Welcome Teachers and Administrators!

With great excitement, we present this year's All Pikes Peak Reads curriculum! There have been many changes in the lesson structure this year. Primarily, we have simplified the lessons, with three over-riding goals:

1. To provide teachers with lessons that are manageable with regard to both time and materials;
2. To create lessons that are relevant to the Colorado State Standards; and
3. To create lessons that engage students in the Space subject overall and with the chosen books in particular.

If you catch yourself wishing for more material, you will find it on the PPLD website (www.ppld.org/appr). At this site, you can get a calendar of all of the APPR events that run from September 20-October 30, including information about visits from David Silver of the Heinlein Society and Homer Hickam, author of *Rocket Boys*. You will also find links to sites that give more information about the authors and the books chosen for APPR this year (www.heinleinsociety.org www.homerhickam.com).

Also at the PPLD website, you can download any and all APPR lessons. In other words, if you are teaching at the 6-8 level and need to differentiate for a struggling student, you can go right to the 3-5 level. If you need to differentiate for an advanced student, check out the 9-12 work. (In fact, all APPR lessons are free and available to the public.)

Another exciting feature of this year's curriculum is that the K-5 lessons are designed to allow for an **all-school read!** (A hearty thank-you goes to APPR writer Kelly Moeller for this awesome idea!) The K-2 lessons align very nicely with those written for the 3-5 students. We hope that this structure allows for a community experience with such things as book discussion groups, shared activities, science fairs, and school-wide displays of student work.

Writing standards-based lessons that are engaging for students throughout the Pikes Peak region is no easy task! You may find spots where we miss the mark, but we truly hope that the new lesson format will serve you and your students. Feel free to send feedback directly to those of us involved in the writing and editing of the work (see info below), or send your feedback to PPLD.

Best of luck in Space this year!
Cheri Colburn

Lesson Structure

Where possible, the lessons are arranged so that the first page contains the standards, the lesson overview, and the lesson objectives—a fairly comprehensive preview of the lesson. Here is a description of each of those elements:

State standards

Every lesson begins with Colorado State standards for the targeted subject areas (either ELA and Social Studies or Math and Science). Next comes Art or Music standard and the Writing standard that the lesson addresses. The art and music information is provided to appeal to all types of learners; the writing information is provided to allow for writing-across-the-curriculum opportunities. Along with the standards, benchmarks are identified. You may notice that for better fit on the page, we often removed "for example" statements from the standards/benchmarks.

Lesson Overview

This section provides a brief summary of the lesson. The overview is step-by-step, but it is very general.

Learning Objectives

This section articulates the connection between the lesson activities and the standards being addressed.

The Lesson: Before, During, and After

Lessons are divided into three sections. The **Before** section provides information about the APPR books. (For example: "Students read (or listen to) pages 1-30 in the nonfiction book *Space*.") This section also introduces any vocabulary that may prove problematic. (Vocabulary is not leveled with regard to literacy/grade levels but is instead focused on comprehension.) Finally, the Before section identifies materials that should be on hand and teacher prep work that will need to be completed prior to beginning the lesson.

The **During** section provides a step-by-step breakdown of the activity. Some teacher scripting and expected student responses are included. These features are designed to be pragmatic. We have included them where we thought they might be useful, but you won't find them at every step in every activity. (Teacher scripting is printed in italics to distinguish it from the rest of the lesson.)

The **After** section usually provides some kind of whole-group activity designed to help summarize and deepen the learning and to allow for sharing of student products.

Differentiation

This section suggests simple ways that the lesson can be differentiated for advanced students and for struggling students.

ELL Feature

Here we note how the lesson already addresses the learning needs of English Language Learners or how it can be differentiated for ELLs.

Other Space Titles
The hope here is that students will want to investigate the subject of Space more deeply. If they do, they can find other space titles that should be manageable for students at the lesson level. Notes are provided that describe the suggested books.

Space Websites
Again, we are hoping students will want to delve deeper. These websites provide more Space content. A description of the website is provided.

Notes from the Writing Team

Dee Vazquez: APPR Co-Chair
Each year as we look at the wealth of information we can use to build projects and study modules for our program, we encounter wonderful people who wish to contribute and fantastic resources that we can include. It is our wish that you would find exactly what you need to become involved in the Read: in the classroom, in your home, or in your community group. Please take a moment and share your thoughts or your experiences with us. You will find a form on the All Pikes Peak Reads web page or email us directly at appr@ppld.org.

Cheri Colburn: Managing Editor
I have worked for several years in the educational publishing industry, and during that time, I've worn many hats—copy editor, content editor, writer, and managing editor. With the APPR project, I have worn each of these hats at different times. It has been a pleasure to work with the fine people involved in this project and to help to develop the new lesson structure for APPR. I truly hope the new approach will allow for region-wide participation in All Pikes Peak Reads. I'd love to hear from you! Please send comments, questions, and suggestions for next year to: colburnwordsmithing@hotmail.com

Kelly Moeller: Math and Science
"What I did on my summer vacation" has taken on a whole new meaning this year! As an 11-year veteran of science teaching at Timberview Middle School in Academy District 20, I have learned a lot about the writing side of curriculum development. I hope you find the math/science lessons easy to use, with very few alterations necessary. Please drop me a line, kelly.moeller@asd20.org, to let me know much your kids enjoyed the activities. I am excited to attend the special events planned for All Pikes Peak Reads!

