

# THE UNIVERSE - AN EXPANSIVE SUBJECT

**Master Teacher:** Nancy Long

**Grade level:** 6 - 8

**Time Allotment:** Four one-hour class periods

**Overview:** In this lesson students will explore the concept of the expanding universe and will model the expansion of the universe with balloons. They will use a webquest on the universe to explore topics related to the universe and decide whether the United States should continue the study of deep space.

**Subject matter:** Science

The Expanding Universe Theory

Galaxies

Comets

The Solar System

The Origin of the Universe

**Learning Objectives:**

The student will:

Create a model of the expanding universe.

Use the Internet to research a topic related to the universe.

Work with a group to reach a decision about the need for deep space research.

**Standards: Texas Essential Knowledge and Skills** (located at <http://www.tea.state.tx.us/rules/tac/ch112.html#s11222>)

(6.13) Science concepts. The student knows components of our solar system. The student is expected to:

(A) identify characteristics of objects in our solar system including the Sun, planets, meteorites, comets, asteroids, and moons;

(8.13) Science concepts. The student knows characteristics of the universe. The student is expected to:

(A) describe characteristics of the universe such as stars and galaxies;

(B) explain the use of light years to describe distances in the universe;

(C) research and describe historical scientific theories of the origin of the universe.

**Media Components:**

ETV series *Starfinder* #4 "The Expanding Universe"

Webquest activity located at the website

<http://www.kn.pacbell.com/wired/fil/pages/webuniversena.html>

**Materials:**

Medium-sized balloon (one per student)

Black permanent fine-point marker (one per student)

Measuring tape (one per student)

Copies of activity (one per student)

TV and VCR with remote control

Computers (up to one per student)

**Prep for teachers:**

Before the lesson begins, the teacher should bookmark the link for the webquest on each computer to be used by students.

<http://www.kn.pacbell.com/wired/fil/pages/webuniversena.html>

The videotape should be cued to the beginning of Lesson 4, "The Expanding Universe".

### **Introductory Activity: Setting the Stage**

Begin the lesson by asking the question, "How big is the universe?" Discuss the students' answers. Ask, "What does the universe contain?" Discuss students' answers, being sure to include galaxies, comets, meteors, solar systems composed of stars and planets. Ask, "Do you think there is life in outer space?" Discuss students' answers, encouraging them to give their reasons.

### **Focus for Media Interaction**

To give students a specific responsibility while viewing, **say**, "Let's watch to see one way in which scientists gather information about the universe."

#### Learning Activities

**Step 1**      **Begin** the video at the beginning of the lesson.

**Step 2**      **Pause** the tape after the title *Starfinder* appears on the screen. **Ask**, "In what year was the telescope invented? (1609) In what year was the Hubble Space Telescope launched into Earth's orbit?" (1990)

**Say**, "Let's find out how the HST helps astronomers learn more about the size of the universe and what lies within it. **Resume** the video.

**Step 3** **Pause** it after Eric Chaisson says, "Quite frankly, there is nothing more basic than the birth of a star," and the image of the star spins away to reveal Maggie Linton. **Ask** students, "What does the HST allow astronomers to see that they can't see with earth-based telescopes?" (The stellar nursery within the center of 30-Doradus)

**Ask**, "How do you think astronomers determine the distances between stars, when they are so far away?" Discuss students' answers. **Say**, "In the next segment watch to see how the process of measuring the distances between stars was developed."

**Resume** the video.

Step 4 **Pause** the tape after the narrator says, "The word **universe** was born, all because of our space rulers, the cepheid variables," with a still picture of a galaxy in view.

**Ask**, "What is a cepheid variable? How is it used to measure the distances between stars?"

(It is a star that varies in brightness over a certain period of time. Once astronomers figure out the cycle of each cepheid variable, they can use that information to find out how far away the stars are.) **Ask**, "Do you think the stars stay the same distance apart?" Discuss students' answers. **SAY**, "Let's watch to see what Edwin Hubble discovered about the distanced between stars."

**Resume** the video.

Step 5 **Pause** the tape after Maggie Linton says, "...the farther the galaxy, the faster it speeds away." **Ask**, "How does red shift show that the stars are moving away from each other?" (The farther star clusters are from Earth, the more their spectral patterns shift to red. The farther away the galaxy is, the greater the red shift is.)

**Say**, "It's hard to imagine a universe that keeps expanding forever. Let's watch to see an example of how it might work."

**Resume** the video. **Stop** the tape when the close-up of the raisin cake changes to a photo of space, when Maggie Linton says, "That's like our universe."

### **Culminating Activities**

Step 1: **Say**, "That was an easy model to understand. Now we are going to make a model of our own to show how galaxies move away from each other."

