A Teacher Resource Guide for

Skywatchers of Africa

For Grades 3 to 8

Beazley Planetarium

Children’s Museum of Virginia
Lesson Overview

The education resource was developed using the 5E model of learning and involves pre-visit activities to ENGAGE student interest, planetarium presentations using simulation software along with hands on activities to EXPLORE and EXPLAIN about the nature of constellations and related the constellations to the lore from African societies, an EXTEND/ELABORATE section where they further develop the concepts of their visit as well as the EVALUATE section to allow a check of student mastery.

The delivery of the EXPLORE and EXPLAIN sections can be tailored to your particular needs and may include one of two possible planetarium shows as well as a mini lesson on selected constellations.

Standards of Learning

Virginia Standards

- History 3.1, 3.4, 8.3, 8.4

Science

- Various point 1 bullets for grades 3 - 6

National Standards

Geography

- How to use maps and other geographic representations, tools and technologies to acquire, process and report information.
- How to use mental maps to organize information about people, place and environments.

Science

- As a result of their activities in grades k – 4, all students should develop an understanding of:
  - Objects in the sky
  - Changes in Earth and sky

Essential Questions

- What are constellations and what methods are best to observe them?
- How do the constellations you can see vary from one spot to another on Earth?
- How do the accepted constellations of today differ from those created by early African civilizations?

Instructional Objectives

Students will

- observe the planetarium sky using familiar patterns to navigate other constellations;
- view the southern skies above Africa to illustrate how the groups of constellations varies with latitude;
- learn about several of the dominant cultures of native Africa and about the names for the constellations; and
- recognize that the constellations which they invent can be just as useful as the ancient Greek, Roman or African constellations.

**Background**

Step outside on completely clear night, far from the lights of civilization and with no moon, you may see as many as 3000 stars twinkling in the sky. However if you step outside the Children’s Museum of Virginia at night you may only see a dozen or so stars due to light pollution. But with even with a fairly dark sky you may see as many as 1000 stars! The number of stars can be a bit overwhelming. So to cope with the staggering number of stars in the sky and to make some kind of order, human civilizations have made efforts to identify groups of the brightest stars in a sort of connect the dots pattern. The patterns were named **constellations**.

The dimmer stars that were not part of the original constellation were sometimes called scattered or outside the image stars. Sometimes there was a group of bright stars within a larger pattern or constellation (think Big Dipper within Ursa Major) or a new pattern could be made from the brightest stars of separate constellations (think the Summer Triangle made up of Deneb in Cygnus the Swan, Vega in Lyra the Harp and Altair in Aquila the Eagle). These patterns were given the name **asterisms**.

Early civilizations such as the Greeks, Romans, Arabs, Africans, and Native Americans (to name just a few) placed their own versions of star patterns in the sky and telling stories about the figures they had constructed that reflected their deepest hopes and fears. There was a natural connection between the astronomy and the humanities. The stories or lore often told of the frailty of the human condition, the exploits of great heroes, and with the timely arrival of certain constellations – the best time to plant and harvest crops.

While each civilization’s constellations told of a specific people, it was necessary for sky watchers to adopt an international system so that a common language would allow for study. In the 18th and 19th century the scientific community started making suggestions for additional constellations, many of which could not be agreed upon. It wasn’t until the 1920’s that the more familiar pattern of 88 recognized constellations was adopted. Today the sky is broken into regions associated with a constellation and includes even the faint stars in the region. They resemble boxes or sectors of the night sky named for the prominent ancient star pattern within them. Over half of the constellations consist of the ancient pattern within them such as Orion, Cygnus, Canis Major and are often associated with Greek mythology influenced by Ptolemy. The remainder of the constellations are names of scientific instruments; Telescopium & Octans, and exotic animals like Chameleon & Tucana.
The African continent is vast, with diverse civilizations such as the Dogan from the West Africa’s Republic of Mali, the Egyptians of the Nile Region, the Masai from Kenya and Tanzania and the Zulu from Natal on the eastern coast of South Africa. Each civilization viewed the night sky through the lens of their history and influenced the perception of their star patterns. They saw African animals, which were familiar to them, in the star patterns. Important figures such as Osiris and Isis filled prominent regions of their sky. When the Earth’s revolution around the Sun allowed particular constellations to appear the people knew the life giving rains would soon arrive, that the Nile would soon flood supplying fertile soil to the fields and when it was time to harvest the crop to be place in grain silos.

Resources

Online Sky Chart:
https://in-the-sky.org/skymap.php

African Sky Lore

http://www.psychohistorian.org/display_article.php?id=200901111733_african_star_lore.content

5E lesson Development

ENGAGE (Pre Visit)

This activity involves the stage of scientific thinking in which many different ideas, or hypotheses, are generated. There is a focus on the types of problems that allows for many good solutions (like naming an animal) in contrast to problems that have only one right answer, such as a math equation or finding a particular star. Before class begins duplicate the Circle Puzzle, Dots Puzzle and Create a Constellation sections of the Student Guide. Provide board space and take to display student’s work.