Travis Duncan: ELA and Social Studies
The first building I ever walked into in Colorado Springs was the East Library, right after the kick-off of the first All Pikes Peak Reads. *To Kill a Mockingbird* displays and information about APPR were everywhere. Attending book discussion groups and other APPR-related programs was great way to meet people in town. Now, seven years later, I consider it a real privilege to have been involved in shaping the curriculum guide for this year's APPR. I'd love to hear your comments and questions. E-mail me at travisduncan23@gmail.com. (Travis wrote in alongside and with the assistance of his wife, Frances Gomez, who is currently enrolled at the University of Colorado, Colorado Springs in the school counseling program. She has studied comprehensive curriculum instruction, and her contributions were essential to the quality lessons that Travis produced. You can contact Frances Gomeztangle at: fgomeztagle@gmail.com.)

3-5 APPR Curriculum

ELA and History

Lesson 1: Imagine Yourself as an Astronomer
ELA Standard 1: Students read and understand a variety of materials.
History Standard 1: Students understand the chronological organization of history and know how to organize events and people into major eras to identify and explain historical relationships.
1.3 Students use chronology to examine and explain historical relationships
Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Art Standard 1: Students recognize and use the visual arts as a form of communication.

Lesson 2: Plant Your Flag on the moon
ELA Standard 2: Students write and speak for a variety of purposes and audiences.
History Standard 3: Students understand that societies are diverse and have changed over time.
3.2 Students understand the history of social organization in various societies.
Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Art Standard 1: Students recognize and use the visual arts as a form of communication.

Lesson 3: Inventing the Future
ELA Standard 4: Students apply thinking skills to their reading, writing, speaking, listening and viewing.
History Standard 4: Students understand how science, technology, and economic activity have developed, changed, and affected societies throughout history. 4.1 Students understand the impact of scientific and technological developments on individuals and societies.
Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Art Standard 1: Students recognize and use the visual arts as a form of communication.

Math and Science

Lesson 1: Moon Buggy Model Construction and Presentation
Math Standard 4: Students use geometric concepts, properties and relationships in problem-solving situations and communicate the reasoning used in solving these problems.
Science standard 5: Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.
Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Art Standard: Students know and apply visual arts materials, tools, techniques, and processes.

Lesson 2: Impact Craters
Math Standard 1: Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.
Science Standard 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)*
Writing Standard 4: Students apply thinking skills to their reading, writing, speaking, listening, and viewing.
Art Standard 1: Students recognize and use the visual arts as a form of communication.

Lesson 3: Film Canister Rockets
Math Standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
Science Standard 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.

Art Standard: Students know and apply visual arts materials, tools, techniques, and processes.

All Pikes Peak Reads
3-5 ELA and History
Lesson 1: Imagine Yourself as an Astronomer

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

ELA Standard
Standard 1: Students read and understand a variety of materials.
Benchmark
- Using text to self strategies, materials such as directions, nonfiction material, rhymes and poems, and stories.

History Standard
Standard 1: Students understand the chronological organization of history and know how to organize events and people into major eras to identify and explain historical relationships.
1.3 Students use chronology to examine and explain historical relationships
Benchmark
- Identifying cause-and-effect relationships in a sequence of events.

Writing Standard
Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmark
- generating topics and developing ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation)

Art Standard
Standard 1: Students recognize and use the visual arts as a form of communication.
Benchmarks
- Identifying visual images, themes, and ideas for works of art;
- Selecting and using visual images, themes, and ideas to communicate meaning; and
- Comparing the use of visual images and ideas.

Lesson Overview
1. With teacher assistance, students construct a timeline representing their lives.
2. With teacher assistance, students construct a timeline that shows the scientific discoveries outlined in *Space (*pages 13 – 21).
3. Students work in groups of four to illustrate the major milestones from the scientific timeline and include captions that identify important discoveries.
4. Working alone, students write a short essay of approximately 5 to 10 sentences that describes the timeline of the scientific discoveries outlined in *Space*.
5. Selected students read their work to the class.

Learning Objectives
1. use text to self strategies to understand the reading
2. understand how historical scientists have shaped our knowledge of the world

3. summarize the lesson by writing a short essay demonstrating knowledge of chronology and identifying cause-and-effect relationships.

Before

1. Students read pages 13-21 in the book *Space*.
2. Students read pages 1-17 of *Midnight on the Moon,*
3. Students review the concept of timelines.
4. **Preview vocabulary:**
   From *Space*
   astronomy (p. 14): the science that deals with the material universe beyond the earth's atmosphere.
   astronomer (p. 14-21): an expert in astronomy; a scientific observer of the celestial bodies.
   telescope: an optical instrument for making distant objects appear larger and therefore nearer.
   gravity (p. 20): the force of attraction by which terrestrial bodies tend to fall toward the center of the earth.
   From *Midnight on the Moon*
   satellite (p. 12): a natural body that revolves around a planet.
5. **Gather materials:**
   White board and markers or
   Chart paper
   Paper or learning log for student writing

During

The First Timeline: Self-to-Text

1. Review how a timeline works. Say: *Today we are going to build a graphic organizer called a timeline that lets us see things in the order that they happened.*
2. Review chronological order. Say: *When things are in order from the first thing that happened to the last, we say they are in chronological order.*
3. Divide the students into groups of 4 and give students each a number (1-4).
4. Place the 4 scientists on a timeline on the board, noting their discoveries (as follows).

