

A Galactic Zoo

Lesson plan for grades K-2

Length of lesson: 1 Class Period (60 minutes)

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SOURCES AND RESOURCES:

- An elementary introduction to galaxy morphology:
<http://www.kidsastronomy.com/galaxys.htm>
- Sloan Digital Sky Survey (SDSS) intro to Hubble Tuning Fork diagram:
<http://cas.sdss.org/dr3/en/proj/basic/galaxies/tuningfork.asp>
- American Museum of Natural History: The Known Universe Video
<http://youtu.be/17jymDn0W6U>

POTENTIAL CONCEPTS TEKS ADDRESSED THROUGH THIS LESSON:

Beginning with school year 2006-2007:

§111.11.b Mathematics, Grade K: 5

Beginning with school year 2010-2011:

§112.11.b Astronomy, Grade K: 8C

§112.12.b Astronomy, Grade 1: 8C

§112.13.b Astronomy, Grade 2: 8D

PERFORMANCE OBJECTIVES:

Students will be able to:

- Describe the humans' place in the universe beginning with the Earth out to galaxies
- Differentiate between the three main shapes used to classify galaxies
- Report that we live on a spiral galaxy called the Milky Way Galaxy

MATERIALS (per group of four):

- Four half-sheets (one sheet is 8.5" x 11") of assorted construction paper.
 - Try to keep the total number of colors of paper below 10 for the entire class. This will be important for a later in the lesson.
- Four dark-colored markers
- Four age-appropriate safety scissors
- Four bottles (or sticks) of non-toxic, approved glue
- Two jars of glitter of two different colors (gold and silver suggested)

CONCEPTS:

People live on the planet **Earth**. If we travel far enough into outer space, we will see that the Earth moves around the **Sun**. The Sun is a ball of hot gas called a **star**. Traveling even further in our imaginary spaceship, we would see that the sun is just one of many, many stars (billions) that make up a **galaxy**. Galaxies come in many shapes and sizes. The many, many (billions) galaxies are part of the **universe**.

Galaxy Morphology: Since astronomers discovered them, galaxies continue to be grouped to this day based on their shape. Some galaxies like the **Andromeda Galaxy**, our nearest galactic neighbor, have grand **spiral** arms in their structure. Others like the galaxy M32 (*Messier Object 32*) are shaped like eggs and are called **elliptical** galaxies. Finally, some galaxies like M82 may have no spiral arms and are not shaped like eggs, these are called **irregular**.

We live in a spiral galaxy called the Milky Way galaxy.

BACKGROUND:

In the early twentieth century, astronomer Edwin Hubble began to classify the galaxies he observed into three main categories (elliptical, lenticular, and spiral) according to a sequence that would later bear his name, called the **Hubble tuning fork diagram**. For both amateur and professional astronomy, this system of galactic classification based on shapes is still widely used today. **Irregular** galaxies are not part of the traditional diagram, but for this lesson, elliptical and lenticular galaxies are grouped together, and irregular galaxies are introduced as a third category for simplicity's sake.

PREPARATION:

The instructor may wish to visit one of the above, recommended links for an introduction to galaxies and their relationship to the size of the universe.

ENGAGE: (15 min)

Gather the students on the carpet or wherever readings or presentations normally take place in your classroom. A power-point presentation will accompany this lesson.

Part 1 of the slideshow will proceed from asking the students about where they can find zoo animals. The slides will proceed asking where they can find a zoo in relation to the Earth.

Part 2 of the presentation will introduce the students to the Earth as a planet orbiting the sun. Subsequently, it will continue the pattern of "zooming out" until the sun is shown to be a star that is part of a galaxy. This galaxy is in turn part of the many others that make up the visible universe. The presentation will not include the solar system, the moon, or any specific names of galaxies or galaxy clusters. The emphasis is on visually showing what may be new concepts for a majority of the students.

Part 3 connects the initial slide about zoo animals with galaxy types. That is, just as there are many types and families of zoo animals, so too is the universe made up of a variety of galaxy types. The three most general types of galaxies are each magnified in a slide of their own. These are so that the instructor focuses on the broadest qualitative features of the galaxies.

Ask: The students may provide various answers to the questions in part 1. If their answers are different than the slides (e.g. “You can find a state in the USA”), redirect or expand upon their responses. The idea is for the students to generalize at each step of the slideshow.

Between parts 1 and 2, ask the students if this is as big as they can go. For example, “If we all got on an imaginary spaceship, do you think we can keep zooming out?” During part 2 (slide 8), ask the students if they know the **name** of the galaxy in which we live (but not the type!).

Before part 3, remind the students of how they began with the zoo animals. Ask them how they think galaxies are like the zoo.