Give each student a copy of the Expanding Universe activity, a balloon, a marker, and a measuring tape. Have students read the directions with you. Allow them inflate their balloons to a diameter of three inches and make the marks on their balloons one centimeter apart, labeled A, B, and C. Students then inflate their balloons to a diameter of about six inches, measure the distance between the marks, and record their data. Finally, students inflate the balloons to a diameter of fifteen inches, measure the distance between the marks, and record their data.

Have them complete the activity by answering the question at the bottom of the page.

Step 2: **Ask**, "What do you think about the United States program to study deep space and search for other life in outer space?" Accept students' responses. Explain that we are going to role-play the part of a team of scientists whose job it is to gather information on the universe, the bodies within it, and its origins and to decide whether deep space research should continue to be funded. Divide students into teams of four. (Modification for Special Ed.: A special needs student may be the fifth person in a team and may work with another student on the same research topic.) Have them go to the computers and locate the website for the Universe Webquest, which was previously bookmarked on each computer. Read through the introductions and directions together. Have team members decide which role they will play in the team's quest. Allow the rest of the class period for them to explore the background websites.

Step 3 Assign a date for the final product (letter) to be turned in and also e-mailed to the Space Scientist Online. **\*Note:** The amount of work on the project done in class depends on whether the students have Internet access at home

## **Cross-Curricular Extensions:**

### **Math:**

Have students calculate the ratio of the diameter of the balloon in the Expanding Universe activity to the distance between the marks on the balloon.

### **Art:**

Students may use wax resist method to make a picture of a galaxy, nebula, comet, or other celestial scene.

### **World History:**

Make a time line showing the development of astronomy from the 1600s to the present. Mark the birth countries of famous astronomers on the map.

### **Music Appreciation:**

Listen to excerpts from *The Planets* by Gustav Holst.

### **Reading:**

Read *A Wrinkle in Time* by Madeline L'Engle. Discuss the concept of time/space travel as it is presented in the book.

### **Community Connections:**

Invite members of a local stargazers group or an astronomer to speak to the class. Arrange a star party, where amateur astronomers set up their telescopes for students to use on a clear night. Provide maps of constellations for student use.

Universe WebQuest  
**An Internet WebQuest on The Universe**  
created by Nancy Long  
[Martin Middle School](#)

[Introduction](#) | [The Quest](#) | [The Process & Resources](#) | [Conclusion](#) | [HyperText Dictionary](#)

## **Introduction**

Picture this: you and a team of learners are presented with the task of describing an elephant. But instead of looking to an encyclopedia or a zoo exhibit, you are each blindfolded and guided to a real elephant. Each of you touches a different part of the animal: one, the soft and delicate tip of the elephant's trunk; another, the hard tusk of ivory; and a third, the wrinkled hide around the elephant's belly.

Based upon what each of you learned, one thinks an elephant is smooth and soft, another would say an elephant is smooth and hard, while the last would conclude that elephants are rough and soft. What's the truth? When we study complex topics, we are often like the elephant examiners: there's usually a lot more to a topic that we don't learn about after only a quick exploration.

This is particularly true when we use the Internet for our research because many people post their personal opinions or only know a sliver of the whole story. In the following WebQuest, you will use the power of teamwork and the abundant resources on the Internet to learn all about universe. Each person on your team will learn one piece of the puzzle and then you will come together to get a better understanding of the topic.

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## **The Quest**

Do you think the United States government should continue to fund deep space research and the search for life in outer space?

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## The Process and Resources

As you may know, our government spends hundreds of millions of dollars annually on the space program. Can you think of some of the ways that money is spent? If you said astronaut training, space shuttle missions, and the Hubble Space Telescope, you are partly right. Money is also spent on probes which travel through space and send back photos of planets and their moons. NASA is currently spending money to find a way for men to go to Mars. A tremendous amount of money is spent on research and development of ways to explore deeper and deeper into space. And radio telescopes, such as the Very Large Array in Socorro, New Mexico, are being used to search for intelligent life in outer space.

Is it worth it? Should our country be spending that much money for space research? That is the question you and your group members will answer.

In this WebQuest you will be working together with a group of students in class. Each group will answer the Task or Quest(ion). As a member of the group you will explore WebPages from people all over the world who care about universe. Because these are real WebPages we're tapping into, not things made just for schools, the reading level might challenge you. Feel free to use the online Webster dictionary or one in your classroom.

You'll begin with everyone in your group getting some background on what we already know about the universe and what it contains before dividing into roles where people on your team become experts on one part of the topic.

### Phase 1 - Background: Something for Everyone

Use the Internet information linked below to find out about our solar system, comets and meteors, galaxies, and the origin of the universe. Be creative in exploring the information so that you will have a good background of information as you begin to gather answers for the questions you will receive.