- ***Ptolemy***
  - *What did Ptolemy believe?* (Earth was at the center of everything.)
  - *What might be a good picture you could draw to represent Ptolemy?*
- **Copernicus**
  - *What did Copernicus discover?* (Earth and other planets travel around the sun.)
  - *What might be a good picture you could draw to represent Copernicus?*
- **Galileo** 1564 – 1642
  - *What did Galileo use to look at the night sky?* (Telescope)
  - *What were telescopes used for before Galileo?* (Seeing people in war.)
  - *What did Galileo believe that was different from astronomers who came before? (G*alileo thought the Earth was not the center of everything.)
  - *What might be a good picture you could draw to represent Galileo?*
- ***Sir Isaac Newton***: 1643 – 1727

- What did Newton discover? (The law of gravity, the invisible force that kept the moon traveling around the Earth and the planets traveling around the sun.)
- *What can you draw to represent Newton?*

The Big Mistake: *What was the "big mistake" these astronomers made?* (They thought that everything in space traveled around the sun.)

5. Have students write a short **essay**:
   Students take out a pencil and sheet of paper or their learning logs. Say: *Now each of you is going to write an essay that talks about how one of the astronomer's helped to cause the next astronomer's ideas. You will write two sentences about the first astronomer that you choose: Ptolemy, Copernicus, or Galileo.* (Students cannot use Newton because this lesson does not discuss the astronomers that came after him.) *First tell what that astronomer believed or discovered. Then write about how that belief or discovery affected the next astronomer on the timeline. Then write about the next astronomer and what he believed. Last, you should write a sentence about the "big mistake" that all of these astronomers made. You can refer to the timelines we made in class for help.*

After

Have one student representing each astronomer read their essay to the class. Discuss as a group.

Differentiation

More advanced students can write a separate essay that demonstrates knowledge of chronology and cause-and-effect relationships in their own lives. Struggling students can work on their essay in groups or with help from the teacher.

ELL Feature

Provide positive feedback by repeating what students say, using grammatically correct structures without explicitly pointing out student errors.

Other Space Titles

Starry Messenger: Galileo Galilei
Peter Sis
Publisher: Farrar, Straus and Giroux
ISBN-13: 9780374470272
This highly-acclaimed 40-page book is suitable for children age 6 to 9. In Galileo's own words, and with beautiful illustrations, this story demonstrates the astronomer's prescience in simple language.

Nicolaus Copernicus: The Earth is a Planet
Dennis Brindell Fradin, Cynthia Von Buhler (Illustrator)
Publisher: Mondo Publishing
ISBN-13: 9781593360061
This 32-page book is suitable for children age 7 to 12. The story helps students understand the importance of Copernicus's assertion that Earth was not the center of the universe and how that would influence Galileo and Newton later.

Space Websites

http://inventors.about.com/od/gstartinventors/a/Galileo_Galilei.htm
Summary: About.com has a very informative and easy to understand biography of Galileo.

http://www.astronomy-for-kids-online.com/famous-astronomer.html
Summary: This is a good spot to find a little information on a lot of famous astronomers.

All Pikes Peak Reads
3-5 ELA and History
Lesson 2: Plant Your Flag on the Moon

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

ELA Standard
Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmarks
- Generating topics and developing ideas for a variety of writing and speaking purposes
- Organizing their speaking and writing;
- Choosing vocabulary that communicates their messages clearly and precisely;
- Revising and editing speech and writing

History Standard
Standard 3: Students understand that societies are diverse and have changed over time.
3.2 Students understand the history of social organization in various societies.
Benchmarks
- Identifying reasons for living in social groups
- Describing important components of the cultural heritage of the United States; and
- Recognizing that there are families and cultures around the world.

Writing Standard
Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmark
- generating topics and developing ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation)

Art Standard
Standard 1: Students recognize and use the visual arts as a form of communication.
Benchmarks
- Identifying visual images, themes, and ideas for works of art;
- Selecting and using visual images, themes, and ideas to communicate meaning; and
- Comparing the use of visual images and ideas.

Lesson Overview
6. Students generate topics and develop ideas about what they believe are important and good ways to behave in their family, in their country, and on planet Earth. (Sharing, working together, good manners, not stealing, etc.)
7. Students identify reasons for living in families, in countries, and social groups in general.
8. Students work in groups of four to organize and edit the lists of things they do that we call “good ways to behave” in families, our country, and social groups, then create a legible handwritten or typed placard to accompany their four flags.
9. Students write letters to leave on the moon that describe the good ways that we act on Earth.
10. Students present their work to the class.

