5E Solar System Lesson Plan

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Topic: Solar System
Grade Level: 4th-7th

Materials:
- Computer
- Scratch paper
- Inflatable balls of varying sizes

Additional Materials:
- Supplemental worksheets for LD and EL Students.

Next Generation Science Standards:

MS-ESS1-1.
Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-PS2-4.
Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Common Core State Standards:

CCSS.ELA-LITERACY.RI.6.7
Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

CCSS.ELA-LITERACY.RI.5.7
Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

Science and Engineering Practices (SEP):

SEP 1- Asking Questions and Defining problems
SEP 2- Developing and Using Models

Crosscutting Concepts (CCC):

CCC2- Cause and effect: Mechanism and Exploration
CCC4- Systems and System Modes

Integration with Math Practices (MP):

MP4- Model with Mathematics
MP5- Use appropriate tools
MP7- Look for and make use of Structure

Lesson Objectives:
Students will be able to:
- Investigate and describe the movement of planets in our solar system
- Use the Scratch program to demonstrate their understanding of the movement of Earth's rotation around the Sun.

Misconceptions:
- The earth is the center of our solar system.
- The earth rotates clockwise around the sun.

Differentiation strategies to meet diverse learner needs:

EL Students: EL students will be provided with supplemental glossary definitions, and pictures for the academic vocabulary words. These students will be provided with a visual guide of the instructions for Hour of Coding and the Scratch program.

LD Students: LD students will be provided with a worksheet with coding directions and visuals to help guide them when using scratch.

Gifted Students: Gifted students will be asked to complete all 20 cases in Hour of Code if they find the task of 12 cases not challenging enough.

Engagement:
- Teacher will give a demonstration using an inflatable balls of varying sizes. The teacher will hold up the largest inflatable ball to represent the sun and have students orbit around it using the other inflatable balls to represent each planet. The teacher will explain how different planets orbit around the sun in our solar system. The demonstration will be supplemented with a Youtube video: https://www.youtube.com/watch?v=libKVRa01L8 .

Exploration:

I. Students will participate in a solar system project in which they will code an animation of Earth's rotation around the sun.
   A. First, students will follow the link to get to Hour of Code: http://studio.code.org/hoc/1
      1. They will complete the first 12 cases.
      2. Students with extra time can challenge themselves by completing all 20 cases.
   B. Students will then implement physical movement into the lesson
      1. In pairs, students will make a circle (one student will represent the sun and the other the earth)
      2. Students will decide whether the Earth will rotate/revolve around the sun clockwise or counter-clockwise.
      3. Students will be asked to remember how many steps they are from the sun and the degree of their body movement from the sun.
   C. Third, students will go to http://scratch.mit.edu/projects/101840846/ to begin to code their solar system animation.
      1. Students will be asked to complete the code through step 2.
         a) The earth is 92.96 million miles away from the sun. To imitate

this distance, create a variable for the number of miles (93) and when the program is started, add code to the Earth model (snippet) to go to position x, y on the Stage, where x=miles and (y=0).

b) The Earth revolves around the sun (counterclockwise or clockwise?). Add the necessary code to the earth model (snippet) to imitate this motion (Hint: we do not want this motion to stop!)

Explanation:

- Students will differentiate planets from stars through group discussions.
- Students will validate that the earth spins counter clockwise through the solar system animation they create using Scratch.
- Students will be able to design, develop, and create a replica of the solar system using the Scratch Program.

Extension:

- Students will add two components to the Solar System project. For example: additional planets, different angles/direction, stars, etc. Use additional loops, variables, and more. Make it creative!

Evaluation:

- Students will be able to understand and code the following problems by submitting:

1. A URL to the new Scratch project you created.
2. Answer the following questions:
    a. Describe what your new Solar System program (with the added components) does in your own words (not code)?
    b. Identify key components you took to approach this extended project.
    c. In your own words, provide a step by step procedure on how coded it? For example, for our solar system project we:
        i. placed the sun in the middle
        ii. then moved the earth 90 million miles away from the sun
        iii. then the earth moved up
        iv. in an infinite loop it turned 5 degrees left, and moved 3 steps
    d. What new project idea based on this experience would you use in your future teaching (science or any other subject area)?

- Teachers will evaluate students' submissions using the computational thinking (CT) rubric. See appendix.

Resources:

- https://www.youtube.com/watch?v=libKVRa01L8
- https://studio.code.org/hoc/1
- https://scratch.mit.edu/projects/101840846/
- Project originally created by Dr. Hanna Kim and Dr. Rachel Adler.

APPENDIX

A. Computational Thinking Rubric

\ Quality Criteria \	No/Limited Proficiency (1 pt.)	Some Proficiency (2 pts.)	Proficiency (3 pts.)	High Proficiency (4 pts.)
Decomposition of a problem into smaller, more manageable parts	Not able to break down the problem	Recognizes some parts of the problem but unable to identify key contributing components	Identifies the key components that contribute to the problem	Identifies the key components that contribute to the problem and describes their significance
Ability to manipulate variables/paramete rs for desired result	Unable to differentiate between different variables/parameters or determine their effect upon the model	Understands significance of variables/parameters, but cannot properly change them to cause variations in the model	Has good grasp of significance of variables/parameters; is able to manipulate models accordingly after initial instruction	Has excellent grasp of variables/parameters; is able to change models correctly with little guidance
Analyze and interpret program output or data	Unable to describe program output or data	Describes program output or data, but incorrectly interprets the meaning	Correctly interprets the meaning of the program output or data	Correctly interprets the meaning of the program output or data and draws conclusions within the context of the program's limitations
Use algorithmic thinking to modify or construct computer code	Cannot develop steps to modify or construct computer code	Begins to develop steps to modify or construct computer code, but some steps are missing or not in a logical order	Series of steps to modify or construct computer code is complete and in logical order	Series of steps to modify or construct computer code is complete, in logical order, and efficient
Generalize to another problem or discipline	Cannot conceive of how the program could be transferred to address another problem	Relates program's problem-solving process to another context, but with flawed logic	Logically describes a broader application of the program's problem-solving process to address another problem	Logically describes broader applications of the program's problem solving process to address problems in multiple disciplines