first woman to enter space

1965 CE Alexei Leonov is the first man to *space walk*
1969 CE Neil Armstrong is the first man to step on the moon

1972 CE The last time humans are on the moon

1977 CE *Voyager 1* launches into space.

1990 CE *Hubble Space Telescope* launches

2003 CE The space shuttle *Columbia* explodes on its way back to Earth

2006 CE Pluto is no longer called a planet

2012 CE *Voyager 1* reaches interstellar space

2012 CE The *Curiosity* rover lands on Mars

2014 CE *Space tourism* begins; each flight costs around $20 million

2014 CE Live HD video streams from space so the public can see what the Earth looks like from the International Space Station

Many people see an individual man with crazy hair wearing a white jacket. But as you read about the scientists below, you’ll see the truth is that scientists often work in teams, and scientists are people of all different genders, races, and ethnicities.

William (1738-1822) and Caroline Herschel (1750-1848)
William and Caroline Herschel were brother and sister astronomers born in Germany. They are known as the founders of modern astronomy. William is best known for discovering the seventh planet, Uranus, as well as many moons and stars. William’s interest in math and lenses actually came from his work as a musician and composer. Caroline was an expert comet hunter, and she discovered eight new comets as well as three new nebulae.

Annie Jump Cannon (1863-1941)
Annie Jump Cannon was an American astronomer. She worked at Harvard and discovered more than 300 variable stars and five novae. Cannon was one of several scientists at Harvard who attempted to record information about as many stars as possible. She is credited as one of the creators of the Harvard Classification Scheme, a system that classifies stars based on their temperature. She was the first woman to become an officer in the American Astronomical Society. She was awarded an honorary doctorate from the University of Oxford in 1925 and the Henry Draper Medal of the National Academy of Sciences in 1931.

Albert Einstein (1879-1955)
Einstein was a physicist who is known for having created the mass-energy equivalence formula, $E=mc^2$. He is also known for creating the general theory of relativity, which explains how gravity works. This remains a very important theory in modern physics. After explaining how gravity works, Einstein attempted to create an even bigger idea that would include all electric, magnetic, and gravitational forces. However, he died before developing this theory, and no one else has been able to develop it yet.
Edwin Powell Hubble (1889-1953)

Edwin Powell Hubble was an American astronomer who helped form the field of extragalactic astronomy, which means studying objects outside the Milky Way galaxy. Hubble’s discovery that things exist outside the Milky Way galaxy was revolutionary but debated. One of his findings, known as “Hubble’s Law,” implies the universe is expanding. In 1990, NASA launched the Hubble Space Telescope, named in his honor. He famously said, “Equipped with five senses, man explores the universe around him and calls the adventure science.”

Image credit: Wikimedia Commons; Public Domain

Neil Armstrong (1930-2012)

Neil Armstrong was an American spacecraft commander for Apollo 11, the first manned spacecraft to land on the moon. On July 20, 1969, he became the first American to walk on the moon and said the well-known phrase, “That’s one small step for man, one giant leap for mankind.” His team left an American flag, a patch honoring the members of Apollo 1, and a plaque that reads, “Here men from the planet Earth first set foot upon the moon. July 1969 A.D. We came in peace for all mankind.”

Image credit: Wikimedia Commons. CC Attribution-Share Alike http://creativecommons.org/licenses/by-sa/3.0/

Alexei Leonov (1934- )

Alexei Leonov is a Russian cosmonaut who is also an artist. He became the first man to step out of a spacecraft and walk in space on March 18, 1965. Leonov spent about twenty minutes in space while tethered to their spacecraft, Voskhod 2. When Leonov tried to re-enter the spacecraft, he could not fit through the airlock because his suit had expanded while he was in space. He had to release some air before he could fit.

Image Credit: Wikimedia Commons. CC Attribution-Share Alike http://creativecommons.org/licenses/by-sa/3.0/

Valentina Tereshkova (1937- )

Valentina Tereshkova is a retired Russian cosmonaut. On June 16, 1963, she became the first woman to travel into space. No other female cosmonaut entered space until the 1980s. Tereshkova’s trip aboard the Vostok 6 included 48 orbits and 71 hours, which meant when she returned to Earth, she had spent more time in space than all U.S. astronauts combined.