Learning Objectives
4. use text-to-world strategies to comprehend the reading and develop ideas
5. identify reasons for living in social groups
6. work in groups to understand there are differences between families and cultures

Before

6. Students read (or listen to) pages 87-95 in the book *Space*.
7. Students read (or listen to) pages 18-39 of *Midnight on the Moon,*
8. Students watch short video of astronauts placing the American flag on the moon at: http://www.youtube.com/watch?v=RMINSD7MmT4

9. **Preview vocabulary:**
   From *Space*
   probe (p. 88): an unmanned spacecraft designed to explore the solar system and transmit data back to earth.
   module (p. 92): any of the individual, self-contained segments of a spacecraft, designed to perform a particular task: *the spacecraft's command module; a lunar module.*
   From *Midnight on the Moon*
   spacesuit (p. 19): a sealed and pressurized suit designed to allow the wearer to leave a pressurized cabin in outer space or at extremely high altitudes within the atmosphere.

10. **Gather materials:**
    Pencils, crayons, markers
    Construction paper
    Paper for students to write on

During

Social groups: Self-to-World

1. Have students break into groups of 4. Say: *Remember how the first astronauts as well as Jack and Annie both left signs that said they came in peace? Why do you think they did that? What message did they want to convey to anyone from outer space that saw it?*
2. *Today we are going to make our own sign that shows others where we come from and that tell something about the good ways that we work and live together.*
3. *In your group, discuss one rule of good behavior in your family. Write at least one sentence on your own sheet describing this rule.*
4. *Now that your group has written what you think is a good behavior in your family, discuss what ways of behaving we think are good in our country. Write at least one answer on your own sheet.*
5. *Now that your group has written about what behaviors we think are good in our country, discuss and write down what behaviors we think are good as a planet. What are some behaviors that we think are good that people in other countries also probably think are good? What is important for aliens to know about us?*
6. *Each of you is going to write a letter to leave on the moon for future space explorers to read.* (Remind students to use letter structure and explain what that means at the level of detail you see fit.) *Begin your letter with the answer you wrote down for what you like to do best with your family. Then write one or two sentences that talk about why you think that's an important activity. Do the same with the good behaviors you listed for the United States and for planet Earth.*

After

1. Have the students read their letters aloud to the class and talk about what behaviors they value about being in a family, being an American, and being an Earthling. Point out similarities and differences between the letters.
2. As time allows, have the group in front of the class answer questions about why they chose the "good behaviors" they did. Ask if they think children from another state might have chosen different values for family. Or from another country. Or from another planet.
3. Have students put their letters into a box to "send to the moon." If your school is putting together a larger Space display, add this package.

Differentiation

Teachers can differentiate this lesson by having more advanced students write a letter from the perspective of aliens from another planet. How are the aliens the same as us? How are they different? Less advanced students can dictate their work instead of writing.

ELL Feature

Using small groups helps to ease the anxiety ELLs may experience when asked to produce English responses during whole-class instruction.

Other Space Titles

Moon Landing: Apollo 11 40th Anniversary Pop-Up
Richard Platt, David Hawcock (Designed by)
Publisher: Candlewick Press
ISBN-13: 9780763640460
Summary: This 10-page pop-up book is suitable for children from 8 to 12 years old. It includes two mini-books, multiple informational flaps and a good background on mankind's fascination with the moon, the space race, and the moon landing itself.

Mission Control, This Is Apollo: The Story of the First Voyages to the Moon
Andrew Chaikin, Alan Bean (Illustrator)
Publisher: Penguin Group (USA)
ISBN-13: 9780670011568
Summary: This 128-page book is suitable for children from 8 to 12 years old. The book describes the Apollo voyages and features the illustrations of Alan Bean, an astronaut who walked on the moon during the Apollo 12 mission and devoted his life to painting the world he witnessed there. For more information on Alan Bean, see: http://www.nytimes.com/2009/06/25/us/25astronaut.html

Space Websites

http://www.nixonlibrary.gov/forkids/speechesforkids/moonlanding.php
This site poses some interesting questions about whether the United States should have used its flag, a United Nations flag, or any flag at all. The site provides good background information for teachers using this lesson.

http://video.google.com/videoplay?docid=1416393771637021814
This video is a great overview of the first moon landing suitable for children to view.

All Pikes Peak Reads
3-5 ELA and History
Lesson 3: Inventing the Future

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

ELA Standard
Standard 4: Students apply thinking skills to their reading, writing, speaking, listening and viewing.
Benchmarks
- Predicting and drawing conclusions about stories
- Differentiating between fact and opinion in written and spoken forms
- Responding to written and oral presentations as a reader, listener, and articulate speaker
- Formulating questions about what they read, write, hear, and view; and
- Using listening skills to understand directions

History Standard
Standard 4: Students understand how science, technology, and economic activity have developed, changed, and affected societies throughout history.
4.1 Students understand the impact of scientific and technological developments on individuals and societies.
Benchmarks
- Describing the impact of various technological developments on the local community and the state (for example, irrigation, transportation, communication)
- Identifying individual achievements of scientists and inventors from many cultures and describing their achievements

Writing Standard
Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmark
- generating topics and developing ideas for a variety of writing and speaking purposes

Art Standard
Standard 1: Students recognize and use the visual arts as a form of communication.
Benchmarks:
- Identifying visual images, themes, and ideas for works of art;
- Selecting and using visual images, themes, and ideas to communicate meaning; and
- Comparing the use of visual images and ideas.

