UbD Template 2.0 Modified

Grade Level: 6th

Topic or Content Area: ESS Science -Space

Please list the Big Idea or Ideas: **Analyzing and Interpreting Data** and **Scale, Proportion, and Quantity**

<table>
<tr><th colspan="3">Stage 1 Desired Results</th></tr>
<tr><td rowspan="4">ESTABLISHED GOALS

Standard: MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

1. The students will use their understanding of scale and proportion to create an accurate model of the solar system.
2. The students will analyze their model of the solar system, by comparing and contrasting their model to other group models.
3.

*Related Standards
<u>Math</u>:</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…

● <u>Analyze and interpret data to determine similarities and differences in findings.</u></td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS ccc/dci
Students will understand that…
● The accuracy of size and distance (scale) relationships within the model, including any scale limitations within the model.
● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.</td><td>ESSENTIAL QUESTIONS- Label Facets
1. What is in the universe, and what is Earth's place in it?
2. What makes the Earth a special part of the solar system?</td></tr>
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RATIOS AND PROPORTIONAL RELATIONSHIPS 6.RP Understand ratio concepts and use ratio reasoning to solve problems	***Acquisition***	
	Students will know…vocab ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.	*Students will be skilled at…sci/eng practices* ● Analyze and interpret data

Stage 2 - Evidence

Evaluative Criteria	**Assessment Evidence**
Text Message Exit Slip	a. To create a text message to a friend about their mini project hunt. They select one planet and describe how the real sun would look from their real planet compared to how we see the sun from earth. b. Rubric i.

Criteria	Approaching	Meeting	Exceeding
Claim		Scientifically correct and complete	
Evidence		Provides Appropriate and sufficient evidence to support claim	
Reasoning Completed		All the ideas to link evidence to claim are included	
Reasoning Accuracy		The evidence is tied to the	

	<table><tr><td></td><td></td><td>claim and explained</td><td></td></tr></table> ii.
Group Model/Calculations lab sheet	OTHER EVIDENCE: ● Lab sheet in turned in and completed ○ using their knowledge of scale/proportion to create a scale model of the solar system ● Group model has been checked off by teacher and has compared model with another peer group. ○ half of the group is making a **model** based on the **distance** of each planet from the sun ○ other members of the group are making a **model** based on the **diameter** size of the planets ■ analyze data from their scale model to explain their findings/model to a different group.

Stage 3 – Learning Plan

Summary of Key Learning Events and Instruction

Two part activity (two 45 minute classes)

- **Engage**: Gather students' attention to the board and display http://scaleofuniverse.com/ . Allow students time to write down questions in their science binder. After a few minutes, students will 'stand up, hand up, pair up' and have a conversation about their questions/what they noticed.
    - Today we will be using our information (from our data matrix from yesterday) to create a scale model of each planet's distance from the sun.
        - How far is Mars from the Sun? A volunteer reads the distance from their lab sheet.
        - How big is that?
    - Again state: Our task today is to build and create a scale model of the distances and size between the planets and the sun. In their science binder, allow students to complete a quick write " what is a scale model, give one example, and explain the limits and importance" (students always begin with a quick write and then, towards the end of unit, are provided a chance to go back in the quick write *with a different color pen* and add/make changes. Then the quick write is turned in.
- **Explore**: In three stations, students are adding too and using their data sheets to set up their proportions. Now, I have not told students what the ratio is going to be. Through these stations, students are trial/error what they think the best scale could be to design a solar system in the classroom. Basically, if we wanted to make a scale model of the solar system, how would you do that?
    - Collaborative Station: Working in pairs, students are using manipulatives (playing a proportion card game) and then creating their proportions for the planets.
    - Independent Station: Independently, students are watching a study jams video http://studyjams.scholastic.com/studyjams/jams/math/algebra/proportion.htm and creating their proportions

- Direct Station: Small group with teacher reviewing proportions/scale and allow students a safe place to practice applying their proportions to their planets.

