Mathematical Mysteries of Space

Miesha Brayboy Gadsden

Overview

In teaching the Solar System to my 3rd grade students, several inquisitive questions always come up from their discussions. "How long would it take us to get to Mars? How far is the sun from us? Will the planets ever bump in to each other? Will the sun last forever or will it burn out?"

I love hearing their questions and possible reasoning for answers. Their curiosity propels my curiosity as well and I often wonder how we can come closer to their answers on a level they can understand. I want to create a unit that will boost their natural curiosity about space and see how other disciplines in learning can be integrated, particularly math.

This unit will explore the mysteries of our Solar System through mathematics. Students will begin to see that math is all around them and that their own scientific minds use math everyday. This unit will cover mathematical concepts such as Numbers and Operations as well as Data Collections/ Problem Solving.

This unit will use goals and objectives from National Council of Teachers in Mathematics (NCTM). This council is a national organization that is known for producing higher standards for students by creating criteria that students should meet by the time they reach high school. This unit will address 2 of the main standards including Numbers and Operations and Problem Solving. Students in grades 3-5 should be able to *understand the place-value structure of the base-ten number system and be able to represent and compare whole numbers and decimals* (NCTM).

After reflecting on student achievement and discussions with fellow colleagues, I began to realize students were lacking a strong sense of place value. Therefore I want to embed lessons that target place value skills and allow students to solve problems in a variety of ways. Following several workshops and in-services for Investigations Math, I discovered the natural strong correlation between math and science concepts. No longer were students just asked to solve 2 + 2 or 15-7, but there were asked to find WHY. When students are asked to explain **how** they got their answer instead of just **what** is their answer, their minds evolve to a more complex level. This same line of questioning is similar to what scientists use to explain theories or laws. I want students to continue their use of WHY to explain real life problems and see the exciting connections between math and science.

Demographics

Lansdowne Elementary School is a suburban school serving students K-5. The school is located in the heart of a historic neighborhood as part of the Charlotte-Mecklenburg School System. The school has a diverse population of 565 students. Within our subgroups we have our student background is 30% African American, 48% White, 12% Hispanic, 7% Multi-Racial, and 3% Asian. Our school received its hallmark distinction as being an International Baccalaureate School in 2008. Our school serves students with physical, emotional and mental special needs as part of our Inclusion program. Students also have opportunities for enrichment through our Talent and Development Program, English as a Second Language Program, Girls on the Run, Student Government, and Chess Club. This school has been an integral part of our community and school system for 50 years.

I am a 3rd grade teacher at Lansdowne and have also taught Kindergarten at Lansdowne. I teach a wonderful group of students who come from various background and are on diverse academic levels. I collaborate with my fellow 3rd grade team as well as staff to create lessons that meet the needs of all my students. I use professional development such as Discovery Education training and Investigations Math Training to enhance knowledge and growth in my classroom.

Our PTO involvement is very high within the school as parents volunteer both their time and monetary gifts. This year we were fortunate to receive 2 additional SMART boards for classrooms, which aid in technology and preparing our students for the 21st century. Currently each 4th and 5th grade classrooms have SMART boards installed in their classroom and the goal for PTO is to have each classroom equipped with this essential resource.

Through the IB program, Lansdowne also participates in several service projects throughout the year to help the community and demonstrate positive examples of helping others. Each fall students participate in “Pennies for Patients” which is a fundraiser used to benefit the Leukemia and Lymphoma Cancer Society.
The LLS mission: Cure leukemia, lymphoma, Hodgkin's disease and myeloma, and improve the quality of life of patients and their families. LLS funds lifesaving blood cancer research around the world and provides free information and support services.[1]

Rationale

Often math is taught as a stand-alone subject and students ask themselves time and time again “When am I ever going to need this?” They are bombarded with numbers, figures, problems and facts but miss the connection on how to apply those foundational skills into the world around them. I want students to be able to connect their math to real world experiences around them and develop the same appreciation and curiosity about math as they already do about science.

"Good science teachers have figured out how to use science as a springboard to other disciplines," says Gerald Wheeler, Ph.D., executive director of the National Science Teacher's Association in Arlington, Virginia. Students must be able to make connections to their learning through all disciplines." [2]

Kids learn that in school, as in life, information is interconnected, and the skills that serve them well in one subject can help with problem-solving in another. I also believe that using a multi-disciplinary approach helps students retain information and concepts much longer compared to a one-dimensional, single focus approach. If students can make connections to other disciplines versus a stand alone topic, they are much more likely to not only be engaged in the lessons, but become more knowledgeable through them.