Image credit: Wikimedia Commons; CC Attribution-Share Alike http://creativecommons.org/licenses/by-sa/3.0/

Sally Ride (1951-2012)

On June 18, 1983, Sally Ride became the first American woman in space as a crew-member on Challenger. Before joining NASA in 1978, Ride was working on her Ph.D. in physics at Stanford University, and after leaving NASA she became a Physics professor and award-winning author. She started Sally Ride Science in 2001 to urge young people, especially girls, to pursue their interest in science.

Image credit: University of Houston Digital Library; CC Attribution-Share Alike https://creativecommons.org/licenses/by-sa/2.0/
Biographies

Get to know a few astronomers, physicists, and astronauts.

Neil deGrasse Tyson (1958-)

Neil deGrasse Tyson is an American astrophysicist known for his work directing the Hayden Planetarium, authoring many scientific books and papers, and hosting the television shows NOVA ScienceNow and Cosmos: A Spacetime Odyssey. He has also received the NASA Distinguished Public Service Medal, which is the highest award NASA gives to people who do not work for the government. Tyson has been a member of several presidentially appointed teams that have studied U.S. aerospace and space exploration. His work often tries to make scientific topics accessible to non-scientists.

Image credit: Johann Edwin Heupel; CC Attribution license; https://creativecommons.org/licenses/by/2.0/

Jane Luu (1963-)

Jane Luu is a Vietnamese American astronomer who has worked at the Massachusetts Institute of Technology (MIT) and Harvard. As a graduate student at MIT, she co-discovered the Kuiper Belt, which NASA defines as “a disc-shaped region of icy objects beyond the orbit of Neptune—billions of kilometers from our sun.” She has found many objects within the Kuiper Belt, and for that work she has won many awards and had an asteroid named after her (asteroid 5430 Luu).

Image credit: The Shaw Prize Foundation

Beth A. Brown (1969-2008)

After viewing the Ring Nebula while at an observatory for a high school project, Beth Brown was hooked on astronomy. While studying physics and astronomy at Howard University, she held two internships with NASA. She thought she wanted to be an astronaut until she realized her near-sighted vision and fear of small spaces didn’t fit well with the astronaut job description. So, she decided to go to graduate school and became the first African American woman to earn an Astronomy Ph.D. from the University of Michigan. In addition to her work on elliptical galaxies, about which she published important papers, she also worked to educate the public about science. Specifically, she worked to help minorities and women succeed in the field of physics and served in leadership roles with the National Society of Black Physicists (NSBP) and the National Conference of Black Physics Students (NCBPS).

Image credit: American Physical Society
Introduction Video: A Day On Earth

Scholastic's video discusses the Earth in relation to space. The video explains that the Earth's rotation gives us day and night and that the tilt of the axis gives us two hemispheres with different seasons.

What You Need:
- Computer

Steps:
1. Before watching the video, ask the students about what causes night, day, and seasons.
2. Discuss key words for the video (definitions from Scholastic Study Jams)
   - **Rotate**: to turn around and around
   - **Orbit**: the visible path followed by an object circling a planet, the sun, etc.
   - **Axis**: an imaginary line through the middle of an object, around which that object spins, as in Earth’s axis
   - **Seasons**: one of the four natural parts of the year. The four seasons are spring, summer, autumn, and winter
3. Watch the video.
4. Repeat the first and second step.

Standards:
- **ESS1.A**: The Universe and Its Stars
- **ESS1.B**: Earth and the Solar System
**Shadow Play**

Younger students can learn about the sun by tracing its shadow. This activity requires the students to go outside and trace each other’s shadows. After thirty minutes or an hour has passed, the students will go back to their original spot, and their tracer will trace their new shadows. Students will record the difference between their shadow positions and explain the Earth’s rotation around the Sun.

