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Models on Earth and Space

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Overview

This interdisciplinary curriculum unit is based on the Teacher Institute of Philadelphia's seminar entitled "Is There Any Life in the Worlds Beyond Our Own?" The seminar discussed common misconceptions about the size of our universe and how these misconceptions can be corrected with instruction about scale. This unit discusses using scale to create models in both science and social studies to clear up misconceptions and develop a deeper understanding of content area topics. Students from first to third grade can benefit from this unit with modifications in response formats. Teachers may start in the beginning of the year and pull in many examples across social studies and science subjects. Starting at the beginning of the year will give students time to become comfortable with creating and using models across the curriculum.

During this unit students will develop higher order thinking skills such as comparing, contrasting, creating, assessing, and analyzing. They will learn the purpose of models and how scientists use scale to study very large or small objects. Students will learn to create models and use them to explore the world around them. The culminating activity will be a model of the solar system based on distance to be displayed in the school neighborhood.

Rationale

Models are tools used in subjects such as science, social studies, math, and even reading to represent objects, relationships and behaviors (Schweingruber, Shouse, Michaels, & National Research Council, 2007). Models in social studies and science might help students understand a map or the parts of a plant. In math, students can use models to represent and interpret data. Models can be written descriptions, 2-dimensional drawings, or 3-dimensional structures. Students entering school can benefit from having ways to build on their knowledge of the natural world as well as to clear up any misconceptions (Duschl, Schweingruber, & Shouse, 2007).

Accurate models of the solar system, for instance, can give students perspective about distances between planets, stars, and across galaxies.

Models give students something finite to interact with. Many subjects, like the solar system or a germ, are too abstract for students to understand. How far planets are away from each other or how small a germ is might be hard to visualize. Students in all grades can use models as a way to visualize objects and the processes they go through (Schweingruber, Shouse, Michaels, & National Research Council, 2007). This unit adds a deeper level of understanding than just reading about a subject. Students have the chance to create and experience what they are learning about.

Objectives

This curriculum unit will progress through two social studies (studying maps and communities) and two science units (studying plants and the solar system).

During the map investigation students will:

- Investigate the purpose of maps
- Identify the main characteristics of maps
- Create a map of their own
- Evaluate the usefulness of a map
- Read, listen to, and watch informational text about maps

During the communities investigation students will:

- Read, listen to, and watch informational text about communities
- Investigate the purpose of communities
- Identify the main characteristics of a community
- Plan a community
- Justify the components of planned community

During the plant investigation students will:

- Read, listen to, and watch informational text about plants
- Identify the parts of a plant and their uses
- Construct a model of a plant

During the solar system unit students will:

- Read, listen to, and watch informational text about the solar system
- Identify characteristics of each planet as well as their distance from the sun
- Plan a model of the solar system
- Construct model in school neighborhood

Strategies

Students and teacher will use many strategies throughout this unit to gather, interpret and apply information.

Close Reads: Teacher will model and guide students through reading informational text closely with a question in mind.

Read Alouds: Teacher will read some texts aloud modeling how to gather and interpret information.

Think Alouds: Teacher will use think alouds during close reads and read alouds in order to model this strategy. Students will use this strategy as well during their independent reading.

Graphic Organizers: Teachers and students will gather information learned on graphic organizers specifically T charts, webs, and KWLs.

Independent Reading: Students will read independently to gather information for each unit.

Lessons:

Lesson One

Objective:

Students will state what a model is and list a model's use in science.

Materials:

- Several models of a body part such as a hand, tongue, finger etc.
- Chart paper
- Markers

Procedure

- Split students into small groups of four or five students
- Give each group a model and ask them to come up with a definition for what a model is and what it might be used for.
- Collect ideas from each group as they explore and discuss
- Discuss how the model might be used by scientists
- These ideas can be added to a T-chart
- Show students the first minute of youtube video [What is A Model?](#)¹
 - Pause to validate any correct guesses or information that students came up with
 - Adjust or add to the definition of a model.
 - Bookmark this video as it will be referred to in another lesson
- Come up with a working definition for a model and add it to chart paper
 - Display somewhere in the room as this will be referred to throughout the unit
- Give students exit ticket
 - Exit ticket can ask students to identify a model and write what it might be used for.

¹ Short Youtube video explaining what a model is and what it is used for.

