Doin' the Moonwalk

MASTER TEACHERS	**Debbie Smith and James Parsons**
LESSON TITLE	Doin' the Moonwalk
GRADE LEVELS	This lesson targets K-2, but may be adapted to other grade levels.
TIME ALLOTMENT	The lesson can be completed in six 20-minute sessions. Sessions should be taught in order of presentation.
OVERVIEW	"I see the Moon, and the Moon sees me…" From the earliest days of childhood, students have been connected through literature and music to our nearest neighbor in space, the moon. Scientists have studied it via telescope, and astronauts have walked its rugged surface, yet the moon is also easily studied from students' own backyards. This lesson integrates inquiry science methods with video, web sites, and informational text to provide students with the opportunity to take an introductory "moonwalk."
SUBJECT MATTER	Earth Science
LEARNING OBJECTIVES	Students will be able to: • Identify the size of the moon in relation to the earth. • Describe the distance of the moon from the earth. • Tell the age of the moon. • Explain why the moon shines. • Define the moon's orbit. • Recognize the moon has different phases. • Describe the composition of the moon's surface. • Define crater. • Describe the environment on the moon. • Retell the story of the first moon visit.

STANDARDS

National Standards:
National Science Education Standards
http://www.nap.edu/readingroom/books/nses/html/6c.html#csdk4
Inquiry Standards (K-4)
Ability to do scientific inquiry
Earth Science Standards (K-4)
D—Objects in the Sky: The sun, moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be observed and described.
E—Changes in the Earth and Sky: Objects in the sky have patterns of movement. The moon moves across the sky on a daily basis much like the sun. The observable shape of the moon changes from day to day in a cycle that lasts about a moon.

State Standards:
Science - TN
http://www.state.tn.us/education/ci/cistandards2001/sci/ciscik3standards.htm
Earth Science Standards (K-3)
7.0 Earth and Its Place in the Universe
Learning Expectations:
7.1 Recognize that different objects appear in the day and nighttime sky.
7.2 Recognize that there are predictable patterns occurring in the universe.
11.0 Force and Motion
Learning Expectations:
11.1 Realize the basic concept that forces can move objects.

MEDIA COMPONENTS

WEB SITES
NPT's United Streaming
http://wnpt.unitedstreaming.com/login_wnpt.cfm
This site allows teachers to download, or stream videos into the classroom using the computer. (Requires username and password to access.) Download: **The Sky Above: A First Look** segment "Visiting the Moon" (1:04) and **Spin Around the Solar System: A Moon Dance** segment "Moon Formation" (3:32). (The full videos contain segments not utilized in this lesson.)

WEB SITES
(**Teacher Note:** Web sites are listed in the order of presentation in the lesson.)
The Earth and the Moon Coloring Sheet
http://www.enchantedlearning.com/subjects/astronomy/activities/coloring/earthmoon.shtml
A coloring sheet representing the size of the moon in relation to the earth is available at this site.

Craters
http://kids.msfc.nasa.gov/solarsystem/meteors/craters.asp
This web site provides information and picture references on moon craters.

Lunar Crater 308
http://kids.msfc.nasa.gov/rockets/apollo%2D11/crater.asp
This site provides an excellent picture of a crater.

The Moon
http://kids.msfc.nasa.gov/earth/moon/moon.asp
Current phases of the moon can be accessed at this web site.

Moon Calendar
http://www.ameritech.net/users/paulcarlisle/MoonCalendar.html
Students may access the phase of the moon for the day they were born at this site. The site also includes an animation of the moon's phases.

On the Moon
http://www.nasm.edu/galleries/attm/nojs/a11.om.1.html
Use this site to introduce students to the spacesuits worn by Apollo astronauts.

How Much Would You Weigh on Another Planet?
http://kids.msfc.nasa.gov/Puzzles/Weight.asp
Students may use the online calculator to determine how much they would weigh on the moon.

