Project Guide: Exploring Earth's Rotation, Revolution, and Seasonal Changes

Florida Benchmarks:

- SC.5.E.7.1: Explain the role of Earth's tilt and orbit in causing seasons.
- SC.5.E.5.3: Distinguish Earth's rotation (causing day/night) from its revolution (causing seasons).

Next Generation Science Standards (NGSS):

- 5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Objective:

- To understand how Earth's rotation causes day and night and how its tilt and orbit around the Sun cause the seasons.
- To demonstrate and observe the seasonal changes and daily variations in day length and direction of shadows through practical experiments.

Materials:

- 1 Globe
- 1 Flashlight
- Markers or Sticky Notes for labeling regions
- Project Report Sheet (includes the questions below)

Procedure:

Step 1: Earth's Rotation and Day & Night (SC.5.E.5.3)

1. In your group, you have 1 globe and 1 flashlight. The flashlight represents the Sun.
2. One person will hold the flashlight steady, and another will rotate the globe slowly.
3. As the globe rotates, notice how one side of the Earth faces the flashlight (experiencing day) and the other side is in darkness (experiencing night).
4. Discuss how the Earth's rotation (spin) causes this cycle of day and night and note down which regions on your globe are experiencing day and night during the rotation.

Step 2: Earth's Tilt and Seasons (SC.5.E.7.1)

1. Tilt the globe at about a 23.5-degree angle to simulate Earth's axial tilt.

2. Shine the flashlight at the tilted globe to see how sunlight falls at different angles across the Earth. This represents how the tilt affects the distribution of sunlight across the Earth.
3. Discuss how the Earth's tilt and its orbit around the Sun cause the seasons. Determine which hemisphere is experiencing summer and which is experiencing winter, depending on the tilt of the Earth.
4. Write down your observations and explain how the tilt of the Earth leads to the different seasons (winter, summer, spring, and fall).

Step 3: Daylight, Nighttime, and Seasons Across Regions (5-ESS1-2)

1. Choose a region or country on your globe.
2. Rotate the globe and observe whether that region is experiencing daylight or nighttime based on its position relative to the flashlight (Sun).
3. Identify which season that region is experiencing based on the Earth's tilt and its position in orbit around the Sun.
4. You will graphically represent these changes, marking which regions experience day/night and which ones are in summer/winter at any given time.

Questions for Your Project Report:

1. What happens on Earth that causes day and night? Can you show this by rotating the globe?

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2. What do you notice about the Earth's rotation as it turns? How does this explain the cycle of day and night?

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3. As you rotate the globe, observe the sides experiencing daylight and those in darkness. What do you think is happening on the side in the dark?

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4. If you tilt the globe, how does that affect the way sunlight hits different parts of Earth? What happens to the sunlight at the poles versus the equator?

5. Try tilting the globe to about 23.5 degrees. How do you think this tilt impacts the weather in different regions of Earth?

6. When you tilt the Earth toward the flashlight, what season do you think the Northern Hemisphere is experiencing? Why?

7. Now, tilt the Southern Hemisphere toward the flashlight. What season do you think it's experiencing?

8. Use your globe and flashlight to demonstrate a summer solstice. What changes do you notice in the daylight and the direction of the Sun?

9. What's the difference between the summer solstice and the winter solstice? Can you use the globe to show these two positions of Earth?

10. Imagine it's winter in the Northern Hemisphere. Which hemisphere would be experiencing summer, and why?

11. If the Earth is moving around the Sun, how does this affect the seasons? Try showing the revolution of the Earth and notice how it changes the angle of sunlight.

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12. Pick a region that's experiencing daylight. What time of day do you think it is there, and how can you tell?

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13. Choose a country in the Northern Hemisphere. What season do you think they're experiencing? Can you demonstrate this using the globe?

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14. Now, pick a country in the Southern Hemisphere. What season are they likely experiencing right now? What clues on the globe tell you that?

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15. Look at the different regions on Earth. How do you think the amount of sunlight changes throughout the year in different locations because of the Earth's tilt and revolution?

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Safety Precautions:

1. **Flashlight Safety**: Do not shine the flashlight directly into your eyes. Always hold it at a safe angle.
2. **Globe Handling**: Be careful when rotating the globe to avoid dropping it. Ensure the globe is securely placed on a flat surface.
3. **Space Awareness**: Make sure there is enough space for all members of the group to work comfortably without bumping into each other or the equipment.

4. **Supervision**: Always have a teacher or adult supervising when using the flashlight or globe to avoid any mishaps.
5. **Clean-up**: After completing the activity, ensure that all equipment (flashlights, globes) are turned off and stored properly.