Kinesthetic Astronomy Lesson Changes/Updates for New Utah SEEd Standards (2017)

Utah SEEd Standards

Strand 6.1-The solar system consists of the Sun, planets, and other objects within Sun's gravitational influence. Gravity is the force of attraction between masses. The Sun-Earth-Moon system provides an opportunity to study interactions between objects in the solar system that influence phenomena observed from Earth. Scientists use data from many sources to determine the scale and properties of objects in our solar system.

Standard 6.1.1 - **Develop and use a model** of the Sun-Earth-Moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and Moon, and seasons. Examples of models could be physical, graphical, or conceptual.

Scientific and Engineering Practices Utilized:

- Developing and using models
- Analyzing and interpreting data

Crosscutting Concepts:

- Patterns
- Scale, proportion, and quantity

Sky Time Astronomy Lessons

It is up to the teacher's discretion which worksheets they want to use, but we recommend using the *Scale Model of the Earth, Sun, and Moon*, *Body Geography*, *Kinesthetic Times of Day*, and the *Kinesthetic Seasons* as they all closely align with the standards in that they help the students to develop and use models to construct explanations of the phenomenon.

IIb. The Astronomical Meaning of Day and Night

Phenomenon- Apparent motion of the sun. From their own experience students should know how the sun appears to move across the sky during the day and that it cannot be seen at night

Recommended changes:

We recommend stopping this activity after step 62 and waiting to add the Earth's tilt until after step 86 in the next lesson (Astronomical Meaning of a Year)

IIc. The Astronomical Meaning of a Year

Phenomenon- Midnight Constellations PowerPoint or astronomical software showing constellations throughout the year if available. Students should observe the zodiac constellations visible at local midnight near the dates of the solstices and equinoxes. Have students note the apparent height of the zodiac constellations at each seasonal date. Note: in the Midnight Constellations PowerPoint slides, the top of each slide is at the zenith (point straight overhead) in the sky.

Recommended changes:

In step 82, replace the "HINT" with the following: "Which way in our model would Earth need to orbit the Sun in order for us to see the constellations visible at midnight at different times of year?"
Following step 86, go back and complete the section ***Adding Earth's Tilt to the Kinesthetic Day*** (steps 63-75). After step 64, ask students which of the midnight constellations appeared highest and lowest in the sky. Then ask, "Where would Earth have to be in our model to see those constellations at midnight?" [Directly between the Sun and those particular constellations in each case. Those two Earth positions are on opposite sides of the Sun.] "How would Earth need to tilt in order to see Taurus and Gemini high in the sky and Scorpius and Sagittarius low in the sky?" [Leaning away from the Sun in the case of Taurus and Gemini and leaning toward the Sun in the case of Scorpius and Sagittarius. It may help to have them hold their hand horizontally under their nose to simulate their southern horizon.] Then continue to step 64.

Moon Rise, Moon Set

IIb. We recommend using this activity as an assessment of student knowledge of the moon phases. It should help them practice transferring their theoretical knowledge of the moon phases to the kinesthetic model.

IIc./IId./IIe. These activities can be used as enrichment activities at the teacher's discretion to deepen students' understanding of moon phases.

Planets in Motion

While the phenomena in this activity is not directly addressed in Strand 6.1, students modeling the motion of Earth and the planets has application in their developing a model of orbits (Standard 6.1.2), solar system distance scale (Standard 6.1.3) and engaging students in the science practice of using mathematics and computational thinking.

Scientific and Engineering Practices Utilized:

- Developing and using models
- Using mathematics and computational thinking

Crosscutting Concepts:

- Patterns
- Scale, proportion, and quantity

Phenomenon - apparent motion of the planets relative to the stars.

Many solar system diagrams show all the planets in a straight line which does not ever occur. This activity will allow students to use a model to construct an explanation for the apparent motion of the planets relative to the stars and also allow them to experience a more realistic model of planet locations and how their positions change over time. It also has a component that can be used to help students review fractions and show students how they can use fractions to help model the motion of the planets.