Lesson Overview
11. With teacher assistance, students discuss how the technological achievement of launching the first satellite into space by the Russians impacted the United States.
12. With teacher assistance, students identify the major achievements of Russians and Americans in the “space race.”
13. Students work in groups of four to create an invention that will aid future astronauts.
14. Students present their work to the class.

Learning Objectives
7. use text-to-world strategies to recognize the author’s point of view
8. identify the first satellite sent into space, the first person to travel in space and the first person to walk on the moon
9. work in groups to create an invention that will aid future astronauts

Before

11. Students read pages 77-97 in the book *Space*.
12. Students read pages 1-24 of *Midnight on the Moon,*

13. **Preview vocabulary and historical figures:**

From *Space*
Sputnik (p. 80): the first man-made satellite, launched October 4, 1957.
Astronauts (p. 81): a person engaged in or trained for spaceflight. From text: American term which means "travelers to the stars."
Cosmonaut (p. 81): A Russian or Soviet astronaut. From text: Soviet term which means "travelers to the cosmos" or "universe."
Yuri Gagarin (p. 82): 1934–68, Russian astronaut: first human being to make an orbital space flight (1961).
probe (p. 88): an unmanned spacecraft designed to explore the solar system and transmit data back to earth.
Neil Armstrong (p. 93): born 1930, U.S. astronaut: first person to walk on the moon, July 20, 1969.

14. **Gather materials:**

Pencils, crayons, markers
Construction paper
Paper for students to write on

During

Social groups: Self-to-World (Discussion questions)

7. *Who remembers what the space race was? (*A race between the United States and the Soviet Union to explore outer space.)
8. *What started it*? (The Russians with the launch of the first satellite on October 4, 1957. It was called "Sputnik*.")*
9. *Who was the first person in space?* (Cosmonaut Yuri Gagarin, April 12, 1961)
10. *How did these achievements affect the United States?* (pg. 81: President John F. Kennedy said America was losing the space race and challenged Americans to put a man on the moon before the end of the 1960s.)
11. *Who was the first person to walk on the moon?* (Astronaut Neil Armstrong, July 20, 1969)
12. *Neil Armstrong gets credit for being the first person to set foot on the moon, but there were many other people back on Earth who made that achievement possible. Who can name some of them?*
13. *It's been estimated that it took around 400,000 people to make Armstrong's first step on the moon possible. Work with your group to invent something that will aid future space travelers.*
14. Have students draw a picture of their invention and write a few sentences about what it does.
15. Have the students show their drawings to the class and talk about how their invention will aid future space travelers.

After

Lead a class discussion about whether this invention should be shared with the world or should be kept only for the United States. Ask students to explain their opinions and why they are opinions, not facts.

Differentiation

Teachers can differentiate this lesson by having more advanced students debate the advantages and disadvantages of one country owning their invention. Less advanced students can draw their invention and write just a caption.

ELL Feature

Validate ELL's experiences by encouraging them to share songs or words or ideas from their native cultures that relate to the Space content.

Other Space Titles

T-Minus: The Race to the Moon
Jim Ottaviani, Zander Cannon (Illustrator), Kevin Cannon (Illustrator)
Publisher: Simon & Schuster Children's Publishing
ISBN-13: 9781416949602

This 128-page graphic novel is suitable for children age 8 to 12. It tells the story of America's come-from-behind victory in the space race.
This book was recently reviewed in The New York Times Sunday Book Review:
http://www.nytimes.com/2009/07/12/books/review/Shafer-t.html?_r=1&ref=books

Team Moon: How 400,000 People Landed Apollo 11 on the Moon
By Catherine Thimmesh
Publisher: Houghton Mifflin Books for Children
ISBN-13: 978-0618507573

This 80-page book gives great background information on those who worked behind the scenes to make the first moon landing possible.

Space Websites

http://www.fi.edu/pieces/hiley/history.htm
Summary: A kid-friendly site that provides lots of information about the history of the space suit.

http://www.youtube.com/watch?v=SmC2v4G5zq0
A fun video of life aboard a space station that may get students' minds churning on what is fun and challenging about living and working in space.

All Pikes Peak Reads

3-5 Math and Science

Lesson 1: Moon Buggy Model Construction and Presentation

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

Math Standard
Standard 4: Students use geometric concepts, properties and relationships in problem-solving situations and communicate the reasoning used in solving these problems.
Benchmarks

- 1. recognize shapes and their relationships (for example, symmetry, congruence) using a variety of materials (for example, pasta, boxes, pattern blocks);
- 2. identify, describe, draw, compare, classify, and build physical models of geometric figures;

Science Standard
Standard 5: Students understand that the nature of science involves a particular way of building knowledge and making meaning of the natural world.
Benchmark

- 2. models are used to represent events and objects (for example: comparing a map of he school to the actual school; a model of he Earth to the Earth itself)

Writing Standard
Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmark

- 1. generating topics and developing ideas for a variety of writing and speaking purposes

Art Standard
Standard : Students know and apply visual arts materials, tools, techniques, and processes.
Benchmark

- 1. identifying and describing different materials, tools, techniques, and processes
- 2. using materials, tools, techniques, and processes to make works of art.