Landing on the Moon: A 30th Anniversary
http://kids.msfc.nasa.gov/news/1999/news-apollo11.asp
This web site provides a wealth of information on the Apollo missions, including astronauts, spacecraft, moon shots, etc. Audio and video clips of the Apollo 11 moon landing are also available.

Saturn V Animation
http://kids.msfc.nasa.gov/rockets/apollo%2D11/animation.asp
This site provides animation of the Saturn V liftoff and path during the Apollo missions to the moon.

Zoom Astronomy Activities
http://www.enchantedlearning.com/subjects/astronomy/activities/radiobuttonquiz/Moonpz.shtml
Students may complete an interactive review puzzle about the moon at this site.

Lunar Prospector: Alka Rockets
http://lunar.arc.nasa.gov/education/activities/active4.htm
Directions on building a rocket with basic materials, such as index cards, film canisters, and Alka Seltzer tablets are available at this web site.

BOOKS
Man on the Moon by Anastasia Suen, ISBN 0-14-056598.

The Moon by Niki Walker, ISBN 0-86505-689-7.

Roaring Rockets by Tony Mitton/Ant Parker, ISBN 0-7534-5305-3.

Space by Fiona McDonald, ISBN 0-531-15426-2.

Whiz Kids: Tell Me Why the Moon Changes Shape by Shirley Willis, ISBN 0-531-15980-9.

MATERIALS

PER CLASS: Television with appropriate computer cables, computer with Internet access and printer, overhead projector, CDs for downloading video clips, chart paper, marker, moon vocabulary chart, inflatable globe, 4 softball-size Styrofoam balls, large ball, desk lamp, paper models of moon phases, overhead transparency for "Contents" page of *Tell Me Why the Moon Changes Shape* by Shirley Willis, overhead transparency for "Going Through Phases" from *The Moon* by Niki Walker, bathroom scales

PER COOPERATIVE GROUP: 1 long balloon, 1 straw, 1 12-foot piece of string, adhesive tape, scissors, 1 paddle ball, 1 large ball, 1 large bread pan, flour to fill bread pan, cocoa to sprinkle in thin layer on flour, 1 marble, 1 ping pong ball, paper for mission patch, markers

PER STUDENT: *The Earth and the Moon* coloring sheet, 1 round balloon, 1 penny, 1 large paper plate, 1 small paper plate, ruler, pencil, rock, Rock Inquiry worksheet, 2-5x8 index cards, crayons, tape, film canister, *Alka Seltzer* tablet

PREP FOR TEACHERS

Preview and download the identified video clips to CD or the hard drive using **NPT's United Streaming** located at http://wnpt.unitedstreaming.com/login_wnpt.cfm. Download: **The Sky Above: A First Look** segment "Visiting the Moon" (1:04) and **Spin Around the Solar System: A Moon Dance** segment "Moon Formation" (3:32). (The full videos contain segments not utilized in this lesson.)
Bookmark and preview web sites included in the presentation.
Download and load plug-ins.
Adobe Acrobat Reader
http://www.adobe.com/products/acrobat/readstep/htm
Provides for viewing and printing of PDF files.
Macromedia
http://macromedia.com/downloads/
Allows viewing of multimedia features, such as animation.
Real One Player
http://real.com/
Allows viewing of multimedia features.

Prepare overhead transparencies of the "Contents" page of *Tell Me Why the Moon Changes Shape* by Shirley Willis and for "Going Through Phases" from *The Moon* by Niki Walker.
Download **Earth and Moon Coloring Sheet** from http://www.enchantedlearning.com/subjects/astronomy/activities/coloring/earthmoon.shtml and make copies for students.

Prepare moon vocabulary chart (Apollo, astronaut, atmosphere, crater, earth, maria, moon, moonlight, phases, reflect, rock, rocket, temperature).
Cut and tape 12-foot lengths of string to the ceiling.
Fill bread pans with flour, and dust top layer with cocoa.
Make copies of Rock Inquiry worksheet.
Make copies of **The Earth and the Moon** coloring sheet.
Prepare paper models of moon phases.
Visit **Lunar Prospector: Alka Rockets** (teacher resource page) located at http://lunar.arc.nasa.gov/education/activities/active4a.htm to download instructions, in advance, for students. Prepare Alka rocket example.