**What You Need:**
- Clear sky
- Chalk
- Outdoor drawing area

**Steps:**
1. Divide class into partners of two. Have one student be the ‘statue’ and the other is the tracer.
2. Take the class to the outdoor drawing area. Give each group a piece of chalk.
3. Have the ‘statue’ stand straight, without moving. Have the tracer outline the statue’s feet before the shadow. Put their name in front of their feet.
4. Let the tracer begin outlining the statue’s shadow with chalk.
5. Go back to the classroom, wait thirty minutes to an hour before going back outside. During this time, discuss simple vocabulary, such as the ones introduced in the activity beforehand or in the introduction.
6. After time has passed, go back outside and have the statues stand exactly where they were before (that’s why the feet and names were drawn).
7. The tracer, will then again, trace the statue’s shadow.
8. After the activity is over, ask the students what has changed.
9. Students should realize that the length of the shadows has changed. Depending on the grade level, the students can trace the lengths of the shadows.

**Standards:**
1-ESS1-1: Use observations of the Sun, Moon, and stars to describe patterns that can be predicted
Moon Cycle Oreo Cookies

In this activity, students will explore the moon cycles by using Oreo cookies. Arranging the cookies on a plastic plate, the students will be able to mold the different phases of the moon by shaping the crème on top of the Oreo. For K-2, it is recommended that the phases should already be labeled underneath each Oreo moon.

What You Need:
- 6 Oreo cookies per student (bring extra: expect some cookies to break or the frosting not to come off as wished)
- Paper towels
- Paper plates
- Plastic spoons

Keywords:
Full Moon: the Earth, Moon, and Sun are in approximate alignment. This position is the same for the New Moon, except the sunlit part of the Moon isn’t facing us.

First Quarter and Third Quarter: both called half moons, when the moon is at a 90 degree angle with respect to the Earth and Sun

Crescent: refers to the phases where the Moon is less than half illuminated

Gibbous: refers to the phases where the Moon is more than half illuminated

Waxing: means growing or expanding in illumination

Waning: means shrinking or decreasing in illumination
(for more information about moon phases: http://www.moonconnection.com/moon_phases.phtml)

Steps:
1. Begin asking simple questions: What does a full moon look like? What does a new moon look like? How often do you think you see a full moon?

2. Tell the students they will be demonstrating the phases of the Moon using Oreo cookies. Show them how to twist the cookie apart in order to keep all of the crème on one side.
3. Pass out a paper plate. Using the picture above, the Oreos will be placed in a circle on the plate. Think about placing the cookies like the times on a clock: the full moon will be at 12; the new moon will be at 6. The show the changes in the Moon’s phases, ask the students to draw arrows between each phase in a counterclockwise direction.

4. The order as follows (counterclockwise): Full Moon, Waning Gibbous, Waning Half, Waning Crescent, New Moon, Waxing Crescent, Waxing Half, Waxing Gibbous. For younger students, you might want to label the plate as such before the activity starts.

5. Pass out 6 Oreo cookies for each student. Remind them about the twisting method. Pass out the plates, paper towels (for mess), and spoons. Use the picture above to show what the phases of the Moon look like. Tell the students to use the spoon to carve out the shapes.

6. After they are done, invite the students to eat their work!

Standards:
1-ESS1-1: Use observations of the sun, moon, and stars to describe patterns that can be predicted.
Learning about Eclipses

In this activity, the students will learn about eclipses. Sometimes all or part of the Sun or Moon becomes dark; this is called an eclipse. Using simple objects, the students will be able to make their own eclipses. This activity can be done at home or in the classroom.

What You Need:
- Scissors
- Drinking straw
- Penny
- Frosted lightbulb
- Large ball (soccer ball, volleyball)
- Moon model (small white styrofoam ball on top of a nail or stick)

Steps:
1. Give each student a straw and a penny. At the tip of the straw, make a slit with scissors so the straw can hold the penny.
2. Install the frosted light bulb in a unit on the ceiling; it will represent the Sun. The coin represents the Moon.
3. Tell the students to close one eye. Ask them to hold the coin close to the other eye and move the coin between their open eye and the light bulb. Ask them how much of the bulb is covered. How much of it can they see? You may ask the students to record their observations.
4. Take out the Moon model and the large ball. Hold the Moon model between the light bulb (Sun) and the larger ball (Earth). Look for the Moon’s shadow on the larger ball. Ask, “If you were in the shadow, what would happen to your view of the Sun?”