Lesson Overview

1. Students identify and create geometric shapes as they build a moon buggy.
2. Following construction of their buggies, students use their senses to make observations and record their data.

Learning Objectives

1. use a model to represent a moon buggy
2. identify and describe the geometric figures found in the moon buggy
3. write sentences describing and explaining their buggies

Before

1. Students read the first five chapters of *Midnight on the Moon*.
2. Students review page 96 from the nonfiction book, *Space.* This page has information and a drawing of a moon buggy. Show the students the picture, and discuss the various parts of the moon buggy, their shape, and their use.
3. Allow students to review the video of the Apollo 15 lunar mission. The astronaut in this video makes large 'rooster tails' by spraying moon dirt as he drives.
4. **Preview vocabulary:**
   model (with *prototype* as a synonym): a small representation of an actual vehicle or building. If possible, bring an actual model to the classroom. Point out the ways that it has small parts that represent the parts of the actual, life-size vehicle. Say: *Engineers use models/prototypes of objects before they build the actual object.*
5. **Gather materials:**
   Student science logs
   Boxes of different sizes
   Pipe cleaners and popsicle sticks
   Construction paper
   Straws
   Tape and glue/glue-sticks
   Aluminum foil
   Plastic bottles

During

1. Students draw a plan for their moon-buggies, making sure to include geometric shapes. (Require particular shapes at your discretion.)
2. Have students look at their completed drawings. Say: *"What are some of the different shapes in your drawing?"* Call on different students to share their shapes.
3. Show students the different materials they can use for construction. Say: *"Look at this cereal box. What shape is it? Are there any shapes like that in your drawing? Look at this plastic water bottle. What shape is it? Are there any shapes like that in your drawing? Look at this pipe cleaner. What shapes can you make out of it?"*
4. Students use classroom materials to construct a moon buggy.

After

1. Students use their senses to write sentences that describe the materials and shapes that make up their moon buggy. Say: *Take out your notebooks and describe your moon buggy. Be sure to include the shapes that you find—rectangles, circles, squares.* ("We used a cereal box for the body because it is a rectangle." Or "We used pipe cleaners because they are bendy and strong.")
2. Students present their completed moon buggy models to the class. Assign each student in the group a shape to discuss. For example, one student can point out all the circles, "The *wheels on our moon buggy are circles, the satellite receiver is a circle.*"

Differentiation

Advanced students can be asked to find more advanced geometric shapes, such as a rhombus, or a hexagon. Struggling students can be asked to find at least one of each kind of shape.

ELL Feature

The use of manipulatives is an ELL strategy—students internalize the name of shapes more fully when they have the shapes in their hands.

Other Space Titles

Captain Fact's Space Adventure (Captain Fact Series #1) by Packer Knife
ISBN-13: 9780786855117
Publisher: Hyperion Books for Children
Captain Fact and his dog Knowledge are on an adventure! The author cleverly weaves facts as the duo travel from outer space to the Egyptian desert.

Team Moon: How 400,000 People Landed Apollo 11 on the Moon by Catherine Thimmesh
ISBN-13: 9780618507573
Publisher: Houghton Mifflin Harcourt
A behind the scenes look at all the people that made the lunar landing possible. This book includes first person accounts from the seamstresses that sewed the space suits to NASA computer programmers.

Space Websites

Astronomy Picture of the Day: A professional astronomer explains a different space picture each day. The description often provides links for more information on the terminology used.
http://antwrp.gsfc.nasa.gov/apod/astropix.html

All Pikes Peak Reads
3-5 Math and Science
Lesson 2: Impact Craters

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

Math Standard
Standard 1: Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.
Benchmarks
- demonstrate meanings for whole numbers, and commonly-used fractions and decimals (for example: 1/3, 3/4, 0.5, 0.75), and represent equivalent forms of the same number through the use of physical models, drawings, calculators, and computers
- use numbers to count, to measure, to label and to indicate location

Science Standard
Standard 4: Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. *(Focus: Geology, Meteorology, Astronomy, Oceanography)*
Benchmarks
- 2. natural processes change Earth's surface *(for example: weathering, erosion, mountain building, volcanic activity, earthquakes and floods)*
- 7. there are basic components of the solar system *(for example: Sun, planets, moons)*

Writing Standard
Standard 4: Students apply thinking skills to their reading, writing, speaking, listening, and viewing.
Benchmarks
- differentiating between fact and opinion in written and spoken forms;
- using listening skills to understand directions.

Art Standard
Standard 1: Students recognize and use the visual arts as a form of communication.
Benchmark
- Selecting and using visual images, themes, and ideas to communicate meaning;

Lesson Overview
3. Students build a model of impact craters.
4. Students use whole numbers to measure the impact craters and their rays.
5. Students write a sentence stating a fact from the experiment and a sentence stating an opinion or a new question they have following the experiment.