As a student, I often had a fear for mathematics because I didn't understand it and thought it was very confusing. I want students to feel comfortable with math and not fear it like I did. I believe the more experience they have with it and the more exposure they have, the better they will become.

So how can we bridge the gap between fear centered learning to that vibrant world of MEANING and FUN?
Realize how much Math you do already. Math is everywhere. It is a language that expresses ideas just like music and English. Use positive affirmations.[3]

I would like students to use the scientific process to solve mathematical problems and concepts. The scientific process uses questions, hypothesis, research, procedure, data collections, and conclusions. Do we ask **questions** in math? Questions are asked all the time in math from *How many inches are in one foot*? to *How many right angles are in our classroom?* Should students make **hypothesis** or educated guesses in math? Students should consistently practice making estimates when solving problems just as they make predictions when conducting a science experiment. Do students use **research** in math? Research can be used in a variety of ways in math from using different strategies to solve problems to sharing strategies with partners and teams in the classroom. Are there specific **procedures** put in place for math? Math is a great way for students to organize information and numbers in a systematic approach. Although there are numerous ways to show work for a math problem, math is typically learned using a step-by-step approach. Do students collect data in math? Absolutely! From charts and graphs to tables and diagrams. Data collection is evident in math. Are **conclusions** made in math? Students make conclusions through dialogue with other students and use self-reflection over their work.

The scientific method is an organized way to investigate something we don't know. It can help you make decisions and answer questions we have. [4]

The Scientific Method

Background Knowledge for Math

Students must have a basic foundation of knowledge from previous grades of K,1,2, It is important for teachers to collaborate with one another to see how concepts and skills build over time. Kindergarten teachers must know what is taught in higher grades so they know where they should take their students with their lessons. Likewise, upper grade teachers must have knowledge of lower grade levels to understand what students were previously taught and how they can use that to build more knowledge.

When teachers link new information to the student's prior knowledge, they activate the student's interest and curiosity, and infuse instruction with a sense of purpose. (North Central Regional Education Laboratory). Basic math skills are taught in Kindergarten, 1st and 2nd grade and it is important for upper grade teachers to build on students' knowledge to make learning more meaningful. Students need to have a basic understanding of Bloom's Taxonomy so they can use it to engage in thought-provoking discussion and use reasoning skills when forming inquiry based questions.

Level 1: Knowledge
Level 2: Comprehension
Level 3: Application
Level 4: Analysis
Level 5: Synthesis
Level 6: Evaluation

Background information that will be helpful in teaching this unit includes place value and number system, time and graphing skills. Students will use knowledge of place value to compare and order constellations and moons from other planets. Students will compare the size of our Moon to the size of other moons in our Solar System. They will also compare the number of craters found on moons that and discover how to order moons from the youngest to the oldest by looking at their craters. Students have learned in 2nd grade how to look at 2-digit and 3-digit numbers to place them into categories based on hundreds, tens and ones. In this unit, students will expand their knowledge of place value by adding 4-digit numbers and finding multiple ways of illustrating equivalences for numbers. For example, 125 craters can be illustrated by showing 1 hundred, 2 tens, and 5 ones. An equivalent example can also be illustrated by showing 12 tens and 5 ones. A lot of students have difficulty with finding equivalencies, and this unit will target those challenges.

Students will use their knowledge of time to engage in elapsed time when they use their Star Journal to record the time the sun and moon rise and set. Students will keep a daily log of the sun and moon and compare the time difference between the rising and setting. Students will engage in real life applications of story problems and have opportunities to create their own story problems to engage in higher level thinking.

Students will use their knowledge of graphing to organize the data collected from their Star Journal and the information collected from moons and craters. In 2nd grade, students have an understanding of how to read a bar graph and how to read a pictograph. In this unit, students will use data collected to construct their own bar graph, pictograph and line graph. Not only will they use their knowledge of reading graphs, but they will synthesize the information collected to build their own. This engages their problem solving skills and helps them apply their data collections. Students will construct bar graphs on the number of moons for each planet, the various temperatures found on each planet and the number of craters found on moons. Each graph can be modified to meet the needs of all learners. For example, students having difficulty with large numbers may choose to create a graph in chunks (more than 15, less than 15, or 15). This allows them to work with 3 categories instead of 9 different categories.

