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BASIS Lesson Plan

Lesson Name: There are Days and Seasons

Grade Level Connection(s)

NGSS Standards: Grade 3, Earth and Space Science
FOSS CA Edition: Grade 3, Earth Science

**Note to teachers: Detailed standards connections can be found at the end of this lesson plan.*

Teaser/Overview

In this hands-on lesson, students will explore why there are days, nights, and seasons. Kids will explore these concepts with fun, interactive simulations and modeling activities. We'll conclude with a discussion about why the North and South Poles are so different from the Equator.

Lesson Objectives

- Students will use models to understand that the spinning of the Earth is the cause of the cycles of night and day.
- Students will use models to understand that the tilting of the Earth and the orbiting of the Earth around the Sun are the causes for the seasons.
- Students will use computational thinking to understand that the length of time for one day and one year are directly related to the spinning rate and the orbiting rate of the Earth, respectively.
- Students will discuss the climates of different regions, specifically the Equator, the North Pole, and the South Pole and use evidence to support the claim that the Poles are cold because of the tilted axis and orbiting of the Earth around the Sun.

Vocabulary Words

Antarctica: the southern-most continent, which includes the South Pole
Spin: to move around yourself in a circle, or for an object to move around itself in a circle, without changing location
Tilted: to be positioned at an angle

Equator: imaginary line dividing the Earth into top and bottom halves
North Pole: the very top of the Earth, which the Earth spins around
South Pole: the very bottom of the Earth, which the Earth spins around
Orbit: to move around something else in a circle

Materials

Scientist Volunteers will bring:

- Inflatable or small globes (17)
- Circle stickers (17)
- Flashlights, small (17) [to project light in one direction; not a lamp that illuminates in all directions]
- [Optional] Pictures from Antarctica, which demonstrate that it is always light in summer; it's cold; it's icy; and there are unique, interesting animals that live there.
- [Optional] Pictures from tropical places near the Equator, which demonstrate that it's always hot and there are unique, interesting animals that live there.

Classroom Set-Up

Please ensure that the room can be darkened by drawing the shades and turning off the lights. Students should be paired up and placed into groups of 4 (consisting of 2 pairs).

Classroom Visit

1. Introduction (10 minutes)

Role Model Introduction:
Being a role model is an important part of being a BASIS volunteer! Begin your lesson by explaining who you are and what you do as a scientist. Feel free to tell your "story" as if giving an elevator pitch to kindergartners: Why did you become a scientist? What questions are you trying to figure out? What do you do in your job? Why should students relate to you? Feel free to bring in photos, specimens, and other props. Let your personality shine through!

Topic Introduction:
After you introduce yourselves as role models, take some time to introduce the topic of this lesson: the reasons for days, nights, and seasons. It may be helpful to keep the suggested take-

away in the back of your mind throughout the lesson: **Specific movements of the Earth and Sun affect our days and seasons.**

Your topic introduction should cover, at a minimum, the following information. As much as possible, try to frame this information as questions posed to the class, rather than as a lecture. This helps activate students' prior knowledge and facilitate student-guided conversation. It is suggested to supplement the following discussion frame with visuals (e.g. look of a photo of the bay at twilight – what time do you think it is here? Look at the bay at 6:30am in the summer – what time do you think it is?)

- When you woke up this morning to get ready for the school, was it light or dark outside?
- When you go to sleep at night, is it light or dark outside?
- What time does the Sun rise in the morning? What time does the Sun set in the evening?
- So, about how many hours of daylight do we have in one day?
- Is this number always the same? Has anyone noticed that it gets darker earlier at certain times of the year? [Gets darker usually when the weather gets colder – seasons!]
- Do you think that the amount of sunlight in one day is the same all over the world? [This is a nice opportunity to invite international students or those who did not grow up locally to engage in the conversation.]
- Why or Why not? [If students think it stays the same, then can use that as the question of investigation – let's do some activities to investigate if that's true! If students happen to know that the Sun never sets in Antarctica at certain times of the year, can instead frame the question to investigate why that actually happens.]
- Does anyone have any ideas of what causes day and night?
- Does anyone have any ideas what causes the seasons?
- We're going to do some fun activities to learn more about the causes of day, night, and the seasons!