Explanation: An Eclipse is when, on occasion, the Sun looks like it is completely or partially covered with a dark circle because the Moon is between the Sun and the Earth. If you are in the dark part of the shadow, the whole Sun disappears. If you are in the lighter part of the shadow, part of the Sun disappears.
Pre-Visit Activities
Before You Explore the Planetarium

Modeling the Night Sky
This interactive activity engages students in exploration of the orbits of planets around the Sun and their relation to the constellations. The activity requires a group of thirteen (13) students. If your class includes more than thirteen students, conduct the activity by rotating participants. See more information below in the procedure. Prior to the activity, you might even tailor some investigative questions to the grade-level and specific content on which you would like students to focus (e.g. repeating patterns in the solar system and prediction of these patterns, comparisons of the various orbits, the order of constellations relative to the Earth’s orbit, etc.). You can pose these questions at the beginning of the activity.

What You Need:
• A bowl or other container
• Glue sticks or rolls of tape
• Crayons, pencils, chalk, and markers
• 2 copies of the constellation strip http://stardate.org/sites/default/files/pdfs/teachers/ModelTheNightSky.pdf. Make sure to cut out each individual constellation prior to the activity
• 5 cards, each with the name and/or picture of one of the following: the Sun, Earth, Mercury, Mars, and Jupiter (a few of the planets are omitted for clarity and efficiency)
• Student notebooks, journals, or other paper-based material

Steps:
1. Prior to class, cut out each of the thirteen constellations and place collectively in a bowl or other container. The constellations are provided in the link above. Makes sure to preserve one copy for yourself with the constellations in this order: Gemini, Taurus, Aries, Pisces, Aquarius, Capricorn, Sagittarius, Ophiuchus, Scorpius, Libra, Virgo, Leo, Cancer.

2. Next, draw (with chalk outside or tape or other medium) concentric circles on the floor that represent the orbits of Mercury, Earth, Mars, and Jupiter around a central spot reserved for the Sun.

3. Explain that because of the Earth’s orbit around the Sun, different stars show up at different times of the year. Give one student the Earth card and one the Sun card. Ask the other students to work in pairs and/or as a group to decide and then place each one of these students in the correct place or orbit. Of course, “Sun” should be in the center and “Earth” in the circle/orbit after Mercury.
Pre-Visit Activities
Before You Explore the Planetarium

4. Once the Sun is in place and Earth is in the correct orbit, ask Earth, to face away from the Sun and to begin orbiting (at a reasonable pace) left to right and rotating left to right. Make sure each of the two students holds the appropriate Earth or Sun card.

5. As Earth orbits and rotates around the Sun, explain the concept of periods, specifically focusing on Earth’s one year period (orbital period around the Sun). Explicitly point out that one lap around the Sun equals a year (for this activity).

6. With accompanying cards, assign a student to each of the remaining three planets. Ask all of the “planets” to orbit and rotate in the same direction as Earth, but all at different rates. Explain that Mercury orbits the Sun every ¼ year and will move much more quickly than Earth in orbit. Ask the students to agree on the rate of orbit and to count the number of times Mercury completes a circle around the sun (4 times in one Earth-year). As you add other planets, carefully explain their orbital periods: Mars will move at about half of Earth’s speed (period: about 2 years) and Jupiter (period: about 12 years) much, much more slowly than Mars.

7. Ask the “planets” to stop orbiting and rotating and to sit down for a rest. Allow each remaining student who isn’t representing a planet to choose a constellation out of the bowl or container. Assure students who don’t have a chance to choose one of the constellations that they will trade places with “constellation” students shortly in the activity.