Background Knowledge for Science

Students in 3rd grade will learn about the Earth, Moon and Stars. To enhance their understanding, they need to have background knowledge of moon phases, geography and atmosphere of planets, and temperature. Students will make observations of the moon and sun, but need to know how to make effective observations.

- **Moon Background Info**: *From any location on the Earth, the Moon appears to be a circular disk which, at any specific time, is illuminated to some degree by direct sunlight. Like the Earth, the Moon is a sphere which is always half illuminated by the Sun, but as the Moon orbits the Earth we get to see more or less of the illuminated half. During each lunar orbit (a lunar month), we see the Moon's appearance change from not visibly illuminated through partially illuminated to fully illuminated, then back through partially illuminated to not illuminated again. Although this cycle is a continuous process, there are eight distinct, traditionally recognized stages, called phases. The phases designate both the degree to which the Moon is illuminated and the geometric appearance of the illuminated part. These phases of the Moon, in the sequence of their occurrence (starting from New Moon), are listed below.* (USNO, Phases of the Moon)
- **Constellation Background Info**: *Students need to have knowledge that our Sun is a star and be able to visualize or compare its size to other objects. Students should know that our Sun is so large that it would take 109 Earths lined up together to make the equivalence of our Sun's diameter. This knowledge will help*

them with equivalencies as well as place value. That is one huge diameter! Students should also have knowledge of temperature and how it affects the color of stars. The color of stars are affected by the temperature and some temperatures can reach 80,000 degrees!

Strategies

There are several strategies that will be covered in this unit. It is important to use a variety of strategies to make sure teachers are meeting the needs of all students. Some main strategies that I plan to use include: Flexible Grouping, Higher Level Questioning and Organizational tools.

Flexible Grouping

Within flexible grouping I would like to use whole group teaching to introduce lessons and new concepts. I feel it is very important when starting a unit for all students to know what the unit will involve and what objectives will be focused on. Each student should have their own **Math Journal** to record problems of the day and areas to solve their problems in. Students will have multiple opportunities to record their thoughts and problems into their Math Journal. Students will use their journals during both Whole Group instruction and during Independent work time. To engage student thinking for most math and science lessons, I like to put one word or phrase in the middle of the board and have students write ideas in their math journal related to that topic. They can include words, sentences, pictures or numbers in their math journal as long as it is on topic. Students will have between 3-5 minutes to generate all of their ideas independently, then will use our **Think-Pair-Share strategy**. In this strategy, students think first on their own, then share with a partner, then share with the whole group. This gives students 3 different opportunities to expose themselves to the new topic or concept being introduced.

A second strategy within grouping includes **Heterogeneous Grouping**. For some math activities I would like students to interact with different academic levels so they can share their ideas and strategies. I would also like students mixed by different ability levels to aid in teachable moments. Students usually learn best from their peers and sometimes their peers are able to explain it in ways that even teachers have difficulty with. Some lessons lend itself to different ability groups while other lesson and activities are better suited for homogeneous grouping. Using this strategy, I plan to group students based on objective or skill to review key concepts during the unit. For example, if there are students who struggle with place value, I can use the homogenous grouping to target specific skills and students to reach mastery.

Cooperative Grouping is another strategy I would like to use with this unit so students can share ideas and learn how to work together. When placing students in

Science teams, it is helpful to assign task jobs for each student to hold them accountable for their own learning. Some examples of task jobs include: Director, Investigator, Materials Manager, and Data Recorder. (NSTA Cooperative Grouping)

Director or Taskmaster—Encourages each group member to participate and perform his or her jobs. The director may also read directions, notify the teacher of group problems or questions, and monitor the time.

Investigator—Performs tasks that involve manipulating the materials, such as pouring, measuring, etc.

Materials Manager—Gathers all necessary materials for the group. Ensures that all members are taking care of materials and using them properly, and that the work area is cleaned by all members of the group at the end of the activity.

Data Recorder—Writes answers on a group paper once members have reached a consensus. They check for accuracy. They may also act as group reporter if needed.