INTRODUCTORY ACTIVITY: SETTING THE STAGE

Step 1. Introduce the book, Roaring Rockets, by Tony Mitton and Ant Parker, in a shared reading format. Include a picture walk, prediction time, and vocabulary development. After reading the story, capture student interest with the following statement: "I've always wanted to get on board a rocket and roar off into the skies. I would head straight for a beautiful world called Luna. You can see Luna from your own backyard—a big, shining sphere in the nighttime sky. Can you guess where I want to go? That's right! I want to travel to the moon. Luna is our moon. Would you like to go with me? Oh, I know we can't board a real rocket right now, but we can take a journey to Luna—through books, and video and web sites. Let's get started by making a list of what we already know and what we want to learn about the moon."

Step 2. Guide students in completing a KWL chart about the moon. Then, say: "We'll begin our journey by looking at a book called, *Tell Me Why the Moon Changes Shape*, by Shirley Willis."
Use the overhead projector to preview the Contents page to determine what topics are covered. Note that each heading is in the form of a question. Relate these headings to correlations on the KWL chart. Introduce the moon vocabulary chart that will be used throughout the lesson. Identify the word "moon" and circle it.

Step 3. Read aloud page 6, "How Far Is the Moon?" from the book, *Tell Me Why the Moon Changes Shape*, by Shirley Willis. Explain that the moon is so far away (239,000 miles) that astronauts used a rocket to travel to the moon. Form cooperative groups to complete the *Balloon Rocket* experiment on page 7. Students will insert string into the straws taped to the ceiling. Balloons should be inflated and held by one student while another student tapes the balloon to the straw. At a prearranged signal, students will release the balloon and observe the "rocket" action. Announce "We have liftoff for our study of the moon." Ask students to repeat the distance of the moon from the earth. (Answer: 239,000 miles)

LEARNING ACTIVITIES

Step 1. Read pages 8-9 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Discuss the size of the moon in relation to the earth. Help students understand the relationship by distributing the inflatable globe and 4-softball size Styrofoam balls for examination. Explain that the earth is four times as big as the moon. Distribute copies of **The Earth and the Moon** coloring sheet for students to review and color. (Download instructions in Teacher Prep Area.)

Step 2. Read pages 10-11 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Discuss the age of the moon in relation to events in recorded history (Examples: Columbus discovers

America, Medieval times, age of dinosaurs). Tell students the moon is as old as the earth. **CUE** the downloaded video segment "Moon Formation" to the beginning frame showing the title and a picture of the moon. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to find out when the moon was formed. **BEGIN PLAY**. **PAUSE** to highlight a point after the words, "…from more or less the same type of materials." This frame shows the moon orbiting the earth. Select a student to repeat how long ago the moon was formed. (Answer: 4.5 billion years ago). Ask students to identify what was formed at the same time as the moon. (Answer: Earth). Provide students with a **FOCUS FOR MEDIA INTERACTION** by instructing them to listen for three ideas scientists have for how the moon was formed. **RESUME PLAY. STOP** for discussion after the statement, "The chunks, however, eventually regrouped in Earth orbit to form the moon." This frame shows the chunks regrouping. Guide students in listing the three ideas on moon formation:

1. Big blob pulled away from Earth
2. Developed separately from same cluster of space particles that formed the Earth;
3. Earth struck by object, knocking out chunks that regrouped to form the moon;

REWIND and **REPLAY** as necessary to identify these three points. **STOP** the video at the same point as described above.