Lesson Two:

Objective:

- Students will identify characteristics and purposes of maps
- Students will identify maps as a kind of model

Materials:

- Me On the Map by Joan Sweeney²
- Chart paper with Venn Diagram

Procedure:

- Read Me on the Map to students
- Fill in Venn Diagram as class with characteristics of a map, comparing a map to previously explored models
- Watch next section of [What is a Model?](#)³ Video (1:00 to 1:40)
- Give students exit ticket

Lesson Three:

Objective:

Students will explore scale and the difference it makes for maps

Materials:

- 2 maps of classroom created by teacher
 - 1 map should include objects in classroom in general order and distance
 - 1 map should follow the scale of one cm on the map being equal to one foot on a ruler
- Prize for students such as stickers, pencils, or small toys
 - Should be used as “treasure” on map
- Chart paper
- Rulers

Procedure:

- Review purpose of maps
- Show students teacher created map and discuss how to find the treasure
 - Guide students in discussing why the map is difficult to follow (due to it not being exactly like real life)
- Demonstrate following a scale
 - Use second map and show how one cm on the map is equal to one foot (or entire ruler length) in real life.
- Guide students in measuring distance from a central part of the classroom (such as the door or carpet) to the treasure

² Read aloud book that shows how maps can represent places that are close by or large far away places.

³ Second part of the video on models. Discusses uses of models and scale.

- Give students practice in finding other areas of the classroom using the map
- Discuss as a class why scale on a map matters

Lesson Four:

*This lesson will likely take more than one day

Objective:

Students will create their own map and test effectiveness

Materials:

- Rulers
- Paper
- Pencils
- Crayons

Procedure:

- Review the purpose of a map and how to use a scale
- Break students into groups of four and give them an area of the classroom, hallways, schoolyard etc.
- Ask students to use what they know to create a map of the area
- Allow time, give guidance, and make examples students used in class accessible
- Allow students to present their maps and demonstrate using their map to get from one area to another
- Discuss as a class how effective the maps were
 - This is a difficult concept for students at the primary level. You might introduce scale calculators at this time as a way to make creating scaled models easier.

Lesson Five:

Objective:

Students will identify parts of a plant and their uses

Materials:

Procedure:

- Show students video [*The Parts of a Plant*](#)⁴
- Discuss how a model of a plant might help scientists learn about plants
- Have students label a plant through a worksheet
 - Students could also use Google Drawings

Lesson Six:

Objective:

Students will explore scale and the difference it makes for plants

Materials:

- Pictures of trees of varying heights

⁴ Short song about the parts of a plant.

Procedure:

- Review previous discussion on how scientists might use a model of a plant to learn
- Ask students to turn and talk about what a model for a tree might look like
 - Guide students in discussing scale and how scientists would need to make a much smaller version of a tree
- Discuss the similarities between a scale on a map and a scale on a model of a plant
- Demo calculating scale using a [scale conversion website](http://jbwid.com/scalcalc.htm)⁵ (<http://jbwid.com/scalcalc.htm>)

Lesson Seven:

*This lesson may take more than one day to complete

Objective:

Students will create a model of a plant to show how plants get what they need to live

Materials:

- Straws or chenille stems
- Clay or playdough
- Construction paper
- Scissors
- Glue or tape
- Several pictures of plants with measurements included

Procedure:

- Group children by four or five and give them a picture of a plant
- Allow students to plan while you meet with each group
 - While meeting with each group the teacher can enter the actual measurements into a scale calculator. Students will create their models based off of the scale measurements given by the calculator.
 - Give students time to build their model and create presentations.
- Ask each group to present their models and how the parts work

Lesson Eight:

Objective:

Students will investigate and discuss community helpers and roles

Materials:

- Chart paper with Community written at top
 - Paper should have “Group of People working, living, playing, and learning together” at the top.
- Short text on a school community helper

Procedure:

- Read students definition of community
- Discuss schools as a type of community

⁵ Website that takes the actual measurement of an object and gives you the scaled measurements.

- Have students identify things that a school community provides to its members such as food, clean spaces, education.
- Record these services on the chart.
- Model using close reading strategies to discover these services
- Teachers can use short nonfiction articles or picture books
 - Readworks.com has many leveled nonfiction passages that can be used by teachers and students.
- Discuss how a school might run differently if this person was missing
- Give exit ticket

Lesson Nine

***This lesson could include technology by allowing student to gather information on Google Slides or Google Drawings**

Objective:

Students will identify community helpers and their roles

Materials:

- Copies of nonfiction titles about community helpers
 - Texts should reflect the students' reading levels and interests
- Individual T-charts with community helper on one side and their role on the other

Procedure:

- Remind students about the definition of community
- Break students into small groups to look for examples of community helpers
 - Students can be broken into groups based on reading level or interest.
 - Grouping can also depend on the classroom's access to nonfiction books about community helpers.
- Gather groups and chart answers from each
- Discuss how the community would run if one or more of the community members were missing.