Learning Objectives
4. model impact craters, a major feature of Earth's surface
5. use whole numbers to measure
6. write sentences describing their craters

Before

6. Students read (or listened to) the first chapter six of *Midnight on the Moon*. Say: *Remember when Jack and Annie were trapped by a meteorite that landed right in front of them?*
7. **Preview vocabulary:**
   impact crater: formed when pieces of asteroids or comets or a meteor hit the surface of a planetary body. Say: *On Earth many craters cannot be seen because they are under the ocean or because rain and wind wear them away over time. On the moon there aren't oceans or weather so the craters, like the astronauts footprints, stay there forever.*
   meteor: a meteor is a large rock travelling through space.
   meteorite: a meteor that has landed on a planetary surface—for example, the Earth or the moon. (See *Space* pages 51, 52, and 53 for more information and a picture.)
   ray: the lines that extend from the center of the impact craters. Draw a sunburst (but don't call it a sunburst) on the board and say: *Do you see these lines coming out from this circle? These are called 'rays'. Today when you make your crater you will measure the length of one of the rays*.
8. **Gather materials:**
   Student science logs
   Large trays or sturdy boxes – approximately 8-10 cm deep, 50 cm x 50 cm; 1 per group
   Dry Material: Baking soda or flour—enough to fill each pan to a depth of 3 centimeters
   Dry tempera paint—enough for a thin layer to cover the dry material (red and blue work best)
   Spheres made from different materials (steel, glass, wood, etc)
   Metric balance that masses to the nearest 0.1 grams
9. **Prepare the tray(s)**
   - Evenly place 3 cm of dry material in the bottom of the tray
   - Sprinkle a thin layer of powdered tempera paint over the dry material (just enough to cover the dry material); using a kitchen strainer to distribute the paint makes it easier to make a uniform layer (wear a dust mask over nose and mouth)
   - Place another *very thin* layer (2-3 mm) of dry material over the tempera paint
   - Optional: Sprinkle a thin layer of different colored tempera paint over the second layer of dry material and cover with a third, thin layer of dry material.

During

1. Say: *What happened when the meteor landed on the moon in front of Jack and Annie?* Student responses should include the cloud of dust and the ground trembling as described on pages 41 and 42.
2. In small groups students measure the masses of their different spheres. Students should record (dictate) these observations in their student science logs.
3. Place each tray on the floor and drop the different spheres from the same height onto the prepared tray. It may be easiest for students to kneel on a backwards facing chair and hold their arms out straight to achieve the same height each time.
4. Students make and record observations about the craters formed on the prepared tray (for example: the dry material goes up in a puffy cloud, the tempera paint can be seen around the marble, etc.). Students sketch and label an image of the created crater in their science logs to help them communicate the meaning of their observations.

5. Students measure the length of the ray produced by the sphere to the nearest decimal in centimeters, placing the zero mark at the center of the impact crater and following along the ruler to the end of the longest ray. Students record their measurements on a data table.

Sphere mass (g)	Distance (cm)

6. Students compare their observations and measurements to with those of their group members. (This can also be a whole-group discussion.)

After

The teacher leads a discussion of facts and opinions students supply orally after the experiment. The teacher writes a list of the facts and opinions where the class can see the list and discusses the differences as a whole group.

Differentiation

Higher level students can construct a bar graph of their results. Lower level students work with a teacher or a learning partner to line up their rulers and measure the ray produced by the impact crater.

ELL Feature

The use of manipulatives is an ELL strategy—students internalize the objectives when they physically measure the rays and sketch a picture of the using the terms.

Other Space Titles

Return of Meteor Boy (Extraordinary Adventures of an Ordinary Boy Series #2) by William Boniface
ISBN-13: 9780060774691
Publisher: HarperCollins Publishers
Ordinary Boy (OB) is struggling to fit in in the town of Superopolis, a city where everyone has a super power. He is in pursuit of figuring out what happened to Meteor Boy several years ago. For ages 8 to 12.

Comets and Meteor Showers by Dennis Brindell Fradin
ISBN-13: 9780516261669
Publisher: Children's Press (CT)
This book is from the True Books series first made popular in the 1950s. This updated text includes large, colorful pictures, links to pertinent websites and an extensive glossary.

Space Websites

The American Meteor Society provides the lay person with all they need to know to understand the basics of meteors. This site also has links to several other meteor websites.
http://www.amsmeteors.org/

All Pikes Peak Reads
3-5 Math and Science
Lesson 3: Film Canister Rockets

Texts: *Midnight on the Moon* by Mary Pope Osborne
Space by Will Osborne and Mary Pope Osborne

Math Standard
Standard 3: Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.
Benchmarks
- 2. display and use measures of central tendency, such as mean, median and mode, and measures of variability, such as range and quartiles;
- 4. formulate hypotheses, draw conclusions, and make convincing arguments based on data

Science Standard
Standard 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.
Benchmarks
- 1. design, plan and conduct a variety of simple investigations (for example: formulate a testable question, state a hypothesis, make systematic observations, develop and communicate logical conclusions based on evidence)
- 2. select and use appropriate tools and technology to gather and display (for example: graphs, charts, diagrams) quantitative and qualitative data related to an investigation (for example: length, volume, and mass measuring instruments, thermometers, watches, magnifiers, microscopes, calculators, and computers)

Writing Standard
Reading and Writing Standard 2: Students write and speak for a variety of purposes and audiences.
Benchmark
- 1. generating topics and developing ideas for a variety of writing and speaking purposes

Art Standard
Standard : Students know and apply visual arts materials, tools, techniques, and processes.
Benchmarks
- 1. identifying and describing different materials, tools, techniques, and processes
- 2. using materials, tools, techniques, and processes to make works of art.