- [Stardate](#)
- [Amazing Space](#)

□ [Universe!](#)

## Phase 2 - Looking Deeper from Different Perspectives

### INSTRUCTIONS:

1. Individuals or pairs from your larger WebQuest team will explore one of the roles below.
2. Read through the files linked to your group. If you print out the files, underline the passages that you feel are the most important. If you look at the files on the computer, copy sections you feel are important by dragging the mouse across the passage and copying / pasting it into a word processor or your own Power Point presentation. Remember that you can use any information from the three websites containing general information for everyone.
3. Note: Remember to write down or copy/paste the URL of the file you take the passage from so you can quickly go back to it if you need to prove your point.
4. Be prepared to focus what you've learned into one main opinion that answers the Big Quest(ion) or Task based on what you have learned from the links for your role.

### Galaxy Master

Use the Internet information linked below to answer these questions specifically related to *Galaxy Master*:

1. How are galaxies formed?
2. What kinds of galaxies are there? How are they classified?
3. What questions are scientists trying to answer about galaxies at this time?

□ [Amazing Space](#)

### Comet Cruiser

Use the Internet information linked below to answer these questions specifically related to *Comet Cruiser*:

1. What are comets made of? How are they formed?
2. How is the orbit of a comet like the orbit of a

planet? How is it different?

3. How are comets different from asteroids and meteors?

□ [New Comet](#)

### Solar System Sage

Use the Internet information linked below to answer these questions specifically related to Solar System Sage:

1. What are the nine known planets in our solar system, in order from the sun?

2. How many moons does each of our solar system's planets have?

3. What conditions must a planet or moon have in order to support life as we know it?

□ [Stardate](#)

□ [StarChild](#)

### Origins Guru

Use the Internet information linked below to answer these questions specifically related to Origins Guru:

1. What does the Big Bang theory state?

2. Was the entire universe created at once from one big explosion?

3. What does the term 'expanding universe' mean?

□ [Origin of the Universe](#)

### Phase 3 - Debating, Discussing, and Reaching Consensus

You have all learned about a different part of universe. Now group members come back to the larger WebQuest team with expertise gained by searching from one perspective. You must all now answer the Task / Quest(ion) as a group. Each of you will bring a certain viewpoint to the answer: some of you will agree and others disagree. Use information, pictures, movies, facts, opinions, etc. from the WebPages you explored to convince your teammates whether or not the government should continue to fund space research and the search for life in outer space. Your WebQuest team should write out an answer that everyone on the team can live with, with facts from your research to support your opinion.

## Phase 4 - Real World Feedback

You and your teammates have learned a lot by dividing up into different roles. Now's the time to put your learning into a letter you'll send out for real world feedback. Together you will write a letter that contains opinions, information, and perspectives that you've gained. Here's the process:

1. Begin your letter with a statement of who you are and why you are writing your message to this particular person or organization.
2. Give background information that shows you understand the topic.

### STATE THE TASK / QUEST(ION) AND YOUR GROUP'S ANSWER.

3. Each person in your group should write a paragraph that gives two good reasons supporting the group's opinion. Make sure to be specific in both the information (like where you got it from on the Web) and the reasoning (why the information proves your group's point).
4. Have each person on the team proofread the message. Use correct letter format and make sure you have correctly addressed the email message. Use the link below to make contact. Send your message to Space Scientist Online and make sure your teacher gets a copy.

**Your Contact is:** [starman@unc.edu](mailto:starman@unc.edu) - [Space Scientist Online](#)

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## Conclusion

So is an elephant smooth, rough, soft, or hard? Well, when you're blindfolded and only \*looking\* at one part, it's easy to come up with an answer that may not be completely right. It's the same for understanding a topic as broad or complex as universe: when you only know part of the picture, you only know part of the picture. Now you all know a lot more. Nice work. You should be proud of yourselves! How can you use what you've learned to see beyond the black and white of a topic and into the grayer areas? What other parts of universe could still be explored? Remember, learning never stops.

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<http://www.kn.pacbell.com/wired/fil>  
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## THE EXPANDING UNIVERSE

Objective: Create a model to demonstrate the theory of the expanding universe.

Materials: One balloon

One permanent fine-tip marker

One measuring tape

Directions:

1. Inflate your balloon slightly with just a puff of air to a diameter of about three inches. Make a dot on the balloon with a permanent marker. Label the dot A. Make another dot about one centimeter away from dot A, and label it B. Make a third dot about two centimeters from dot B, and label it C.
2. Record the distance in centimeters between each pair of dots on the data table below.
3. Inflate the balloon to a diameter of about six inches. Measure the distance in centimeters between each pair of dots and record the data below.

4. Inflate the balloon to a diameter of about fifteen inches. Again measure and record the distance between the dots.

Distance Between Dots			
	3-in. diameter	6-in. diameter	15-in. diameter
Between A and B			
Between B and C			
Between A and C			

Complete the statements below.

As the balloon increases in size, the distance between the dots  
\_\_\_\_\_.

The distance between dots A and B increases \_\_\_\_\_  
(more than, less than, the same amount as) the distance between dots B and C.

If astronomers observe that the distances between stars are increasing, they conclude that the size of the universe is \_\_\_\_\_.