Students will rotate their task jobs during different experiments to get an opportunity to experience each task.

Organizational Tools

An additional strategy is using a variety of student products and tools to organize information. For this unit I plan to target math goal including: Numbers and Operations, Measurement, and Data Collections. For Numbers and Operations, I will focus in on place value and comparing and ordering numbers. I plan to have students research the planets in our solar system by locating their distance from the sun and their size and weight. We will use the information collected to connect place value of numbers and ordering each number from smallest to largest. Place value is a skill that a lot of my 3rd grade students had difficulty with in the past. I am hoping they will I am hoping they will be able to visualize the size of planets from pictures and websites to make connections with place value numbers. For example, if Mercury is 4,880 km and Mars is 6,800 km, which place value number determines the largest size? Do we look at the ones place, tens place, hundreds place, or thousands? We will use tools such as place value **number cards, paper foldables, and place value mats** to help them comprehend the differences and values of each. Since most of the planets have large numbers, it may be difficult for 3rd grade students to grasp exponential numbers or numbers greater than 1,000. Therefore, it will be helpful for the teacher to convert numbers on a smaller scale but still relative to size in relation to the other planets.

Activities/Lessons

Learning Activity #1 What is in our Sky ?

Objective: Students will classify by creating a list of objects in our sky and categorize by placing their items into groups. Students will compare lists between cooperative groups from least to greatest based on number of items from list. Skills: Classify and Categorize, Ordering Numbers from Least to Greatest

Materials: pencil/paper
Stopwatch, chart paper

Teacher will write the words: “Our Sky” on the board. Students will use their Inquiry Journal to record as many items they can think of in our sky within 3-5 minutes. Students will share their responses with their table and each group will create a group list of all team members’ ideas. Once the students have their compiled lists, they will write their total number on a large index card or sheet of construction paper. (*This number will be used to sequence and order numbers from the entire class on a number line).

Once all groups have compiled their lists, they will make a Human Number Line. To create a Human Number Line, each group will send one representative to the front of the classroom with their Total Count card. Students will compare and order themselves from least to greatest.

All students will create their own number line in their Inquiry Journal showing the order of their lists and where each number falls on the number line. They will write their explanations on how they ordered their numbers below their number line. For example, did they look at the ones place, or tens place to order their numbers?

Extension: Students can work together to classify their ideas into categories based on similar qualities. *This lesson can also be used at the end of the unit to compare knowledge learned. Pre and Post Assessment

Learning Activity #2 Moon Phases

Objective: Students will observe the moon and sun over a course of one month and use graphing skills to apply their data collected.

Materials: Appendix A (Star Journal Directions)
Moon Observation Log

1. How many days does it take to complete one lunar cycle, a "lunation"?
2. How many days are there between the first quarter and the Full Moon? Full Moon to Last Quarter?
3. What happens when we have 2 Full Moons in one calendar month? Why does that happen?
4. How does the sun's position determine if there is a new moon or a full moon?

Conclusion**:**
2-3 sentences on what you learned

Teacher Tips

Allow one full month for observations. Keep a large chart in the classroom and have a different student come up and fill in the chart each day. If you have more than one class, you can have the charts stacked on top of each other.

Extension: You can use a large sheet of graph paper to record the daily moon rise and moon set related to sun rise and sun set as a line graph, time vs. day, 4 lines. Analyze data and compare phases to rise/set time
Great Link: http://aa.usno.navy.mil/AA/faq/docs/moon_phases.html

http://www.exploratorium.edu/ronh/solar_system/number.

Learning Activity #3: Phases of the Moon

Objective: Students will model and interpret phases of the moon using Styrofoam balls.

This activity allows students to use models of Earth, the Sun, and the Moon to discover why moon phases occur. Students will use a Styrofoam ball to represent the Moon, which will be lit by a single light source in the classroom. They will create a complete series of phases matching the appearance of the Moon. And they will relate moon phases to the positions of Earth and the Sun.

Materials

- Light bulb on a stand or clamp (or lamp with its shade removed)
- Extension cord
- Styrofoam balls or light-colored spheres
- Pencils

Before the Activity

Collect enough Styrofoam balls to distribute one to each student. Clear space for students to stand and move about as they work through this activity. Check that the lamp or light bulb for the model Sun works properly and that it can be placed in the front of the classroom where everyone can see it. The classroom will need to be completely dark for this activity. This activity requires 1 to 2 class periods.