1. On a section of the black board, or using smart board, draw three or four circles each about 18 – 20 inches in diameter.
2. Direct students to follow directions on the Circle Puzzle activity to make each circle into a completely different picture and name what is drawn. Remind students that there are many equally good answers. Allow time for students to work independently.
3. Begin a share session of their answers. Invite student to go to the board to share their different answers.

Materials List

ENGAGE (Pre-visit)

Per Student

From Student Guide:
• Circle Puzzle
• Dots Puzzle

EXPLAIN

Per Student

• Skies Above the Children’s Museum Map
• Southern Skies Blank Star Map

EXTEND (Post-visit)

Per Student

• Create a Constellation Sheet
• Cardboard file folder
• Scissors
• Sheet of aluminum foil
• Clear tape
• Pencil or straightened paper clip
• Either an overhead projector (one for the class) or a soup can or similar tube open at both ends and rubber bands
4. Direct students to follow directions on the Dots Puzzle activity sheet. This activity is similar to the Circle Puzzle but uses dots. The idea here is that in this manner stars are like dots in the sky which can be connected to form images. Give students about 5 minutes to complete this activity and go over their responses on the ideas they developed.

5. Finally direct the students to the Create a Constellation activity in their Student Guide. In this activity they will be using the same dots as in the previous one. Read and discuss the mythology of Cassiopeia. In this exercise let the students design their own constellation, draw their own constellation for the pattern, and compose their own short story or myth associated with their new constellation.

Remind students of the role of constellations (they are used to mark locations in the sky, to mark passage of time, and to serve as a focus for passing myths and traditions to generations). Tell them that they will be learning about constellations, both current and ancient from Africa.

EXPLORE

The EXPLORE section takes in the Beazley Planetarium. Students will be able to observe a beautiful night sky in the Beazley Planetarium and learn more about constellations in general and the special constellations of various civilizations of Africa.

Your tour of the sky begins with a view of the night sky above the museum and directions on how to find your way across the sky. You will use the four cardinal directions as well as by locating a familiar starting spot like The Big Dipper and then star hopping to other constellations. After identifying a few of important current constellations students will then travel to the African continent to observe the similarities and differences between skies.

Next students will learn about the African civilizations that were responsible for the star lore they are about to learn about.

Travelling around Africa students will learn about the constellations through ancient African eyes. Our full dome feature, Skywatchers of Africa, will continue the tour of African mythology and astronomy.

The lesson also includes activities from the Lawrence Hall of Science Planetarium’s Planetarium Activities for Successful Shows (PASS).
EXPLAIN

The EXPLAIN section will also take place within our facility. Students will answer questions about the feature.

1. What were some of the names of the African cultures mentioned in the show?
2. Get with your neighbor and see if you can come up with an example of an African constellation. Report on the constellation’s story and explain why this constellation was important to these peoples.

Students will then view the night sky above the planetarium to complete a map of 4 – 5 constellations in the sky. After locating Virginia on the large Earth they will travel to Equatorial Africa to compare the locations of familiar constellations. They should note that the constellations visible depends upon their location (latitude) on Earth. This change in planetarium location will allow them to see that familiar things like the North Star will change and new features like the Southern Cross, Alpha Centauri and the Magellanic Clouds become visible. Finally working in small groups, students will visit African constellations to develop an appreciation of the diversity of cultures in Africa and to observe how each one views the stars in its own way.

EXTEND/ELaborate (Post Visit)

Before class, print the Random Sky sheets for student use. Following the directions on the Student Guide, students will make their own constellation connecting the stars to form their constellation based upon a favorite game character, item associated with a favorite book (think Harry Potter), or famous person or superhero.

1. Explain lesson requirements. Give time to think about the assignment and select their own constellations.
2. Provide opportunities to share their constellations and stories

Optional

Students will either work to make a model of the constellation they designed or you may have them select or assign a present day constellation from star maps. They would use this method to share their constellation when giving their oral report.

1. ★ Once constellation has been selected students will poke small holes in a sheet of aluminum foil with a sharp pencil or with a straightened paper clip. There are two ways to share their constellations: through projection or through a viewer.
   a. Project method – for use with an overhead projector
      i. Make a frame for the constellation by cutting the center area out of a cardboard file folder. Leave about a 1 inch frame around the edges. Tape enough aluminum foil to cover the open area. Students will punch out opening to represent the stars of the constellation.
ii. Place the framed constellation on projector to share with class.

b. Viewer method – smaller pieces of aluminum foil is placed over the end of soup can without both ends, a cardboard tube or similar sized tube.

i. Using a smaller sized piece of aluminum foil (just a bit larger than the opening of the can, punch holes in foil to represent the completed constellation. Attach with rubber bands.

ii. View constellation by peering through the can towards a bright light. Have students be careful to place the pattern “right side up” or “right side out” so the images are seen correctly, not a mirror image.

EVALUATION (Post Visit)

1. Use questions, discussions and the responses in the Student Guide to assess the student’s understanding of the essential questions.