Teaching Tip: Say, Write, Show

- Bring in photos and props to illustrate the topic intro
- Write new vocabulary words, key terms, and brainstorm lists on the board
- Refer back to the board to engage visual learners and English Language Learners

2. Learning Experience (30 minutes)

If students are not yet in their groups of four (each with two pairs), they should get into those groups now.

Part 1. Spinning – Day & Night

1. Engage students in a conversation about how the Earth spins
    a. What does it mean to **spin**? Can anyone show us? [Have a volunteer demonstrate]
    b. Great! Now everyone can try spinning in place (like a top)! Spinning is moving around yourself in a circle.

   c. This is exactly what the Earth does. Each group takes out their globe. The Earth spins in a very certain way. One part of the Earth is always at the top. Does anyone know what's at the very, very top of the Earth? [The **North Pole**!] Another part of the globe is always at the bottom. Does anyone know what's at the very bottom of the globe? [The **South Pole**!] How do you think scientists know this? [Scientists realized patterns in the sun/stars/shadows followed certain patterns and then used some cool measurements and math to determine that the Earth spins; Astronauts can now also take pictures of the Earth from outer space!]
   d. With your partner, hold your globe with the North Pole at the top and the South Pole at the bottom. Then have the Earth spin, just like you did. [Rotate around to students and make sure all pairs are spinning]
2. Do the Day & Night activity
   a. Each pair of students needs a sticker and a small flashlight. Have students place the sticker where California is on their globe. One student must hold the globe and the other holds the flashlight.
   b. Darken the room and shine flashlight on the globe. Is California in light or in the dark right now? How does that change when the Earth **spins**? What does the light represent? [The sun – daylight]
   c. **Challenge:** With only spinning the globe, can you make the time that California is in the light increase? Decrease? How did you do that?
   d. So what do you think determines how much time one day takes? [The rate of the Earth spinning determines that one day = one full spin = 24 hours]
3. Connect the activity to the big picture
   a. Invite students to reflect on the spinning of the Earth. Volunteers can stand at the front of the room with a demo globe and flashlight and quiz the class: what time is it in California NOW? [some spinning] How about NOW? [more spinning] How about NOW?
   b. Emphasize the overall takeaway of the lesson: **Specific movements of the Earth and Sun affect our days and seasons: for example, the spinning movement of the Earth affects the length of one day!**

Classroom Management Tip: Student Movement

- The fun movement in the activities presented here may get kids pretty excited (which is wonderful!), but may lead to distraction
- To keep students on task, take a moment to re-focus their attention to the front of the classroom or to the volunteer leading the activity
- Try not to rush through or talk over student excitement. Better to wait before moving on to the next step so that students can be more fully engaged

Part 2. Tilting – Temperature

1. Engage students in a conversation about how the Earth is tilted on its axis
   a. What does it mean to be **tilted**? When you tilt your chair, what do you do? Can you tilt your head? Can you tilt your whole body?

   b. Tilting means to hold something at an angle. Let's demonstrate. [Demonstrate before having students participate themselves]
   c. Now everyone can try tilting while spinning. [Have them tilt and spin]
   d. This is exactly what the Earth does – it's tilted and spins at the same time. Take your globes, spinning them like before, but now adding a tilt.
2. Do the Climate activity
   a. One student must hold the globe and the other holds the flashlight. Have students place another sticker at the North Pole, the South Pole, and at the equator.
   b. One student must hold the globe, making sure to tilt it, and the other holds the flashlight. Demonstrate this for students. Darken the room and shine flashlight on the globe.
   c. What do you notice about the light on the different dots? Is there a difference in how much light is shining on Hawaii? How about on the North Pole? The South Pole?
   d. So what do you think this means? If you stand out in direct sunlight, how do you feel? [Hot] What about when you stand in the shade? [Cooler] What do you know about these places already? What do you know about the plants and/or animals that live in these places?
   e. How does this affect the daylight in different places? Pay attention to the North Pole with your partner. Then pay attention to the South Pole.
3. Connect the activity to the big picture
   a. Emphasize the overall takeaway of the lesson: **Specific movements of the Earth and Sun affect our days and seasons: for example, the tilting of the Earth affects the amount of direct sunlight and temperature of different places!**