Lesson Ten

***This lesson will likely take a few periods in class. This lesson could also be completed using digital tools such as Google Drawings or Slides.**

Objective:

Students will create a model of a community. Students will justify their model based on community needs.

Materials:

- Nonfiction texts about community helpers
- Shoe boxes, cereal boxes, or milk cartons
- Construction paper
- Scissors

- Markers, crayons
- Rulers

Procedure:

- Group students into groups of four
 - Make sure students have previously gathered information about community helpers as well as nonfiction texts to gather information from.
- Guide students into creating their own model of a community
 - Discuss the different ways students can show their model including drawing, written description, or 3-dimensional structure.
 - Students will justify their reasoning for the members and structures that they include in their community.

Lesson Eleven

*This lesson will likely take more than one day to complete

Objective:

Students will identify planets in the solar system and their major characteristics

Materials:

- Chart paper
- Pencils
- Crayons
- Drawing paper or worksheets

Procedure:

- Show students [Solar System Song](#)⁶
 - Pause after each planet to gather notes on chart paper or Google Slides
 - After each planet discuss implications for a model
 - Ask students to label map of solar system using worksheet for Google Drawings

Lesson Twelve

*This lesson will likely take more than one day to complete

Objective:

- Students will discuss some reasons that scientists might want a model of the solar system
- Students will explore scale and the difference it makes for a solar system model
- Students will create a model of the solar system that is to scale

Materials:

- Chart paper
- Materials for creating planets
 - Could be planned with students keeping in mind that the model will be outside

Procedure:

- Discuss as a class a need for an accurate model of the solar system

⁶ Slow song with information about each planet.

- Show [website](#)⁷ with scrollable solar system
 - Discuss challenges with making a solar system model to scale
 - Suggest starting with planning the sun and making the rest of the planets scaled from there
 - Show students the [scale calculator](#) made specifically for planets.
 - Form groups of students and assign them two planets each to create
 - Allow students time to plan materials and sizes
- *This could be a stopping point until the next day
- Allow students time to create the planets with acquired materials
 - Look at map or walk through the school neighborhood to plan where the model might go.

Standards:

1.2 Reading Informational Text: Students read, understand, and respond to informational text with emphasis on comprehension, making connections among ideas and between texts with focus on textual evidence.

1.5 Speaking and Listening: Students present appropriately in formal speaking situations, listen critically, and respond intelligently as individuals or in group discussions.

3.1.3.A Identify the structures in plants that are responsible for food production, support, water, transport, reproduction, growth, and protection.

3.3.4.B1 Identify planets in our solar system and their basic characteristics. Describe the earth's place in the solar system

Annotated Bibliography

Resources for Teachers

1. Duschl, R. A., Schweingruber, H. A., & Shouse, A. W. (2007). Taking science to school. *Learning and teaching science in grades K-8*. Washington, DC: National Academies Press.

- Discusses how children learn and

2. Schweingruber, H. A., Shouse, A. W., Michaels, S., & National Research Council. (2007). *Ready, set, science!: Putting research to work in K-8 science classrooms*. National Academies Press.

- Book about teaching K-8 students science. Chapter six is all about using models

Resources for Students

⁷ Really cool website that allows students to see just how big the solar system is and how difficult making a model that is truly to scale would be.

3.[scibuzz]. (2010, Sept. 9). *What is a Model*. [Video File]. Retrieved from https://youtu.be/OKA4_J5yeoU.

- Short and entertaining video defining scientific models and how they can be refined for accuracy.

4.[Harry Kindergarten]. (2015, Oct. 17). *The Parts of a Plant (song for kids about flower/stem/leaves/roots)*. [Video File]. Retrieved from https://youtu.be/ql6OL7_qFgU.

- Song about the parts of a plant and what they do to keep plants alive.

5.[kidsTV123]. (2011, June 21). *The Solar System Song*. [Video File]. Retrieved from https://youtu.be/BZ-qLUIj_A0.

- Song giving information about each planet in the solar system.

6.Sweeney, J. (1996). *Me on the Map*. Crown.

- Picture book discussing the format and uses of maps.

7.If the Moon Were Only 1 Pixel. (n.d.). Retrieved June 16, 2017, from http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html

- Website that allows children to see distances in the solar system to scale. Children scroll to the left for long periods of time until they get to the next planet. Website also allows students to skip ahead to the next planet. Fun resource that show just how difficult it would be to make a model that was truly to scale in real life.

8.Enevoldsen, K. (1970, January 01). Solar System Scale Model Calculator. Retrieved June 16, 2017, from <http://thinkzone.wlonk.com/SS/SolarSystemModel.php>

- Website that will calculate the scaled planet diameters and planet-sun distances for a solar system model.