Step 3. Read page 22, "What Is It Like on the Moon?" from the book, *Tell Me Why the Moon Changes Shape* by Shirley Willis. Tell students that they will find out how the moon came to look the way it does today. **CUE** the downloaded video segment, "Moon Formation" to the end of the statement, "The chunks, however, eventually regrouped in Earth orbit to form the moon." This frame shows the chunks regrouping. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to discover what the word "molten" means. **PAUSE** after the words, "…their surfaces cooled to form crust," to check for understanding. The frame shows the word "molten." Select a student to locate the same word on the vocabulary chart and circle it. Define it. (Molten- formed by heat) In this next section of video we will learn how the surface of the moon was shaped. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to raise a hand when they hear the words "crater" and "maria" in the video. **STOP** for discussion after the words, "…the moon's surface has hardly changed." The frame shows an astronaut exploring the moon's surface. Discuss the formation of craters and the areas known as "maria." **REWIND** and **REPLAY** as necessary for understanding. **STOP** the video at the same point. Have students locate the words, "crater" and "maria," on the vocabulary chart.

Step 4. Open the **Craters** web site located at http://kids.msfc.nasa.gov/solarsystem/meteors/craters.asp. Use the information in the first paragraph on the site to orally review craters. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to listen for the following information: how craters are formed, what shape craters are, and why craters on the moon stay the same. Read the first paragraph, then select students to provide the information requested. (Answers: craters are formed when a meteorite hits the surface of the moon; craters are round like a bowl; there is no air, wind, or rain on the moon to change the shape of craters.) Show students a photograph of **Lunar Crater 308** recorded during the Apollo missions found at http://kids.msfc.nasa.gov/rockets/apollo%2D11/crater.asp Provide a **FOCUS FOR MEDIA INTERACTION** by telling students to raise their hands when they see the large crater in the photo. Have a student point out the crater on the screen. Tell students they will be completing an experiment to help them better understand crater formation. Place bread pans filled with flour and covered with a thin layer of cocoa on the table. Identify this as the surface of the moon. Have students take turns dropping marbles and ping pong balls into the flour from a short distance above the pans. (A picture of this activity is located on pages 22-23 of *Tell Me Why the Moon Changes Shape* by Shirley Willis.) Close the experiment by reviewing the definition for a crater: A crater is a deep hole created by an object hitting the surface of the moon.

Step 5. Read page 20 from the book, *Tell Me Why the Moon Changes Shape* by Shirley Willis. Tell the students scientists have been able to study rocks brought back from the moon by the Apollo missions. Explain that scientists examine the rocks very carefully, recording all the information they can about each specimen. Invite students to become “moon rock scientists” and examine some rocks as real scientists do. Provide cooperative groups of 3-4 students with a rock to study. Guide students in identifying the characteristics of their specimens. Distribute copies of the Rock Inquiry worksheet for students to use in recording their observations. (See Student Materials section.)

Step 6. Ask students the questions: When do we see the moon in the sky? (Answer: night time) Where does the moon go in the morning? Accept whatever answers students provide at this point. Read pages 18-19 from the book, *Tell Me Why the Moon Changes Shape* by Shirley Willis. Tell students that the earth (rotating and orbiting) and moon (orbiting) are constantly moving. Tell students they are going to perform some experiments to discover how the

moon moves around the earth.

Provide each cooperative group with a balloon and a penny. (A large group experiment will work well with kindergarten students.) Direct a student in each group to place the penny inside the balloon. Direct another student to blow up the balloon. Assist students with tying the end of the balloon. Guide students in moving the balloon in a circular motion. The penny will begin to "orbit" the inside of the balloon, and continue for a few moments after the balloon has stopped moving. Allow each student time to experience the orbiting motion. Tell students the moon moves in an orbit around the earth just as the penny moved around the balloon.

Use a paddleball and an inflatable globe to show the orbit of the moon around the earth in another way. Place the globe on the floor. Guide a student in gently moving the paddle in a circular motion around the globe. Then direct the student to stop the paddle. The ball on the string will continue to "orbit" the globe. Read page 14 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Review the definition of an orbit. Have a student identify the word "orbit" on the vocabulary chart.