8. Next, explain that the stars form constellations or groups of stars from or around which we often draw pictures or shapes. Consider incorporating these resources in the lesson at this point to explain the constellations:
   - For short videos on exploring specific planets and constellations on the current evening of the year (an excellent, carefully-paced resource):
     http://hubblesite.org/explore_astronomy/tonights_sky/
   - More information on the shapes and the stories behind the constellations
     http://stardate.org/nightsky/constellations

9. Ask the student “constellations” to take positions along the outer-most circle so they encircle all of the planets. Ask the students to form one continuous loop by standing in order: Gemini, Taurus, Aries, Pisces, Aquarius, Capricorn, Sagittarius, Ophiuchus, Scorpius, Libra, Virgo, Leo, Cancer (next to Gemini). Ask the students to practice pronouncing their constellation names in groups and/or individually for the class.
10. After discussing and practicing the names of the constellations, ask the students to look at Earth’s current position there in the circle and relative to the Sun. Ask these questions: Which of the constellations would appear during the daytime? Which would appear at nighttime? Why? Hint: Those constellations you can see by looking “through” or beyond the Sun from Earth will appear in the daylight hours. Ask the student “constellations” visible in the daytime to shout out their names. Ask the same of those visible at night.

11. Now explain that in as few as six or as many as forty-three days the Sun appears to move from one constellation to another. Ask the student planets to stand up and resume their orbits and rotations. Ask the students who are not part of the model to check the orbits and correct them, if necessary. Let the planets go for several minutes, and then ask them to stop and sit down, explaining how the Sun seems to be located in different constellations at different moments. Repeat this step as necessary to reinforce learning.

12. Ask some of the students representing constellations and planets (including the Sun) to trade places with some of the students who have been observing.

13. Then, ask the students who will observe to take out their notebooks or science observation journals. Explain that they will record two kinds of data: 1) daytime constellations in which the Sun appears and 2) number of times one planet (each student can choose) circles around the Sun (number of one-year laps).

14. Make sure all students have a chance to both participate in the model and to observe and record their raw number data.

15. Lastly, ask all students to carry their data back to their desks and to draw their findings (e.g. draw one of the constellations that is visible in the daytime and in which the Sun appears at a given moment and/or draw a specific planet in orbit relative to the Earth and Sun with the number of laps included). They might even color their drawings.

16. Ask each student to present and explain his or her findings to a small group of classmates and/or to the class as a whole. Also, if you posed investigative questions at the beginning of the activity, return to them. Ask the students to discuss how their answers have changed.

Adapted from “Modeling the Night Sky.” *Star Date/Universo Teacher’s Guide on Stardate.org*, 2010.

**Standards:**

ESS1.A: The Universe and Its Stars  
ESS1.B: Earth and the Solar System
Exploring the Brightness of Stars Grades 2-5

In this activity, students will explore the brightness of stars by using different size flashlights and wax paper to explain why some stars in the sky look brighter than others.

What You Need:
- Three flashlights (two the same size, and the third a different size, which can be larger or smaller)
- Wax paper
- Corner of the room that can be darkened slightly
- Journal and pencils for recording

Keyword:
Luminosity: measure of the amount of light energy produced by a star

Steps:
1. Begin by telling the students they will be studying why some stars appear brighter in the sky than others.
2. Take the students to a corner of the room that can be darkened.
3. Cover the flashlight lenses with the white paper so they produce a uniform but still bright white light rather than a glaring light.
4. Ask the students to observe the two lights, representing two stars that are the same size and brightness and the same distance from Earth, and describe how they would appear in the night sky (the same).
5. Position the lights so that one is farther away from the students and ask the students what happens when two stars of the same size and brightness are different distances away.
6. Put one flashlight aside. Grab the other sized flashlight. Explain that they represent two stars in the sky, the one larger and brighter than the other. Shine the two lights at the students from the same distance away. Invite the students to say how two stars the same distance away appear when one star is larger and brighter than the other.
7. Position the brighter light closer than the other light. Ask the students to say which light will appear brighter here on Earth for each position.

8. Position the brighter light farther away and ask the same question.

9. Ask the students to use their journals to draw illustrations showing three stars of different sizes and brightness at different distances from the Earth, labeling which are brightest in the sky.

Standards:
ESS1.A: The Universe and Its Stars
Equatorial Sundial

One of the first tools used to measure time was a sundial, which is basically a stick that casts a shadow on a face marked with units of time. As Earth rotates, the shadow moves across the face in relation to the position of the Sun in the sky. The face of an equatorial sundial represents the plane of Earth’s equator, and the stick represents Earth’s spin axis.