Scientific Concepts

The observed phase of the Moon is determined by its position relative to Earth and the Sun. In a 28-day period the Moon cycles from the new Moon, through the crescent, to the first quarter, the "gibbous," and then the full Moon, before waning to the new Moon again. The Moon's orbit takes it from a position between Earth and the Sun--the new Moon--to the opposite side of Earth from the Sun--the full Moon.

Connections

This lesson connects students to other concepts such as patterns and cycles. Ask students what things they know to repeat again and again. Then explain that moon phases occur repeatedly because of the configuration between the Sun, Earth, and the Moon. These changes can affect what we see in the sky from our viewpoint on Earth. Explain that students will model the pattern of moon phases.

The Activity

1. Work with students to review the order of the phases from one full Moon to the next.
2. Explain that to understand the phases of the Moon students need to look at models of Earth, the Moon, and the Sun. Place the lamp in front of the classroom. (Remind students to practice safety near the hot light bulb and electrical cord.) Have students stand in a semicircle facing the lamp. Explain that the lamp represents the Sun and that each of their heads represents Earth, with their noses being their hometown.
3. Ask students to stand so it is noontime in their hometown. If disagreement occurs, have students discuss this until they agree that noon is when their noses are pointed toward the model Sun. Ask students to stand so it is midnight. (They should turn to face away from the model Sun.) Then ask them to stand so it is sunrise and sunset. (To stand properly, students must be able to rotate their heads from right to left, with their right shoulders moving forward.) Practice the ideas of sunrise, noon, midnight, and sunset until you sense that the students have a good understanding of these relative positions.
4. Distribute one Styrofoam ball for the model Moon to each student. Have students stick a pencil into the ball to make it easier to hold as well as observe the phases of the model Moon. Ask students to hold the model Moon at arm's length. Allow time for them to explore how the model Sun's light reflects off the model Moon as they place it in different positions around their heads.
5. Choose one of the moon phases and ask students to find where that phase occurs in the Moon's orbit around Earth. (The first quarter is a good phase to start with.) Encourage students to compare their results and discuss differences. If one student has the correct position, ask this student to state why it is so. Then check to see

whether other students understand what to do; see if they all are standing in the same position.

6. Have students model the other moon phases: the full Moon, the third quarter Moon, and the new Moon. As students learn where to hold the Styrofoam ball for each phase of the Moon, challenge them to determine the direction that the Moon travels around Earth to create the phases in the correct order. (This can be demonstrated by moving the ball from right to left around the head.)
7. Allow time for students to experiment with the movement of the Moon. Have them work together to draw a diagram of the Moon's changing position in order to create each phase, and to record on the diagram what causes the phases of the Moon. (The spinning Earth allows us to observe the Moon rising and setting each day, but this spinning does not affect the phase of the Moon. The changing proportion of the Moon's sunlit side that we see as the Moon orbits Earth causes the moon phases.)
8. See that students check their positions for the model Moon against those in a diagram of the moon phases.
9. Lead a class discussion in which students can express their new understandings about the phases of the Moon. Then give students the opportunity to record their new understandings in a science journal or, if they wish to be more creative, in a story, poem, or essay.

Tips and Suggestions

This activity works best in a dark room with a bright light. Leave time to prepare if your classroom is not easily darkened or if a bright light is not easy to find. Dark coverings such as plastic garbage bags work well to block light from windows. An overhead projector can work as the light source.
Because the visualization in this activity can be difficult for some students, consider doing this activity with a smaller group while the rest of the class works on a moon phase chart or another project, or do this activity more than once. Students usually observe that their own shadows cover the model Moon when it is opposite the light source, simulating a moon eclipse during the full moon phase. Ask students to hold the model above or below the shadow of their heads, and ignore the eclipse for the time being.
Before doing the activity, ask the class to list possible explanations for the phenomena of moon phases. Try to avoid making comments on the validity of the theories offered. Ask students to write down their own explanations, based on what they have heard. After the activity, ask students to rewrite their explanations for moon phases and discuss any changes from their previous ideas. Encourage students to do this activity at home with their families or to model the moon phases for younger students and then write about their results. [5]

Fun Interactive Websites:

- **Lunar Cycle Challenge**

http://www.sciencenetlinks.com/interactives/moon/moon_challenge/moon_challenge.html

Learning Activity #4   Moon Drop Measurement

Objective: Students will use measurement and record data to simulate how craters form on the moon. Students will also take their date to create Bar Graphs.