- **Explain**: Now, students are placed in their lab groups and given their lab sheet for creating a scale universe model. Students will be able to explain how the solar system is much larger than we think it is. As I walk around to each group I emphasize, trying to understand how vast the universe is, can be difficult when we are so small. Students will be able to use the scale models tol help them grasp a better understanding of the size of the Solar System.
  - I review the lab sheet which explains the expectation of the mini project.
    - 6th graders will be setting up their own proportions to scale out each planet's distance/size from the Sun.
    - You may use a calculator
    - You must show the set up of each operation on your paper
    - 6th graders round to the nearest whole number
    - In a table on their lab sheet (students are now in pairs/groups), students will be filling out the following columns

Planet Name	Distance from Sun (KM)	Predict how many toilet paper squares each planet will be away from the sun	Squares of Toilet Paper out to Planet's Orbit

After students complete their model, they will finish answering the following questions on their lab sheet

  - On their lab sheet, students are answering the following questions:
    - Answer individually:
    - How do the planets compare in size (think about inner vs outer planets)?
    - Which planet is the largest? Smallest?
    - Which planet is most similar to the size of Earth?
    - Is Mars larger or smaller than Earth?
    - What surprised you most about this activity?
    - Answer as a group:
    - How is a scale model useful in demonstrating the sizes and distances of objects in the Solar System?
    - What did your group do well?
    - Where did your group struggle?
    - How would you describe the solar system to a friend who is not in this class?
    - How did building the model of the solar system change the way you visualize the solar system?

- What additions or changes would you make to the model if you could do it again?

- **Extend**: Big Question: Why did we not create the sun in our model, why did we only create the planets?
  - Have students complete the math and think about what the sun would look like if they were to create it a scale model similar to the other planets.
- **Evaluate**: To create a text message to a friend about their mini project hunt. They select one planet and describe how the real sun would look from their real planet compared to how we see the sun from earth. I collect their ticket at the end of class and use as a formative assessment. **See rubric in stage 2**

Materials and handouts:

- Lab Sheet
- Butcher paper (8 different colors for each planet)
  - Jupiter and Saturn will be about 1 meter in diameter, so make sure you measure the paper
  - inner planets will need smaller, obviously
- toilet paper (Scale one piece of TP = xKM)
- scissors
- markers
- game pieces for 'explore' stations

How Do the Planets Compare in Size?

The solar system is much larger than we think it is. Trying to understand how vast it is can be difficult when we are so small. Using scale models will help to grasp a better understanding of the size of the Solar System.

Helpful Hints

- 6th graders will be setting up their own proportions to figure out the diameter scale of each planet.
- 6th graders will be setting up their own proportions to scale out each planet's distance from the Sun.
- You may use a calculator
- You must show the set up of each operation on your paper
- 6th graders round to the nearest whole number (for distance) and tenth (millimeter) for size
- Place this lab sheet in your science binder (each student must have a record of the data)
- All done? Use your project to answer the questions in your notebook

After activity questions for your binder.

Answer individually:

• How do the planets compare in size (think about inner vs outer planets)?

• Which planet is the largest? Smallest?

• Which planet is most similar to the size of Earth?

- Is Mars larger or smaller than Earth?

- What surprised you most about this activity?

<u>Answer as a group:</u>

1. How is a scale model useful in demonstrating the sizes and distances of objects in the Solar System?
2. What did your group do well?
3. Where did your group struggle?
4. How would you describe the solar system to a friend who is not in this class?
5. How did building the model of the solar system change the way you visualize the solar system?
6. What additions or changes would you make to the model if you could do it again?

Differentiated version for students that struggle with setting up proportions

(90cm x Planet) ÷ Jupiters km =

Sizes of Planets

net	Actual Diameter in KM	Scale in CM
rcury	4,880	
nus	12,100	
rth	12,800	
rs	6,800	
piter	142,000	

turn	120,000		
anus	51,200		
ptune	48,600		

Distance of Planets from Sun

	Distance from Sun (KM)	Predict how many toilet paper squares each planet will be away from the sun	Squares of Toilet Paper out to Planet's Orbit
ury	57,910,000		

	108,200,000		
	149,600,000		
	227,940,000		
er	778,330,000		
n	1,429,400,000		
s	2,870,990,000		
une	4,504,000,000		

Sizes of Planets KEY

Planet	Actual Diameter	Scale in CM
Mercury	4,880	3

Venus	12,100	7.6
Earth	12,800	8.2
Mars	6,800	4.3
Jupiter	142,000	90
Saturn	120,000	76.1
Uranus	51,200	32.5
Neptune	48,600	30.8

Distance of Planets from Sun KEY

Planet	Distance from Sun (KM)	Squares of Toilet Paper out to Planet's Orbit
Mercury	57,910,000	1.28=1
Venus	108,200,000	2.4=2
Earth	149,600,000	3.3=3
Mars	227,940,000	5.06=5
Jupiter	778,330,000	17.28=17

Saturn	1,429,400,000	31.7=32
Uranus	2,870,990,000	63.74=64
Neptune	4,504,000,000	100