What You Need:
• Each student will need a copy of page 19 from StarDate's Teacher Guide, PDF here: http://stardate.org/teachers
• A straw

Steps:
1. Locate your latitude and longitude as well as the North Star, then mark its position in the sky to determine which direction is north.

2. Cut out the Dial Face template.

3. Fold and glue the template.

4. Cut through the center hole for the straw to go through.

5. Mark the straw using the latitude strip from page 19 as a guide.

6. Place the straw in the template hole marking, making sure it is perpendicular to the face and fit snugly into the hole.

7. Take the sundial outside on a sunny day and place it on a flat horizontal surface.

8. Have the top of the straw facing due north.

9. Record the time on the sundial at least four times a day, at least an hour apart for each one.

10. Compare the sundial times to the times on an actual clock.
Pre-Visit Activities
Before You Explore the Planetarium

Adapted from “Equatorial Sundial.” Star Date/Universo Teacher’s Guide on Stardate.org, 2010.

Standards:
ESS1.A: The Universe and Its Stars
ESS1.B: Earth and the Solar System
Note to teachers: Here are a few activities to keep up the spirit of exploration that the Living Arts and Science Center promotes. It would also be good to revisit some of the pre-visit activities in order to see how students’ perspectives and knowledge changed as a result of the presentation.

**Connect-the-Dot Storybook**  
**Grades K-5**

The constellations in our night sky are named after ancient heroes and creatures. Create a storybook with your favorite constellations in order to keep these myths alive!

**What You Need:**
- Construction paper
- Hole punch
- Yarn
- Writing utensils
- Crayons
- Constellation stories (for K-2)

**Steps:**

**Levels K-2**

1. With provided stories, students will draw the constellations that match.
2. Once all constellations are drawn, punch holes along the sides of the construction paper.
3. Tie the yarn between the holes to create a book.

**Levels 3-5**

1. Draw 5-7 of your favorite constellations, while writing out their stories below them.
2. Once you have all of your constellations drawn out, punch holes along each of the pages.
3. Put the pages together by tying the yarn in each hole to create your very own constellation storybook.

**Standards:**
ESS1.A: The Universe and Its Stars
Write/Draw Yourself into the Stars

The constellations we know were named after ancient Greek heroes, but what if there was a constellation named after you?

What You Need:
- Your imagination
- Paper
- Writing utensil

Prompt: Write a story from your life that could be memorialized in the stars. If you are feeling creative, turn this story into a poem. Essentially, write yourself into the stars. Then, put this story into picture form to create a personalized constellation.

Fun additional step: Grab some sidewalk chalk and draw your constellations outside!
Create Your Own Solar Cylinder

Recognizing constellations in the night sky can be very exciting. Continue your space exploration and remember these constellations by creating your very own planetarium for your room.

What You Need:
- Empty and clean, round, cardboard oatmeal container with a plastic lid
- Flashlight
- Black paper
- Tape
- Pushpin
- Pencil
- Construction paper
- Gold stars
- Clear contact paper

Steps:
1. Decorate the outside of your cylinder by taping the construction paper to it and putting down the gold stars wherever you'd like. You may also draw some constellations right onto the container.

2. Put the contact paper over the design to protect it.

3. With the help of your teacher, cut out the round cardboard bottom of the oatmeal container.

4. Now, cut a hole into the plastic lid to fit the flashlight.

5. Tape the lid around the edge of the container to put the flashlight in place.

6. Using the bottom of the container, trace circles onto the black construction paper, making them a little bigger than the circle of the container.

7. Look up some constellations and draw them with your white crayon.

8. Use the pushpin to poke holes lightly into the dots representing the stars.

9. Now it's time to put your mini planetarium together. Tape one black constellation to the bottom of your cylinder, then put the plastic container on the top with the flashlight facing towards the constellation. Each time you are ready for a new constellation, just take off the old one and tape a new one to the bottom.
10. Once you’ve made your planetarium, turn off all the lights in your room and turn on the flashlight in the cylinder and see what happens. The night sky is now in your room!