Background Knowledge:

Teacher will review different tools we can use for measurement. If we wanted to measure the length of our desk, which tool would we use? If we wanted to measure the length of our closet doors, which tool would we use? Teacher will remind students that when measuring, they need to start from the edge of their ruler, instead of starting with number one. This lesson will also make use of cooperative grouping.

Materials per group of 4 students:

- 2 meter sticks
- Magnetic marbles
- Magnet
- Small ruler
- Rectangular Plastic Tupperware container with lid
- Mixture of flour (75%) & laundry detergent (25%) topped with milk chocolate powder (optional)

Procedure:

1. Using your meter stick, measure 30 cm above the "moon surface".
2. Place the marble next to the 30 cm mark then let the marble fall straight down. Be careful, move the ruler out of the way so that the marble does not hit it.
3. Using the magnet, remove the marble without disturbing the crater.
4. Measure the diameter, depth, and the lengths of 3 rays in cm.
5. Repeat 2 more times for 30 cm.
6. Add up the total and determine the average.
7. Repeat steps 1-6, this time using 60 cm.
8. Repeat steps 1-6, using 90 cm.
9. Repeat steps 1-6, using cm of your choice.
10. Graph and answer questions at end.

Moon Drop Recording Sheet

Drop height 30 cm	**Trial 1**	**Trial 2**	**Trial 3**	**Total**	**Average**
Crater Diameter					
Crater Depth					
Length of Ray					

Drop height 60 cm	**Trial 1**	**Trial 2**	**Trial 3**	**Total**	**Average**
Crater Diameter					
Crater Depth					
Length of Ray					

Drop height 90 cm	**Trial 1**	**Trial 2**	**Trial 3**	**Total**	**Average**
Crater Diameter					
Crater Depth					
Length of Ray					

Drop height ________	**Trial 1**	**Trial 2**	**Trial 3**	**Total**	**Average**
Crater Diameter					
Crater Depth					
Length of Ray					

Analysis/Results:

1. Which drop height had the largest average diameter? ________ cm with _________ cm.

2. Largest average depth? ___________ cm with _____________ cm

3. Largest rays? __________ cm with ___________ cm

4. How can you explain what happened for questions # 1, 2, & 3? _________________
____
____
____

5. Where did the rays come from? Explain in detail. ____________________________
____
____

6. In this experiment, we used magnetic marbles that were still intact after impact, what do you think happens to real meteors after impact? ___________________________
____
____

7. What would happen if the meteors hit at an angle? Try it if you are done! _________
____

Students will take their data and record it on a Bar Graph
Click here for bar graph

Learning Activity #5 Sorting Stars

Objective: Students will classify and sort stars based on characteristics such as temperature, brightness and lightness. Students will analyze graphs to determine similarities and trends.

Materials:
Star Circles for each group
Chart Paper
Markers

Background Information: The data included on the stars are helpful for students to interpret and determine whether a star is capable of sustaining life on an orbiting planet. (TERC). Students should realize that the sun is only one type of star, and its type is not even the most abundant. Students will question whether the other types of stars could be suitable for supporting life in a solar system.

- Stars come in many colors.
- A star's color is determined by its temperature.

- Hot stars generally have a shorter lifespan than cool stars.
- The sun is a yellow star, which is in the middle of the color and brightness spectrum, but yellow stars are not the most prevalent type in the universe.

1. Each set of Star Circles contain 100 stars. The teacher will divide the stars among the students and have students make observations and interpretations about the information included on their stars.
2. Have each group create a graph on chart paper labeling their graph.
3. Students will answer their critical questions in their Inquiry Journal.
4. Students will discuss responses as a class and defend their answers.

Critical Questions to include in Inquiry Journal:

1. Why might stars of one color be much more abundant than stars of another color?

Since the red dim stars live the longest, there are many of them still around. The only hot blue stars we see are ones that formed in the past few million years. The others have already died off.