- Elliptical Slide:
 - What color is this galaxy?
 - What shape would you say this is?
 - What does its shape remind you of?
 - Many may say oval, egg, ball, etc.
 - Where is the galaxy the brightest?
 - This is an opportunity to introduce the term **bulge** referring to this denser part of the galaxy.
 - If appropriate with your class, ask the students what they think the dark bands across the galaxy are. These are large bands of interstellar dust. Our own galaxy has these, and these can be severely limiting for astronomers when trying to view objects in the direction of the plane of the galaxy.
- Spiral Slide:
 - What colors do you see in this galaxy?
 - Remind the students of the previous slide. There is a hue of blue in this slide that is not accidental.
 - What shapes does this galaxy remind you of?
 - Some will say pinwheel; the galaxy in this slide is actually colloquially called the pinwheel galaxy! This is a chance to introduce the term **spiral arms** referring to the large, elegant bands that give the galaxy this pinwheel shape.
 - Spiral galaxies, like ellipticals, also have a central bulge that you may choose to ask the students about.

- Irregular slide:
 - What's different about this galaxy?
 - What colors do you see?
 - Does this galaxy look like it has a bulge?
 - This is one of the ways to identify an irregular galaxy: the absence of a central bulge.

Note to teachers: Should the students ask why we don't see galaxies when we look up at the night sky, it is because they are much, much farther away than the stars we see. Nearly all of the stars we see at night are just within the Milky Way. To see even the closest galaxy, Andromeda, one must travel to an observing location with minimal light pollution to see what still appears to be a large, fuzzy spot in the sky.

EXPLORE: (15 minutes)

Now, the students will have the opportunity to create their own galaxy.

1. Announce to the students that based on what they learned about the zoo of galaxies in space, they will now create their own galaxy. Make clear to them the following instructions before distributing materials.
2. Each student will draw his/her own galaxy using a marker.
 - a. Remind them of the three types discussed in the zoo. The students may wish to draw other shapes, and that is permissible. Encourage them to make elaborate spirals and ellipticals, however. Anything *not* spiral or elliptical will be counted as irregular later.
 - b. The students may make their galaxies of any size within the limits of the paper given.
3. Supervising the students, they will proceed to cut out their creation using the appropriate safety scissors. The instructors should carefully monitor the students during this step.
4. The students will decorate their galaxy with **either** gold glitter or silver glitter but not both. The glitter here represents the stars.
 - a. If using liquid glue, use discretion in the amount of glue used. Not much glue **or** glitter is needed for this step.
5. Have the students discard any extra paper in the appropriate bins.
6. Collect all glitter, and have the students clear their desk except for their new galaxy.

EXPLAIN : (10 minutes)

Using your regular signal, acquire the students' attentions. The instructor should help create the scene that he/she is now in a zoo (a galactic zoo), and is interested in looking at the various exhibits (the galaxies the students created).

- If time permits, have each student present his/her exhibit. Otherwise, call on a few students whose galaxies are varied
- Engage the class by asking questions like,
 - What color is his/her exhibit orgalaxy?

- If spiral: How many **arms** does this galaxy have?
- What color is the glitter on this galaxy?
- Is this galaxy **large** or **small**?
- If elliptical or spiral: Where might I find the **bulge** in this kind of galaxy?

ELABORATE: (10 minutes)

The Galaxy Safari Game

Now that the students are familiar with the different galaxies or exhibits in the class, gather their attention and announce that they will now play a game with all the galaxies in the zoo.

1. The instructor will begin by announcing something like, “I’m looking for a galaxy in this zoo that is...”
2. The instructor will select a property such as, “blue”
3. All students in the class whose galaxy is blue would then stand up
4. The instructor then asks for a different characteristic such as, “elliptical.” All ellipticals would then stand up, and those students whose blue galaxies are not ellipticals would sit down.
5. Include traits like number of spiral arms, size, irregular/not, bulge/not, color, and type of glitter.
6. Engage the students by asking if they can think of any question that might get the most or least amount of students to stand up at once.

EVALUATE: (10 minutes)

Finally, have the students complete the included handout about their galaxy. For 2nd grade (and some 1st grade) classes, the instructor may choose to have the students simply write the answers to these questions in complete sentences in their journals (if appropriate). Note: the last question is about our own galaxy. The give the students like mentioning that the galaxy we live in definitely has a **bulge**. This is one the key goals of the lesson!

Name:

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Complete the following sentences about your galaxy.

- 1.) My galaxy is the color _____.
- 2.) My galaxy is **elliptical/spiral/irregular**. (Circle one)
- 3.) My galaxy has _____ arms.
- 4.) My galaxy **does/does not** have a bulge. (Circle one)
- 5.) My table has _____ irregular galaxies.
- 6.) The Milky Way Galaxy is **elliptical/spiral/irregular**.

Name: