

What to Wear?

Maria lives in New York. She is in the third grade. Last year, two of Maria's friends moved far away. Alice moved with her parents to Sydney, Australia. Mattie moved with her parents to Brazil, a country in South America.

Maria and her friends write letters to stay in touch. In December, each one sent a letter telling what they would do over Christmas vacation. All three friends were excited to play outside during their time away from school.

What kind of clothes might each friend wear during her Christmas vacation?

Maria (lives in the United States – New York)

_____ A winter coat, gloves, scarf, and hat

_____ Shorts and a T-shirt

Alice (lives in Sydney, Australia)

_____ A winter coat, gloves, scarf, and hat

_____ Shorts and a T-shirt

Mattie (lives in Brazil)

_____ A winter coat, gloves, scarf, and hat

_____ Shorts and a T-shirt

Explain the thinking you used to make your choices.

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What to Wear? Teacher Notes

Purpose

The purpose of this probe is to elicit students' ideas about seasons in the Northern and Southern Hemispheres and at the equator. The probe is designed to find out if students recognize that the Northern and Southern hemispheres experience winter and summer at different times during the year, and that areas along the equator have fairly constant temperatures throughout the year.

Related Concepts

Earth's axis, seasonal change, latitude and longitude, geographic locations, weather and climate, human behavior

Explanation

Over Christmas break, Maria (living in New York) would most likely wear a winter coat, gloves, scarf, and hat. December in the Northern Hemisphere is a winter month, and temperatures tend to be cold. Snow is also common.

Over Christmas break, Alice (living in Sydney, Australia) would most likely wear a T-shirt and shorts. December in the Southern Hemisphere is a summer month, and temperatures tend to be warm.

Over Christmas break, Mattie (living in Brazil) would most likely wear a T-shirt and shorts. Brazil's equatorial location means that temperatures are warm year-round.

Curricular and Instructional Considerations

In kindergarten and first grade, students develop an understanding of seasons through firsthand observation of temperature, weather, and other noticeable changes in vegetation, animal behavior, and so forth. Students also associate seasons with types of clothing and holidays. Many instructional materials support the idea of four clearly defined seasons (winter, spring, summer, and fall), as experienced in the mid-latitudes of both hemispheres. However, students near the equator or far north or south of the equator often have very different personal experiences with seasonal weather than what is described in many trade books. In these situations, using locally written books will help students match what they observe and what they read. The discrepancy can also provide a "teachable moment" for learning about the differences in seasons at various latitudes.

According to the *National Science Education Standards*, students in the elementary grades should develop skills in observing, recording data, and recognizing patterns. The cause of seasonal variation is not explicitly taught until the middle school years. However, if students in

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elementary school recognize seasonal patterns and also are aware that these patterns are different for various locations, they will be ready to tackle the more difficult concepts come middle school.

Administering the Probe

It is essential that students locate New York, Australia, and Brazil on a world map before completing the probe. This may be done as a class using a large wall map or projector, or students may use individual maps at their desks. In either situation, teachers should be sure that students have the correct locations before allowing them to begin work.

It may be helpful to read the probe aloud before students begin work. Clarify directions and provide definitions as needed, but be careful to not provide any scientific concepts about temperature or seasons that might influence student responses.

For younger students or English language learners, it may be helpful to use pictures of clothing or even samples of the clothing items themselves. The probe could be administered as a one-on-one interview with a student needing reading or writing support.

If students do not observe Christmas, it is necessary to explain that Christmas break is a school holiday occurring around December 25. Even though the term “winter holiday” is more culturally inclusive, we chose not to use this term in fear of influencing student responses.

Related Ideas in *National Science Education Standards* (NRC 1996)

K-4 The Characteristics of Organisms

The behavior of individual organisms is influenced by internal cues (such as hunger) and by external cues (such as a change in the environment). Humans and other organisms have senses that help them detect internal and external cues.

K-4 Organisms and Their Environments

An organism’s patterns of behavior are related to the nature of that organism’s environment. Humans depend on their natural and constructed environments.

K-4 Objects in the Sky

The sun provides the light and heat necessary to maintain the temperature of the earth.

5-8 Regulation and Behavior

Behavior is one kind of response an organism can make to an internal or environmental stimulus. Behavioral response is a set of actions determined in part by heredity and in part from experience.

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5-8 Earth in the Solar System

The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result from variations in the amount of the sun's energy hitting the surface, due to the tilt of the earth's rotation on its axis and the length of the day.

Related Ideas in *Benchmarks for Science Literacy* (AAAS 1993)

K-2 The Earth

Some events in nature have a repeating pattern. The weather changes some from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months every year.

K-2 Energy Transformations

The sun warms the land, air, and water.

3-5 Energy Transformations

Some materials conduct heat much better than others. Poor conductors can reduce heat loss.

Related Research

Explanations of the day-night cycle, the phases of the moon, and the seasons are very challenging for students. To understand these phenomena, students should first master the idea of a spherical earth, itself a challenging task (Vosniadou, 1991).

Suggestions for Instruction and Assessment

Students (particularly those in grades K-2) should develop the idea of repeated cycle of seasons before being expected to consider seasonal differences across the world. Similarly, students should develop an understanding of a spherical earth, the equator, and parallels of latitude before completing this probe.

It is preferable that one of the three girls described in the prompt is in a similar location to that of your students. If not, students will have a difficult time conceptualizing temperature and weather in December for any of the locations. If necessary, modify the prompt so one of the locations more closely approximates your own. *Note: It is important that one location is in the Northern Hemisphere, one in the Southern Hemisphere, and one in an equatorial region.*

After administering the probe, it may be helpful to “adopt” cities and track daily temperature and weather using the newspaper or a web site. By including cities in both hemispheres and along the equator, students will be able to compare and contrast patterns and build an understanding of

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how seasonal characteristics vary with latitude. This may be performed as a whole-class activity (helpful with young students) or in small groups (upper-elementary students).

Elementary students should not be expected to explain why seasons are reversed between the Northern and Southern Hemispheres. Emphasis should be placed on observation, data collection, and the identification of patterns. Simply recognizing the difference builds the foundation for further investigation during the middle school years. Advanced or interested students can begin to explore the reason for seasonal change through trade books and web sites such as Brain Pop and Windows to the Universe.

Related NSTA Science Store Publications and NSTA Journal Articles

Barrow, L. 2007. Bringing light onto shadows. *Science and Children* 44 (9): 43-45.

Keeley, P., F. Eberle, and L. Farrin. 2005. *Uncovering student ideas in science, vol. 1: 25 formative assessment probes*. NSTA Press.

Keeley, P., F. Eberle, and J. Tugel. 2007. *Uncovering student ideas in science, vol. 2: 25 more formative assessment probes*. NSTA Press.

Nelson, G. 2005. Science 101: Do other planets have summer? *Science and Children* 42 (9): 44-45.

Robertson, B. 2007. Science 101: What causes the seasons? *Science and Children* 44 (5): 54-57.

Shackelford, B. 2003. Teaching through trade books: Seeing the seasons. *Science and Children* 40 (7): 14-16.

Stark, M. 2005. Teaching through trade books: Seasons by the sun. *Science and Children* 42 (9): 14-16.

Wiley, D. 2004. Teaching through trade books: A season to inquire. *Science and Children* 42 (3): 16-18.

Related Publications

American Association for the Advancement of Science (AAAS) and National Science Teachers Association (NSTA). 2001. *Atlas of science literacy*. Washington, DC: AAAS and NSTA.

American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford University Press.

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National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academies Press.

Related Web Sites

Brain Pop

<http://www.brainpop.com/science/weather/seasons/>

A short, animated video that explains the changes in the seasons and differences in seasons between the equator, Northern Hemisphere, and Southern Hemisphere in student-friendly language. An interactive quiz follows the video.

Windows to the Universe: What Causes the Seasons?

http://www.windows.ucar.edu/tour/link=/the_universe/uts/seasons1.html&edu=elem

This web page, part of a larger Windows to the Universe site, explains the cause of the seasons and seasonal differences between the hemispheres. Several embedded links allow students to explore further. The site is available in three reading levels (beginner, intermediate, and advanced) and in Spanish.

References

American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford University Press.

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National Research Council (NRC). 1996. *National science education standards*. Washington, DC: National Academies Press.

Vosniadou, S. (1991). Designing curricula for conceptual restructuring; lessons from the study of knowledge acquisition in astronomy. *Journal of Curriculum Studies*, 23, 219-237.