2. Which type(s) of star should we consider first when looking for stars that might have life-supporting worlds around them? Why?

Since our sun is a yellow star, this is a good place to start, and in fact this is where many extrasolar planet searchers are looking. The blue and white stars are often ruled out because they don't live long enough for planetary life to begin and evolve very far before the star goes supernova. The red dim stars may not give off enough energy to support life easily on planets around them.

(* Responses from TERC)

Learning Activity #6

Objective: Students will compare and order sizes of objects, lengths of objects and ages of objects from least to greatest. Students will work in cooperative groups and use predictions and research to test their hypothesis.

Materials: Comsic Survey Cards
Group Recording Sheet
Chart Paper

Notes

[1] The Leukemia & Lymphoma Society - School & Youth - The LLS Mission." School and Youth. http://www.schoolandyouth.org/school/Controller?action=loadContent&itemid=575212 (accessed November 29, 2010).

[2] Scholastic, offers from, and carefully selected third parties.. "Fourth-Grade Cross Curricular Science | Scholastic.com." Teaching Resources, Children's Book Recommendations, and Student Activities | Scholastic.com. http://www2.scholastic.com/browse/article.jsp?id=2119 (accessed November 29, 2010).

[3] 6 Ways how to transform fear of math into love." Conceptis logic puzzles - Have fun, get smart!. http://www.conceptispuzzles.com/index.aspx?uri=info/article/318 (accessed November 29, 2010).

[4] Steps of the Scientific Method." Science Fair Project Ideas, Answers, & Tools. http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml (accessed November 29, 2010).

[5] Schatz, Dennis, Doug Cooper, and © 1994 Pacific Science. "Private Universe - Moon Phase Activity." *Teacher Professional Development and Teacher Resources by Annenberg Media*. N.p., n.d. Web. 30 Nov. 2010. <http://www.learner.org/teacherslab/pup/act_moonphase.html>.

Teacher Resources

6 Ways how to transform fear of math into love." Conceptis logic puzzles - Have fun, get smart!. http://www.conceptispuzzles.com/index.aspx?uri=info/article/318 (accessed November 30, 2010).

This is a great website to challenge students with math and science puzzles.

LaRosa, Liz. "Sky Observations." Middle School Science Lesson Plans. http://www.middleschoolscience.com/skyobservations.htm (accessed November 30, 2010).

This website is a great resource to find templates for star and sky journals.

Schatz, Dennis, Doug Cooper, and Â© 1994 Pacific Science. "Private Universe - Moon Phase Activity." Teacher Professional Development and Teacher Resources by Annenberg Media. http://www.learner.org/teacherslab/pup/act_moonphase.html (accessed November 30, 2010).

This website gives information on phases of the moon and examples of great lessons to modify for all grade levels.

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"moon_challenge." Science NetLinks: Resources for Teaching Science. http://www.sciencenetlinks.com/interactives/moon/moon_challenge/moon_challenge.html (accessed November 30, 2010).

This website gives information and pictures on moon cycles and phases of the moon.

Student Resources

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Nori, Domenic David Rino. *Adventures in Space* . ed. ed. Port Colborne, ON: Ann Nori Publishing, 2005.

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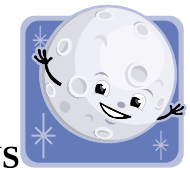
Appendix 1



STAR JOURNAL DIRECTIONS

Name ____ _____________
Parent Signature ___________________________ Observation # 1 2 3 4 5 (Circle)

Directions:

1. **You are to make 5 weekly observations by recording in your Star Journal.**
2. **You may use a compass or other star charts to orientate yourself.**
3. **Spend 10-15 minutes carefully observing and recording what you see.**
4. **Record your observation in your Star Journal nightly.**
5. **At the end of each week, write a conclusion about your observations. What similarities did you notice? What seemed unusual?**

Sun Rise _________ am

Date :
Location:
Time: ___________am/pm

Sun Set _________ pm

Viewing condition:

Moon Rise _______ am/pm

Color Sketch of Observation: Be sure to include landmarks such as the Horizon, trees, buildings,& label North, South, East and West. Also note at least one major constellation, such as the Big Dipper, Little Dipper, Cassiopeia, or Orion

Moon Set _______am/pm

Sketch of Moon & Phase (if seen)