Another alternative is to do this activity with a shoebox. See below for details.

**What You Need:**
- Shoebox
- Scissors
- Pen or pencil
- Pin
- Tape
- Flashlight
- Books

**Steps:**
1. On one end of a shoebox, cut a hole just big enough for a flashlight to fit into.
2. Cut a rectangle out of the other end of the shoebox.
3. Draw dots on a piece of paper to represent the stars of a constellation, and poke holes through the dots with a pin. Do this for several different constellations.
4. Put one of the sheets of paper over the rectangular hole in the box, and tape it in place.
5. Support the flashlight with a stack of books, and put it into the hole in the other end of the box.
6. In a darkened room, turn on the flashlight and project your constellation onto a wall. Quiz your friends or family to see if they can identify the different constellations.

**Standards:**
ESS1: Earth’s Place in the Universe

Painting Constellations Grades K-2

You learned about the different constellations visible in the night sky; now you can create your very own with stories to go along with them.

What You Need:
- Construction paper
- Paint
- Pencil

Steps:
1. Have students use their fingers to create small, brightly colored specks on construction paper.
2. Allow the paint to dry.
3. Once dry, have students connect random specks to create their own constellations.
4. Have them tell a story about their constellations.
The moon goes through 9 phases every 29.5 days, so spend some time watching it change!

**What You Need:**
- Paper
- Crayons

**Steps:**
1. On a plain sheet of paper, draw thirty identical circles, one for each day, at least 2 inches in diameter.
2. Observe the moon 30 nights in a row, drawing what you see in each designated circle.
3. Label each circle with the proper phase name.

**Standards:**
ESS1.A: The Universe and Its Stars
Galactic Letters Grades 3-5

It is a big universe! Pretend that you are an alien from another planet, explaining that planet to a citizen of Earth.

What You Need:
- Paper
- Envelope (or postcard)
- Writing utensil
- Stamp
- Address of a friend or family member

Steps:
1. Research your favorite planet and compile a list of fun facts and descriptions of basic processes.
2. Write a letter to a friend or family member.
3. Address your letter using the following format:
   - Your name
   - Street Address
   - City
   - State
   - Country
   - Hemisphere
   - Solar System
   - Spiral Arm
   - Galaxy
   - Local Galaxy Cluster
4. Put a stamp on the letter and mail it!

Milky Way Bingo

Grades K-5

There is a lot to know about this universe of ours. Test your knowledge by playing Bingo in class!

What You Need:
- Paper
- Writing utensil
- Milky Way bar as a prize
- Star stickers as markers

Steps:
1. Each student in the class gets a blank Bingo card and a list of questions about basic facts of the universe.
2. Students fill in each box with the answers to these questions.
3. The teacher draws a question out of the hat and if the students put the right answer on their sheet, they can cover the square.
4. The first one to reach BINGO gets a Milky Way bar!

Standards:
ESS1.A: The Universe and Its Stars
ESS1.B: Earth and the Solar System
Constellation Medallions

It is sometimes hard to find all of the constellations in the sky, but now you can see them anywhere. Create a mobile constellation projector!

What You Need:
- Flashlight
- Cardboard
- Scissors
- Hole punch
- Paper
- Writing utensil
- Keychain

Steps:

1. Cut several circles (each circle will be its own constellation) of cardboard to be the size of the face of the flashlight.

2. Research constellations and pick your favorite pictures!

3. Hole punch the major stars into the cardboard circle in the same way they are seen in the sky.

4. Draw the constellation picture by connecting the holes, so that it is obvious which constellation is shown.

5. Cut a piece of paper the same size as the cardboard circles.

6. Write the name of the constellation and the myth behind this name on the paper circle.

7. Hole punch each circle (both cardboard and paper) so they can be put on a keychain.

8. Turn off the lights and hold one of the cardboard circles to the flashlight. The constellation will be projected onto the wall!