2. Use a Think Pair Share exercise to address the evaluation of the essential questions.
STUDENT GUIDE

Essential Questions

- What are constellations and what methods are best to observe them?
- How do the constellations you can see vary from one spot to another on Earth?
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Background

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Figure 1. Constellations Credit NASA
sky named for the prominent ancient star pattern within them. Over half of the constellations consist of the ancient pattern within them such as Orion, Cygnus, Canis Major and are often associated with Greek mythology influenced by Ptolemy. The remainder of the constellations are names of scientific instruments; Telescopium & Octans, and exotic animals like Chameleon & Tucana.

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Vocabulary

asterism – An asterism is a prominent pattern or group of stars, typically having a popular name but smaller than a constellation.

Canopus – Canopus is the name of a particularly bright star in the Southern Skies often associated by African civilizations with the good luck for the first one seeing it every year.

canstellation – A constellation is a group of stars forming a recognizable pattern traditionally named after its apparent form or identified with a mythological feature.

equator – The equator is the imaginary line drawn around the Earth equally distant from both poles.

hemisphere – A hemisphere is a half of the Earth, usually divided into northern and southern halves by the equator.

Magellanic Clouds – The Magellanic Clouds are two irregular small galaxies visible in the Southern sky.

Milky Way – The Milky Way is the light colored band of stars filling the sky from the north to the south.

Polaris – Polaris is the name given to the star above the Earth’s North Pole also known as the North Star.

zenith – Zenith is the point in the sky directly above the observers’ head.
You can make your own pictures from even simple shapes. In this ENGAGE activity you should make each circle into a picture of something and write the name for that you have drawn in the provided space. The first two circles are completed as examples. Notice that each one is DIFFERENT and each has its own name.

<table>
<thead>
<tr>
<th>Boy</th>
<th>Clock</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Boy" /></td>
<td><img src="image2.png" alt="Clock" /></td>
</tr>
</tbody>
</table>

1. How many did you find? How many different possibilities do you think there are?

2. How many of you thought of a few different ideas for the circles, and then couldn’t think of any more? What are some different things you could try to think of a different idea?

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Dots Puzzle

These six pictures all show the same pattern of dots. In the first two pictures, people have drawn something which the dots make them think of. They labeled their pictures with a name that tells what the drawing is supposed to be.

Invent four completely different things based on the same pattern of dots. Draw your ideas in the last four boxes and label each one to tell what it is supposed to be a picture of.
Create a Constellation

Create a Constellation

The pattern of dots from the “Dots Puzzle” is really a pattern of stars that you can find in the sky. The Ancient Greeks saw this pattern as a beautiful queen, Cassiopeia, sitting on a throne.

In the box below, create your own constellation for the same pattern of stars.
The Story of Cassiopeia

Cassiopeia was the beautiful wife of Cepheus, king of Ethiopia, and the mother of Andromeda. She is most famous in connection with the myth of her daughter, Andromeda. The queen made the mistake of bragging she was more lovely than the Nereids, or even than Juno herself. The goddesses were, needless to say, rather insulted, and went to Neptune, god of the sea, to complain. Neptune promptly sent a sea monster (possibly Cetus?) to ravage the coast. The king and queen were ordered to sacrifice their daughter to appease Neptune's wrath, and would have done so had Perseus not arrived to kill the monster in the nick of time. As a reward, the hero was wedded to the lovely Andromeda.

By most accounts, Cassiopeia was quite happy with the match. In some versions of the myth, however, the queen objects to the marriage and is turned to stone when Perseus shows her the head of the Gorgon Medusa.

Although she was placed in the heavens by Neptune, the sea-god saw fit to humiliate her one final time.

Write the story of your new constellation here.
EXPLORE/EXPLAIN

Draw 4 or 5 constellations that can be found above the Children’s Museum of Virginia this very evening. Use dots and lines to mark the constellations. Not the locations of each with the proper compass setting.

The Skies Above the Children’s Museum of Virginia
1. How is the sky above the museum and the sky above Africa similar? What do they have in common? How are they different?

2. What was the source of a particular African constellation (name constellation and which people named it)?

3. In what ways were the sightings of particular constellations important to the people who named them?
EXTEND/ELABORATE

You have seen that images can be made from random shapes. You have also seen that in order to find your way around a sky full of stars, patterns can be inferred to help bring order. Also you have learned that to better remember the patterns, stories and myths have been associated with these constellations. Most were named for important people and things of the day. What if you had to make your own constellation today? What would your model be? The Sorting Hat from Harry Potter? Iron Man’s mask? In this EXTEND activity you will first try to locate a pattern from the random stars in this part of the sky, make a stick drawing of the constellation, and come up with the back story of how it was named, and why that constellation is important.
Write a short description of the new constellation you have designed.
**EVALUATION**

Think Pair Share –

1. Think about the answers to each of the Essential Questions.
2. Pair with your neighbor to compare your responses.
3. Be prepared to share your responses with the others in the class as well as provide feedback to other’s responses.

**Essential Questions**

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