MULTI-LEVEL
LESSON PLAN GUIDE
Earth, Moon, and Beyond

Jeni Gonzales
e-mail: JeniLG7@aol.com

SED 5600
Dr. Michael Peterson
December 18, 2001

Unit Plan: Multi-level- Earth, Moon, and Beyond

Theme: Our Solar System is an immense and interactive system that is constantly changing.

Essential Questions:

1. How do objects in our Solar System move?
2. How is life on Earth affected by the movement of objects in the solar system?
3. Why are the Earth and the Moon considered a system?
4. How do lunar and solar eclipses take place, and why are they not more common?

Content Areas Addressed:

Science- Earth and Space
Social Studies- calendar
Art- creating models
Sketching phases of the moon
Literature- writing journal entries
Reading stories and poems about the moon
Writing stories and poems about the moon
Music- Listening to music about the moon
Writing music about the moon
Math- calculations and spatial orientation

MULTI-LEVEL LEARNING GOALS FOR THE UNIT

Overall theme and goal	Level 1 (Highest)	Level 2	Level 3 (Lowest)
The Solar System is immense.	Know time –space relation of Earth-Moon's position in Solar System	Know Earth-Moon's position in Solar System	Know Earth is only small part of Solar System
The Solar System is interactive.	Know why Earth revolves around Sun, and why Moon revolves around earth. Also why we have seasons and why phases of moon and solar and lunar eclipses occur. Know the phases of the moon. Also how the moon affects tides on Earth.	Know why Earth revolves around Sun, and moon revolves around Earth. Know about the seasons. Know why the phases of the moon occur and solar and lunar eclipses. Also how the moon affects tides on Earth.	Know that earth revolves around the Sun and Moon revolves around earth. Be able to name the seasons and tell what weather is like where they live during those seasons. Know that the moon is always a round sphere but that we only see the parts of it that the Sun is reflecting off of.
The Solar System is constantly changing.	Know that the Earth-Moon System is always moving around the Sun, just like the other planets and their moons are always moving around the Sun.	Know that the Earth-Moon System is always moving around the Sun, just like the other planets are always moving around the Sun.	Know that the Earth is always moving around the Sun, and that the moon is always moving around the Earth.

LEARNING ACTIVITIES

ACTIVITIES	MULTI-LEVEL STRATEGIES	Ling	Math	Spatial	Body-Kin	Music	Inter-personal	Intra-personal
Earth/Moon System	Advanced students observe and record, less advanced act as moon, sun, and earth	Naming Earth, Moon and Sun/ additional vocab	Number of hours in Earth Day/ days in Earth year	Distance of Sun and Moon	Hands on: Students act as sun, earth, moon		Work in groups	Reflect in "Space Journals"
Earth's Axis	Advanced draw International Date Line/less advanced label top as "N" and bottom as "S"	Naming parts of globe	Intro to time zones, circumphrence can be discusses	Learning about Earth's rotation on its imaginary axis	Hands on: Creating own globes		Older students can help younger and vice versa	Reflect in Space Journals
Day & Night/ Time Zones	Advanced demonstrate time zones	Learning terms rotation, and time zone	Determining what time it is in different time zones	Earth's position relative to the Sun in its rotation	Students can participate, rotating the Earth model or globe		Work in groups determining time zones	Reflect in Space Journals
Seasons	Advanced determine when the Winter and Spring equinoxes are and why those dates are chosen	Naming each of the seasons	How many days left until winter or spring?	Earth's position relative to the sun in its revolution	Students can participate in creating seasons	Play a song about each season		Reflect in Space Journals
Phases of Moon Model/Eclipses	Advanced figure out when the next solar and lunar eclipse will be in US	Naming each phase of the moon, eclipse vocab	How many days does a complete cycle of the moon take	Moons position relative to Earth and Sun	Students can participate in creating phases of the moon	Play music written using the word moon, "Fly Me to the Moon"		Reflect in Space Journals
Phases of Moon journal	Less advanced just draw pictures of the phases	Reinforcing phases of the moon	Number of days in moon cycle	Moons position in the sky	Hands on: Students are sketching their view of moon		Have students share journal entries	Reflect in Journal/ add moon sketches into journal
Reading/ writing literature about Moon	Different levels of books available/ different levels of writing	Learning terms in the books				Play Mozart quietly	Have students share what they read	Reflect in Space Journal
Planetarium field trip	Students will all get something different out of the experience	Learning term planetarium	How long will it take to get there?	Stars in the "sky"		Usually some music is played	Buddy groups of older and younger students	Reflect in Space Journal

