Solar System—Lesson Four

Using Scale to Place the Planets in their Positions

STANDARD III: Students will understand the relationship and attributes of objects in the solar system.

Objective 1:
   Describe and compare the components of the solar system.
Indicator c:
   Use models and graphs that accurately depict scale to compare the size and distance between objects in the solar system.

Lesson Performance Expectation:
   The students will be able to use math to find out the planets' relative position rom the Sun out to Pluto.

The Planets' Scale and Position Background information:
 (Part of the background information is taken from the State of Utah Science Teacher Resource Book, 6th Grade, 2005, pages 10.2.8 and 10.2.9)

   "Students often have misconceptions about the relative sizes of objects in the solar system and the distances between them. Inaccurate commercial models, posters, drawings in books, and science fiction movies perpetuate these errors."

   "One of the best ways to dispel these misconceptions is to give students opportunities to record accurate representations. It is difficult to accurately measure to scale both the size of objects in the solar system and their corresponding distances because of the vastness of the solar system."

   "The diameter of the sun is approximately 109 times larger than the diameter of
Earth. By coincidence the distance from the sun to Earth is a little more than 107 times the distance of the sun's diameter, or 107 sun diameters. Earth's diameter is approximately 1.5 times the diameter of the moon. The distance from Earth to the moon is approximately

30 Earth diameters. These ratios are useful in calculating relative size and distance. The distances of the planets from the sun are arranged in a somewhat orderly geometric progression."

Science Practices:
- Developing and using models
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations
- Communicating information

Crosscutting Concepts
- Patterns
- Scale
- System Models

Disciplinary Core Ideas
- Mathematics

Investigation

Materials:
1. Calculator
2. Worksheet: Finished WS—Scale of the Planets
3. Converting Decimals to Fractions Sheet
4. Document: Miles and Percentage Distance from the Sun
5. Words of the Planets
6. Tape

Preparation
1. Have calculators for all the students.

Pre-activity Work
1. Put the students in groups of four and have them put their desks in a row. They will be using their desks for the placement of the planets.
2. Each student will need a calculator and their own worksheet from Activity One.
3. Each group will need the names of the planets and tape.

Activity Directions

1. Tell the students that today we are going to see if we can come up with a general scale as to how far each of the planets are from each other in the solar system by using percentages.
2. Put the word "Sun" at the end of the first table and the word "Pluto" at the end of the last table. We are going to see if we can find where the other planets generally lie just by looking at the numbers of the worksheet we did last time, "Scale of the Planets".
3. Have the students look at the worksheet they did last time. They will notice that there is a column for percentage distance that they need to figure out with the numbers they have to the left.
4. Ask the students to talk in their groups as to what calculation they can do to find a percentage as to how far each planet is away from the sun.
5. Have a discussion about it. (Divide each number by 300.)
6. By dividing each number by 300, we are able to find the percentage distance that each planet is away from the sun.
7. Have the students do the calculations.
8. With the percentage numbers we are now able to see a pattern as to where each of the planets lie in the solar system.
9. Pass out the "Converting to Percentages to Fractions" paper so the students can see how the percent can be changed to fractions.
10. Have the students follow along with you now.
    a. Uranus being at 48% is about half way (48 divided by 100) between the sun and Pluto, have the students put Uranus halfway between the sun and Pluto.
    b. Neptune being at 76% is about half way (76 divided by 100) between Uranus and Pluto, have the students put Neptune in the middle of Uranus and Pluto.
    c. Saturn being 24% is about half way (24 divided by 48) between the sun and Uranus, have the students put Saturn halfway between the sun and Uranus.
    d. Jupiter being at 13% is about halfway (13 divided by 24) between the sun and Saturn, have the students put Jupiter halfway between the sun and Saturn.

e. Mars being at 4% is about one-third the way (4 divided by 12) between the sun and Jupiter, have the students put Mars one-third the way between the sun and Jupiter.

f. Earth being at 2.5% is about two-thirds the way (2.5 divided by 4) between the sun and Mars, have the students put Earth two-thirds the way between the sun and Mars.

g. Venus being 2% is about three-fourths the way (2 divided by 2.5) between the sun and Earth, have the students put Venus three-fourths the way between the sun and Earth.

h. Mercury being 1% is about halfway (1 divided by 2) between the sun and Venus, have the students put Mercury halfway between the sun and Venus.

Reasoning

1. Pass out the Miles and Percentage Distance from the Sun Sheet. Go over the sheet with them.
2. Have a discussion why it doesn't matter what scale they put these percentages with for the planet ratios from the sun will always be the same.

Communicating:

1. Have the student communicate their finding by looking at the planets.
2. Have them share their explanations with each other making sure they are within the evidences they have.
3. Have the students take off the words and put the words on again according to their facts.