Step 7. Ask students if they know why the moon is like a mirror. Read pages 12-13 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Discuss how the light from the sun bounces off the moon to create moonlight. Use a desk lamp shining on a large ball to demonstrate this concept (pictured on page 29 of *The Moon* by Niki Walker). Have a student identify the word "moonlight" on the vocabulary chart. Read pages 16-17 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Discuss how the moon's orbit and the light of the sun create the "phases of the moon" that we see in the sky each month. Use the overhead transparency, "Going Through Phases," created from page 17 of *The Moon* by Niki Walker, to identify the cycle of the moon's phases. Select a student to identify the word "phase" on the vocabulary chart.

Step 8. Introduce a review session on the concept of moon phases with the poem, "Moon Poem" by Vachel Lindsay (reprinted in the book, *Space*, by Fiona McDonald). Show students paper models of the moon's phases. Guide students in identifying the various phases. Use the web site, **The Moon** located at http://kids.msfc.nasa.gov/earth/moon/moon.asp to show students the current phase of the moon. Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to identity the phase displayed. (Answer: full, half, crescent, etc. according to the current phase). Use the web site **Moon Calendar** located at

http://www.ameritech.net/users/paulcarlisle/MoonCalendar.html to allow students to observe the moon's phase on the day they were born. The site also includes an animation button to watch the moon change phases throughout the chosen month. Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to be prepared to describe their moon phases after clicking on the appropriate buttons to identify their birthdays and observing the results. (Answers will vary according to the particular dates inserted.)

Step 9. Initiate a discussion of the moon's environment by reading pages 24-25 of *Tell Me Why the Moon Changes Shape* by Shirley Willis. Select a student to identify the word, "temperature," on the vocabulary chart. Use the web site **On the Moon** at http://www.nasm.edu/galleries/attm/nojs/a11.om.1.html to introduce students to the space suits worn by Apollo astronauts that protected them from the extreme temperatures. Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to listen for the following information: what material was used to make the space suits, what protected the astronauts heads and hands, and what parts of the space suit were left on the moon. Read the paragraph entitled, "Apollo 11 Space Suits;" then, have students identify the requested information.

Read pages 26-27 from *Tell Me Why the Moon Changes Shape* by Shirley Willis. Discuss the word atmosphere. Have a student identify the word, "atmosphere", on the vocabulary chart. Tell students space suits also provided a way for the astronauts to breathe properly. Show the photo of the *Apollo Space Suit Model A7L* from the site ***On the Moon*** located at http://www.nasm.edu/galleries/attm/nojs/a11.om.1.html Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to raise their hands when they locate the portable life support system in the photograph. Select a student to point to the life support system on the screen.

Step 10. Introduce a discussion of gravity by having students jump as high as they can jump. Tell students the force of gravity prevents them from jumping any higher because it is pulling them back towards earth. Select a student to identify the word, "gravity", on the vocabulary chart. Point out that the force of gravity on the moon is much less than that on earth (1/6 of the earth's gravity). This means that students would weigh less on the moon, and be able to jump higher. Use the **How Much Would You Weigh on Another Planet?** web site at http://kids.msfc.nasa.gov/Puzzles/Weight.asp to determine what each student would weigh on the moon. Provide a **FOCUS FOR MEDIA INTERACTION** by telling students they will discover their

moon weight by typing in their weight on earth. Assist students with the interactive process as needed. (Teachers may want to provide a set of bathroom scales to use in determining earth weights.)

Step 11. Ask students if anyone has ever been to the moon. Accept whatever responses are offered at this point. Tell students that they will find the answer to this question in a book entitled, *Man on the Moon*, by Anastasia Suen. Provide a listening focus with these directions: "Listen to learn the name of the mission, the name of the rocket, the name of the spacecraft, the name of the lunar module, and the name of the astronauts." Read the story, stopping at key points to identify the focus items.

Use the web site **Landing on the Moon: A 30th Anniversary** at http://kids.msfc.nasa.gov/news/1999/news-apollo11.asp to access pictures of astronauts, spacecraft, moon shots, etc. related to the Apollo 11 mission. The site also offers audio and video from mission control of the moon landing. Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to listen for one fact about the Apollo 11 mission that they can share with the class. Share the various components of the site as a read aloud. Allow students to share facts gleaned from the site as an oral review.