ACTIVITY: EARTH-MOON SYSTEM

Bring in beach balls for the Sun, baseballs for the Earth, and ping pong balls for the Moon. Have students in groups of four. Make sure the groups consist of different levels of students. Have on student in each group act as the Sun and hold the beach ball above their heads. Then have another student in each group act as the Earth and hold the baseball above their heads. They are to stand a little bit of a distance from the Sun, and they are to SLOWLY turn as they **revolve** around the Sun. Have another student from each group act as the Moon and hold the ping pong ball above their heads. They should stand close to the Earth and only make one **rotation** as they **revolve** around the Earth. This means that they should always face the earth, since only one side of the moon ever faces the Earth. Have another student from each group observe and record what they see. After the activity is completed, have the students reflect on the activity, what they have learned, what they are curious to learn more about, and/or any creative thoughts this activity may have inspired them to write. This is their journal, so it is the student's choice what he/she wishes to write. They can do this in a "Space Journal" that will be written in at the end of every activity.

Multi-level Strategies:

Advanced students can observe and record, or act as the moon, explaining to the members of their group that only one side of the moon ever faces the Earth. The less advanced students can act as the Sun or the Earth.

The journal entries can vary from an entire page or more, to just half a page, to just a sentence with a picture. Or students who are younger, or lower functioning can just draw a picture of the activity and maybe write a few words to go along with the picture.

Linguistics:

Naming the Earth, Moon and Sun. Also saying the vocabulary that goes with those three objects: Earth-Moon System
Path
Motion
Ellipse
Be able to describe difference between circular path and an elliptical path
Revolution
Rotation
Be able to describe the difference between revolving and rotating when
Describing objects in the Solar System

Math:

Students can figure out the number of hours in an Earth Day compared to a Moon Day. A Moon Day is 27.3 days long, and a Moon Year is 27.3 days long. How is this possible? Students can learn that the same side of the Moon always faces the Earth from this. If there are 24 hours in an Earth Day, and 365 days in an Earth Year, how many hours are in an Earth Year?

Spatial:

Students can get a glimpse of how big our Solar System is by researching the distances between the Sun and the Earth, and the Moon and the Earth. Also, what is the difference between a circle and an ellipse? They can learn that all of the objects in the Solar System have elliptical orbits. So the Moon revolves around the Earth in an elliptical path, just as the Earth revolves around the Sun in an elliptical path.

Bodily- Kinesthetic:

Hands on project, where the students are constantly moving, just as the objects in the Solar System are constantly moving. One student acts as Sun, one as Earth, one as Moon, and one as an astronomer observing the path the Earth-Moon System takes around the Sun. The students acting as the Earth and the Moon have to slowly spin while walking in an oval. The student acting as the Moon has to make sure that they are always facing the Earth, just like one side of the Moon always faces the Earth.

Interpersonal:

They have to work together in groups of four. Three as Sun, Earth and Moon, and one as the astronomer.

Intrapersonal:

After they have finished the activity, each person can reflect on what they have done and seen, anything they are curious to learn more about, and/or any creative thoughts this activity inspired them to write.

ACTIVITY: EARTH'S AXIS

Give each student a small Styrofoam sphere about twice the size of a baseball. Have them stick a thin, long wooden peg (sticks from the game "Pick-up Sticks" can be used) through the center of the sphere. Have them draw a circle around the top peg and label it the "Arctic Circle." The top peg will serve as the North Pole. Have them draw a circle around the bottom peg and label it the "Antarctic Circle." The bottom peg will serve as the South Pole. Have them draw a circle around the middle of the sphere and label it the "Equator." Explain that the wooden peg is an imaginary axis that the Earth spins around. Demonstrate this by having them slowly spin their "Earths" on their desks. Have them draw and color the continents and the oceans with oil crayons (or ask the art teacher what the best supply would be used for this activity). The coloring of the oceans and continents is optional, as long as they have an idea of where their country is on the globe, relative to the North and South Poles and the Equator.