Lesson Overview
6. Students conduct a simple experiment using a stopwatch to find out if the time it takes a film canister rocket to launch varies with water temperature.
7. Students will conduct four trials at each temperature and calculate the average for each temperature
8. Following the launch, students will communicate logical conclusions based on evidence.

Learning Objectives
7. conduct a simple experiment and make systematic observations
8. use a stopwatch to record time data
9. average the data from four trials
10. communicate logical conclusions

Before

10. Students read *Midnight on the Moon*. Say: *Jack and Annie had a magical tree house that they took to the moon. If people want to go to the moon today they would use a rocket to help them get there.*

11. Preview vocabulary:

rocket: an engine that moves forward when gasses are pushed out. Read (or have students read) pages 78 and 79 from *Space*. Show students an example of a balloon rocket as described on page 79. Show students pictures of rockets from pages 91 and 105 also from *Space*. Say: *Scientists use rockets to send things into space. Some rockets are used to launch satellites that we use for our cell phones and TV; some rockets are attached to a Space Shuttle that takes astronauts to the International Space Station*.

12. Gather materials:

Student science logs
Film canisters – translucent type where the lid snaps inside the canister
Stopwatches – one for each group; may be helpful to have a back-up timer in each group
Styrofoam plates – for launch pads
Large garbage bags – to put under launch pads for easy clean-up
Halved Antacid tablets – effervescent kind – 8 halves per group
Ice water – one easy to pour from container per group
Room Temperature Water – one easy to pour from container per group

13. Visual Art Activity (Optional) Create a Mission Patch

Mission patches can be viewed at www.nasa.gov; in the search box for that website, use 'mission patch'. The Apollo 11 and the Challenger patches can be found there. Common components of a mission patch include:

- an image that can summarize the mission (a school mascot may be appropriate here)
- names of the astronauts (use last names of students in the group)
- an image of the travel vehicle (child's rendition of a rocket)

During

1. Say: *Today we are going to make and launch rockets! We will make our rockets out of these film canisters using water and antacid tablets for our rocket fuel. We are going to use water that is ice cold and water that is room temperature and find out which temperature of water makes the rocket launch faster.*
2. Place a halved antacid tablet into a clear cup of water to show students how it bubbles. Say: *When the antacid makes bubbles inside the film canister there will be so much pressure inside that the canister will explode away from the lid and shoot up into the air!*
3. Say: *Do you think the temperature of the water will change the amount of time it takes the rocket to launch? Why or why not? If you think the temperature will make a difference on the launch time, predict which one will take less time to launch.*
4. Say: *It is very important to follow directions today so that we all remain safe. Please listen and watch carefully*. Go over the following directions with the students; show them exactly what they will do during the experiment.
    a. Show students how to snap the lid into the canister so that they have a tight fit. Have students practice snapping the lid into the canister.
    b. Tell students that they will place the canister on the ground to launch it; and, it is important that the lid is down, toward the ground, or, what we would consider upside down
    c. Show students that they will fill the canister about 1/3 full with water

d. Explain that they will then place one of the halved antacid tablets in the canister, snap the lid on very quickly and place it upside down on the launch plate (Styrofoam plate)
e. The students should move about 2 meters away from the launch pads to watch the launch (it takes about 10 seconds, but they should move away quickly)
f. The time keeper(s) in the group will need to start the stopwatch as soon as the lid is snapped on tight and the rocket is placed upside down on the launch pad.
g. The time keeper(s) will stop timing when the rocket leaves the launch pad
h. Students should record the launch time in seconds on the data table.

Trial	Time (seconds) Ice water	Time (seconds) Room temp. water
Trial 1		
Trial 2		
Trial 3		
Trial 4		
Average		

After

1. Students will draw logical conclusions and make convincing argument based on evidence regarding how the temperature of the water affected the launch time.
2. Students will communicate their conclusions in written form using evidence from their investigation to justify their position.

Differentiation

Advanced students can construct a bar graph of the average data collected for the two different temperatures. Struggling students can choose one of the water temperatures to average, working with a learning partner as necessary.

ELL Feature

If necessary, allow ELLs to dictate their responses, encouraging them to expand their vocabulary as they do so.

Other Space Titles

The Firebird Rocket (Hardy Boys Mystery Stories Series #57) by Franklin W. Dixon
ISBN-13: 9780448089577
Publisher: Penguin Group
Will the Hardy Boys find the missing rocket scientist in time to save the launch of the Firebird Rocket? This mystery geared toward 8-12 year olds is a classic novel for the Rocket enthusiast.

The Usborne Book of Space Facts (Records, Lists, Facts, Comparisons) by Richard Maurer
ISBN-13: 9780590225120
Publisher: Scholastic, Inc.
A seemingly endless book of well known and little known facts that will captivate kids of ages curious about the final frontier.

Space Websites

Space Rocket Guide: Students and teachers will be able to learn about rockets from different countries and times in history. This website links to several other space websites including histories of many aspects of space exploration and links to military space and space businesses.
http://www.aerospaceguide.net/spacerocket/index.html