Step 12. Use the downloaded video segment, "Visiting the Moon," to summarize the mission of the Apollo astronauts. **CUE** to the beginning frame. Provide a **FOCUS FOR MEDIA INTERACTION** by asking students to listen for three things that Apollo astronauts accomplished on the missions to the moon. **PLAY** the entire clip (1:04). **STOP** to allow students to identify the three mission accomplishments. Tell students that each Apollo mission crew had it's own mission patch. Share the Apollo 11 mission patch found at http://kids.msfc.nasa.gov/news/1999/news-apollo11.asp. As a **FOCUS FOR MEDIA INTERACTION,** ask students to identify what animal is portrayed on the patch. Discuss the significance of the "eagle." Allow students to create their own "Moon Mission" patch detailing some of the things they have learned in their study of the moon.

CULMINATING ACTIVITY

Step 1. View the **Saturn V Animation** site available at http://kids.msfc.nasa.gov/rockets/apollo%2D11/animation.asp. Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking them to watch to see what happens as the Saturn V rocket travels to the moon." Have students describe the stages of the lunar landing in their own words.

Step 2. As a class review, complete the "Moon Puzzle" at **Zoom Astronomy Activities** located at

http://www.enchantedlearning.com/subjects/astronomy/activities/radiobuttonquiz/Moonpz.shtml As a **FOCUS FOR MEDIA INTERACTION,** direct students to click on the answers to the review questions to complete the moon puzzle. (This activity may be completed in a large group for younger students.)

Step 3. Build and launch Alka Rockets as described within **Lunar Prospector: Alka Rockets** (teacher resource page) located at http://lunar.arc.nasa.gov/education/activities/active4a.htm. (**Teacher Note:** Teacher will download instructions, in advance, for students.)
Invite other classes at school to view the launch.

CROSS-CURRICULAR EXTENSIONS

Art
Provide round and crescent sponge cutouts to make moon prints with white paint on dark blue paper.

Scientific developments may one day make it possible to colonize the moon. Provide assorted items, such as paper cups, cardboard, aluminum pie tins, plastic sheeting, markers, and glue, for students to use in creating an enclosed lunar village.

Geography
Assist students in pinpointing the landings of other Apollo missions on the moon. Learn the names of the landing sites.

History
Listen to tape recordings of President Kennedy's speech documenting the beginning of the "race to the moon."

Language Arts
Guide students in completing descriptive word poems about the moon. Brainstorm a list of adjectives describing the moon; students may use these to complete their poems.

Give students the opportunity to create journal entries for Neil Armstrong, Buzz Aldrin, or Michael Collins during the Apollo 11 mission. Answer these questions: How did it feel to take those first steps on the moon? How did it feel to be in the Colombia spaceship all alone?

Math
Choose a favorite sugar cookie recipe to create "Moon Cakes." Guide students in using measurement skills to mix dough. After rolling the dough, use round and crescent shaped cookie cutters to represent the moon's phases. Students may even add "thumbprint" craters.

Students may use what they have learned about weight and gravity on the moon to compile a list of objects they could lift on the moon that they could not lift on earth. For example, a 100 lb. barbell would feel like 16 lbs. on the moon.

Music
Provide musical selections as background for student trios to model the moon's orbit around the earth and the earth's orbit around the sun.

Science
Provide the opportunity for students to grow plants from seeds that traveled to the moon. Seeds may be ordered online by the teacher at **In Search of Moon Trees** at http://kids.msfc.nasa.gov/news/2002/news%2Dmoontrees.asp.

COMMUNITY CONNECTIONS

Visit a local planetarium to view a program on the moon.

Schedule a "Moon Watching" night at school. Present readings of "moon" poetry and stories and performances of "moon" music. Provide telescopes for moon viewing. Serve *Moon Pies* and milk as a bedtime snack before adjourning.

STUDENT MATERIALS

Rock Inquiry Sheet (Teacher created – see below)

Sketch of Sample			Observations:
Shape			
Size			
Color			
Texture			
Name _____ ____			Rock Sample # _____