Multi-level Strategies:

The more advanced students could draw and label the International Date Line on their globes, and explain to the class what it means and what its purpose is. This will introduce them to the concept of time zones.

The younger or less advanced students could just label the top peg as "N" for North Pole, and the bottom peg as "S" for South Pole. They should still draw a circle around the center of the globe so they know where the North part of the globe starts, and the South part begins.

Linguistics:

Naming parts of the globe:
- Arctic Circle
- Antarctic Circle
- Antarctica is a continent in the Antarctic Circle
- Equator
- Axis
- North Pole
- South Pole
- Northern Hemisphere
- Southern Hemisphere

Math:

Introduction to time zones. Circumphrence of the Earth can be discussed. The Earth is a sphere.

Spatial:

Learning about Earth's imaginary axis. The Earth spins on this axis (rotates); while it moves in a path around the Sun (revolves around the Sun).

Bodily- Kinesthetic:

Hands on project. The students are working with their hands to create their own globes. This is good for fine motor skill improvement. The option is there for students to work with another art supply such as oil crayons or something that will stick to the foam sphere without coming off too easily if the students touch it. They are also spinning the globe by its axis on their desks. The Earth actually spins quickly, but because of the distance it has to cover to make a complete rotation it takes 24 hours, which seems very slow to us, so the students should spin their globe SLOWLY on their desks. This practices control.

Interpersonal:

In this activity, some students may have more skill and practice at a hands on activity. The older students could help the younger students, or vice versa. It should be made clear that helping a fellow student does not mean completing the task for them. Helping should mean showing the student being helped the strategy the helper used in completing their own task. Or in this case, if the younger students are having a difficult time getting the wooden peg through the center of the sphere, an older student could help them get it through.

Intra-personal:

At the end of this activity, the students should reflect on the activity in their Space Journals.

ACTIVITY: DAY AND NIGHT/TIME ZONES

A lamp without a shade is needed. This will serve as the Sun. Explain to students that in the actual Solar System the Sun is much bigger than the Earth. Then use one of the globes that the students made. Have a student volunteer help (preferably the students whose globe is being used). With the lights out, and the lamp (with no shade) turned on, have the student hold the globe level with the lamp and explain the the class that the side of the globe facing the Sun (lamp) is experiencing daytime. The side of the globe facing away from the Sun is experiencing nighttime. Have the student slowly turn the globe counterclockwise. Explain that on Earth it seems as if the Sun rises in the East and sets in the West. This is because the Earth is rotating counterclockwise. The Sun hits the eastern states before it hits the western states. Ask the students how that makes a difference in what time it is here in Michigan, compared to the time in California, on the western coast of the United States. Since the Earth is turning in such a way that the sunlight hits us before it hits California, that it must be earlier in California. When we see the sunrise outside in the eastern sky, the children in California are still sound asleep because it is still nighttime there. Explain the time zones starting from Michigan and going west, showing that at each new time zone, an hour is taken away. So if its 12 noon here in Michigan, it is 9 am in California. When we are eating lunch, the students in California are just getting to school.

Have the students gather in groups ranging in levels and make sure each group has a globe (one that distinguishes time zones). Have them figure out what time it is in different parts of the world at that moment. Also have them find the International Date Line and discuss in their groups what they think the purpose of it is. Also why do they think the people who came up with the idea, decided to place it where they did. (In the Pacific Ocean where it does not interfere with countries.)

After this activity is completed, have the students reflect in their Space Journals.

Multi-Level Strategies:

Advanced students can learn the different times zones as well as investigate the International Date Line, where it lies and what its purpose is.

Less advanced students can benefit from learning why day and night occur. They can also benefit from learning that in the Earth sky the Sun appears to rise in the east and set in the west and why this occurs.

Linguistics:

Emphasis should be placed on the word **rotation** because day and night occur because of the earth's rotation on its imaginary axis. Other word groups such as time zones and the International Date Line should be learned. Vocabulary: Rotation
Imaginary axis

Time zone
International Date Line
Clockwise
Counterclockwise

Math:

Determining the different times in different time zones. For example, if it is 12 noon here, what time is it in Japan?