Part 3. Orbiting & Seasons

1. Engage students in a conversation about how the Earth orbits
   a. There's ONE MORE important thing the Earth does that we're going to talk about today. What does it mean to **orbit**? Has anyone heard of a satellite that orbits? Can anyone think of what that means?
   b. Orbiting means to move in a circle around something else. We'll demonstrate with each other. [Demonstrate before having students participate themselves]
   c. Now everyone can try orbiting around his/her partner. [Have them orbit]
   d. Great – now switch so that your partner can now orbit you.
   e. **Challenge:** Can you spin and orbit around your partner at the same time?
   f. Try it! Then switch so everyone has a chance!
   g. This is exactly what the Earth does – it spins and, at the same time, it orbits around the Sun. Take your globes, spinning them like before and then orbit around your partner (holding a Sun diagram/drawing)
2. Do the Seasons activity
   a. This activity will be led by BASIS volunteers and will be supported by student volunteers. Choose a student volunteer (or several).

b. Let's make sure that the Earth is tilted as it was before (choose one direction sthat the tilt will always be – to the left or right of the classroom, so that chalkboard drawings will match). Let's look at the dot on California. Is the dot close or far from the Sun [flashlight]? Draw this on the board and write the corresponding season [if closest to the Sun, Summer; if farthest from the Sun, Winter]
c. Now, we're going to orbit around the room, moving around it in a counterclockwise direction. Stop at four different points. [Have the students stop and observe where California is each time. Make corresponding drawings on the board.] What season do you think it is here?
d. Does the sunlight hit California straight or at an angle? In which case will it be warmer? In which case will it be cooler? Are there certain times of the year when it's warmer and cooler? [Summer and Winter] This is why we have seasons! What determines how much time it takes to go through all the seasons? [Time it takes to make one complete orbit around the Sun]

3. Connect the activity to the big picture
   a. Now we noticed what California is like at each of the seasons throughout the year, now let's think about what it's like for people in the Arctic. What about people in Antarctica? [*Depending on the energy level of the class and the timing of the lesson, can have the students follow the BASIS volunteer around the classroom using their original student pairs and inflatable globes*]
   b. Emphasize the overall takeaway of the lesson: **Specific movements of the Earth and Sun affect our days and seasons: for example, the orbiting of the Earth around the Sun is what causes seasons!**

Optional Lesson Additions

Video: If there's a projector in the class, volunteers can present a video of the Earth tilted, spinning, and orbiting the sun.

Matching Game: If there's time, can bring laminated sheets with different places/times/seasons written on them and some laminated images that the students can match up. Groups can engage in discussion and volunteers can provide suggested sentence frames.

3. Wrap Up: Review and Discuss the Learning Experience (5 minutes)

Engage in a wrap-up discussion with the students.

- What does it mean to spin, tilt, and orbit? Review of vocabulary words.
- What did we learn about the Earth and Sun in regards to spinning?
- What would the Earth be like if it did not spin? [No day/night cycle]
- What did we learn about the Earth and Sun in regards to tilting?
- What did we learn about the Earth and Sun in regards to orbiting?
- What would the Earth be like if it wasn't tilted and did not orbit? [No seasons!]
- What would the Earth be like if it orbited, but did not spin? [Daylight for half of the year and darkness for half the year]

- Prompt students to think about other questions they have about the days and seasons around the globe.

4. Connections & Close (6 minutes)

Draw in connections to the real world around students:

- What would your day and year be like if you lived at the Equator?
- What would your day and year be like if you lived at the North Pole? [Sometimes it's dark all the time and sometimes it's light all the time]
- If possible, tie lesson back into your research or role model story [If you do research in very cold places near the Poles or very tropical places near the Equator, this is a great time to talk about it with the students!]

Close:

Wrap up as a role model by leaving a few minutes for students to ask questions about science, about being a scientist, and about becoming a scientist. Then, thanks and goodbye!

Follow Up: After the Presentation

Teachers who wish to extend the impact of this lesson may find the following CRS web pages useful:

- http://www.crscience.org/educators/helpfulreports
- http://www.crscience.org/educators/treasuretrove

Standards Connections

NGSS:

- Connections by topic
  Earth & Space Science: 3. Weather and Climate
- Connections by disciplinary core ideas:
  Earth & Space Science: 3-ESS2 Earth's Systems
- Connections by scientific & engineering practices
  1. Asking questions & defining problems
  2. Developing and using models
- Connections by crosscutting concepts
  1. Patterns
  2. Cause and Effect
  4. Systems and system models
- Connections by performance expectation:
  3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.