Standards:
ESS1.A: The Universe and Its Stars

iPhone/Android Applications

- SkyView
- Star Chart
- Sky Walk

Digital Resources

- A resource that visually shows the relationship of things’ sizes, from quantum foam all the way to the observable size of the universe: http://www.scaleofuniverse.com
- NASA’s Goddard Space Flight Center: http://www.nasa.gov/centers/goddard/home/index.html#.U3q4jF71x8S
- NASA’s webcam: http://www.jwst.nasa.gov/webcam.html
- Senior Scientists and Engineers who volunteer their services to support the needs of education, Community, and the government at the American Association for the Advancement of Society (AAAS): http://www.aaas.org/senior-scientists-and-engineers/programs-dc
- Eastern Kentucky University’s Hummel Planetarium: http://www.planetarium.eku.edu
- National Science Teacher’s Association (NSTA) page for NGSS: http://ngss.nsta.org
- Discovery Education Free Teacher Resources: http://www.discoveryeducation.com/teachers/

Text Resources

Glossary

Some key terms

The Almagest – A work on astronomy compiled by Ptolemy in the 2nd century AD containing a description of the geocentric system of the universe and a star catalogue.

Aristotle – Greek philosopher who emphasized the direct observation of nature and profoundly influenced Western intellectual and scientific thought.

Asteroid – A rocky body, measuring from less than one mile to 600 miles in diameter, in orbit around a sun. Most asteroids in our solar system are found between the orbits of Mars and Jupiter.

Astronaut – A person trained to travel and work in space. In Greek, astro means star and naut means sailor. An astronaut is someone who sails among the stars.

Astronomer – A person who studies the planets, stars, and space.

Astronomical telescope – Any telescope designed to collect and record electromagnetic radiation from cosmic sources.

Astronomy – The study of objects in outer space.

Celestial body – Any large object in outer space.

Circumference – The distance around the outer edge of a circle.

Columbia – The first test vehicle of the NASA space shuttle fleet.

Constellation – A pattern of stars identified with an ancient god, goddess, or animal; also an area of sky with one of these star patterns.

Copernicus, Nicolaus – A mathematician and astronomer who is known for his theory that the Earth revolved around the Sun.

Dark matter – An unknown substance that is only detectable by the gravity it exerts. Up to 23% of the universe is dark matter.

Einstein, Albert – Scientist and inventor who is best known for his theory of relativity and $E=mc^2$.

Galaxy – A grouping of stars, gas, and dust bound together by gravity. Galaxies sometimes have many billions of stars.
**Galilei, Galileo** – Scientist, mathematician, and astronomer who is best known for the improvements he made to the telescope. **

**Hubble, Edwin** – U.S. astronomer noted for his investigation of the age and radius of the universe. He also provided strong evidence that the universe is continually expanding. ~

**Hubble telescope** – A large telescope placed in orbit above Earth that takes pictures of objects in space. +

**Milky Way** – The galaxy to which our solar system, the Sun, and all the other stars we see in the night sky belong. ^

**Moon phase** – A time when the Moon presents a particular appearance: new, crescent, gibbous, waxing, waning or full. >

**Newton, Isaac** – Scientist, mathematician, and astronomer who is best known for defining the three laws of motion and gravity. =

**Nova** – The explosion from a medium-sized or smaller star. ^

**Orbit** – The regular path a celestial body follows as it revolves around another body. =

**Planet** – A spherical object larger than 600 miles in diameter that orbits a star and has cleared its neighborhood of other like-sized objects. =

**Planetarium** – A building in which images of stars, planets, and constellations are projected onto a dome for entertainment and education. ~

**Refracting telescope** – A telescope in which light is collected and focused by lenses. ^

**Satellite** – A natural or man-made object orbiting a planet. =

**Space tourism** – The practice of traveling into space for recreational purposes.

**Space walk** – Any activity done outside the spacecraft. +

**Sputnik 1** – First of a series of Soviet satellites sent into Earth’s orbit, launched October 4, 1957. >
Some key terms

**Star** – A self-luminous celestial body, visible at night as a stationary, twinkling point of light.

**Variable star** – A star that changes in its brightness and dimness over time. ^

**Voyager 1** – One of the two probes launched in 1977 to explore the outer planets in our solar system. ~

References