Spatial:

Students are made aware of distances around the Earth that account for differences in time. Students can see how big each time zone is by looking at a globe. They are also being asked to figure out why the International Date Line lies where it does on the globe. They should be made aware that the International Date Line is an imaginary line used on maps and globes and cannot be seen on the actual Pacific Ocean.

Bodily- Kinesthetic:

Students are able to participate in rotating the globe in their groups, learning counterclockwise versus clockwise.

Interpersonal:

Work in groups to determine time zones and to investigate the use of the International Time Zone. Students are able to work at their own level and to be in the company of students who are both higher and lower functioning than themselves.

Intra-personal:

They are to reflect in their space journals after this activity is completed.

ACTIVITY: SEASONS

Have one student holding the beach ball as the Sun. Use another globe made by one of the students in this activity. Have that student model the seasons. Have the student tilt the axis (wooden peg) of his/her Earth and tell the student to keep it tilted that way at all times. Demonstrate that sometimes the top peg (the North Pole) is tilted towards the Sun, while the bottom peg (the South Pole) is tilted away. This means that the Northern Hemisphere is experiencing summer while at the same time; the Southern Hemisphere is experiencing winter. Explain that this is because the Northern Hemisphere is receiving more direct sunlight because it is tilted toward the Sun. Ask them if anyone has noticed that the Sun seems to be higher in the sky at noon in the summer than it is in the summer. (EMPHASIZE THE FACT THAT STUDENTS SHOULD **NEVER** LOOK DIRECTLY INTO THE SUN!) Ask them why they think that is. Also have the student demonstrate the globe on the other side of the Sun; Where the Northern Hemisphere is tilted away from the Sun while the Southern Hemisphere is tilted toward the Sun. Have the student move the globe a quarter of the way around the Sun so the axis is not tilted toward the Sun at all and explain spring and fall. Explain that the Earth makes a complete revolution around the Sun. One revolution takes 1 year and that is why there are four seasons.

Have the students get into groups of multi-levels with one globe per group. Have one student in each group act as the Sun and another student move the globe around the "Sun" always tilting the same way. The other students in the group have to say which season it is in the Northern Hemisphere. While the group activity is taking place, have instrumental seasonal music playing softly in the background.

At the end of the activity, have the students reflect on the activity in their Space Journals.

Multi-Level Strategies:

Advanced students can determine when the spring and winter equinoxes are and why they fall on the dates they fall on.

The students can learn at a variety of levels in this activity, some only realizing what the different seasons are and what the weather is like in those seasons, and some understanding the entire concept of the earths revolution around the sun and how that affects the Earth's seasons along with the tilt of the Earth's axis.

Linguistics:

Naming each of the seasons: Winter
Spring
Summer
Fall

Emphasize the word **revolution** because the Earth makes 1 full revolution around the Sun in 1 year. Also correspond the word revolution with the word **tilt**, because together they create the seasons on Earth.

Math:

Students can figure out how many days left until winter or spring or summer (depending on what season it is at the time).

Spatial:

Earth's position to the Sun relative to its tilt and where it is in its revolution around the Sun.

Bodily-Kinesthetic:

Students can participate in creating seasons in their groups. The student holding the Earth has to keep it tilted the same way as it revolves around the Sun.

Music:

During the group activity instrumental seasonal music can be played softly in the background.

Interpersonal:

The students work in groups when creating the seasons with the globes.

Intra-personal:

After the activity is completed the students are to reflect in their Space Journals.

ACTIVITY: PHASES OF THE MOON MODEL AND ECLIPSES

The lamp without the lampshade is needed again for this activity. A thin flexible wire is needed with a ping pong ball firmly attached to one end. Also use another globe created by one of the students. Take the end of the wire without the ping pong ball and stick it in the top of the globe. The wire has to be long enough so the ping pong ball (moon) reaches the equator of the globe. The student who made the globe is to hold the globe still during this activity. With the lights out and the lamp (with no lampshade) turned on, that student is to hold the globe level with the lamp (Sun). You can stand next to the student and move the moon around the Earth. (Make sure that at the beginning of the activity the moon is moved in a way so that is does not fall in the shadow of the Earth during the full moon phase.) Show the students that half of the moon is always lit up by the Sun. However, because of our position on earth, we see different parts of the moon being lit up, known as phases. Demonstrate the phases of the moon, and then have a student volunteer come up and manipulate the moon around the Earth. Stop the moon at each full phase (new moon or full moon) and ask the students which phase the moon is at.

Pass out a sheet of paper to each student with one circle in the middle and 8 circles surrounding the center circle. Explain the phases of the moon and have them shade in as much of the moon as can be seen by Earth. Then have them work in groups to finish their diagram and label each of the phases. Have each person in a group explain to the rest of their group about a different phase. During this activity, play music written about the moon or with lyrics about the moon in it. Ex. "Fly Me To The Moon."

Turn off the lights again and have a different student volunteer participate. Use the globe the student completed in the previous activity. Have the student hold the globe level with the lamp (Sun) and position the moon between the Sun and the Earth. Explain that sometimes the moon casts a shadow on the Earth and this temporarily blocks the Sun and is called a solar eclipse. Have the student hold the moon so the Earth is directly between the Sun and the moon. Explain that sometimes the moon moves into the Earth's shadow and blocks the Moon when it is in its Full Moon phase. This is called a lunar eclipse.

After this activity or activities are completed (this can be done as one activity or as two separate activities), have the students reflect in their Space Journals.

ACTIVITY: PHASES OF THE MOON JOURNAL

At home, have the students observe the moon nightly (when it is clear outside) and sketch the moon as it appears in the sky. Have them write which phase the moon is in and then any thoughts that the moon inspires them to write. Tell them not to worry about grammar, and just to write whatever comes to their mind.

Multi-Level Strategies:

The student's entries can vary. They could write pages of thoughts, or just a couple sentences or a sentence, or just a few words. Some of the younger children could even just draw the moon as they see it. They could also draw themselves looking at the moon.

READING/WRITING LITERATURE ABOUT THE MOON:

Take a trip to the school library. Speak with the librarian ahead of time and have books out at different levels about the Moon. Read a book to the class and then let the students look at as many of the books as they would like. Give them some time to read them or start to read them. Have the students each check out their favorite book at the end of the library session.

Have them write a short story of their own about the moon in their Space Journals. It can be completely fictional and humorous, but it should contain at least one fact about the moon.

Multi-Level Strategies:

The older and/or more advanced students can choose books that are at a higher level to read, while the younger; less advanced students can choose picture books that would interest them.

In the writing activity the advanced students may want to write a complex science fiction story, and the younger or less advanced students may want to write a picture book story with or without words.

ACTIVITY: PLANETARIUM FIELD TRIP

Take students to a Planetarium. Have them in buddy groups of two or three students consisting of at least one older and one younger.

After the planetarium visit, have the students reflect about the experience in their Space Journals.

RESOURCES

To complete this project I looked through several curriculum guides as well as a fourth grade teacher's science book, since this is the grade they usually learn about the Solar System. I adapted some of the activities in the book, and created some of my own to make this an exciting and multi-level thematic series of lesson plans.

In the series of lesson plans I state the overall theme and some essential questions I would like the students to be able to answer after everything has been completed. I also have a chart showing the theme broken down into three different parts and the level of understanding I expect the students at each of their levels to understand.

I also include a chart which gives a summary of all of the activities, multi-level strategies and how different areas of learning are being used. After that chart I go on to explain the activities in detail, along with the multi-level strategies.

Materials Used:

Harcourt Science –Teacher's Edition (Earth Science Units C and D), Harcourt School Publishers, 2000

Southfield Public Schools Mathematics and Science Curriculum Guide, June 2000

Masters in the Art of Teaching –Graduate Portfolio for Marygrove College, Gonzales, Alda M., July 1997

The Kids' Science Book Creative Experiences for Hands-On Fun, Robert Hirschfeld & Nancy White, Trezzo Braren, Williamson Publishing, 1995

Inclusive Teaching –Creating Effective Schools for all Learners, Michael Peterson & Mishael Hittie, Allyn & Bacon, Projected Publishing Date 2002