Richmond Public Schools

Department of Curriculum and Instruction
Curriculum Pacing And Resource Guide – Unit Plan

Course Title/ Course #: Life Science

Unit Title/ Marking Period # (MP): LS.1 Scientific Investigation: Experimental Design; MP1

Start day: *See RPS Pacing Guide

Meetings (Length of Unit): 2Weeks (Continue reviewing standard throughout entire school year)

Desired Results ~ What will students be learning?

Standards of Learning/ Standards

LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which

a) data are organized into tables showing repeated trials and means;

b) a classification system is developed based on multiple attributes;

c) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and probeware are used to gather data;

d) models and simulations are constructed and used to illustrate and explain phenomena;

e) sources of experimental error are identified;

f) dependent variables, independent variables, and constants are identified;

g) variables are controlled to test hypotheses, and trials are repeated;

h) data are organized, communicated through graphical representation, interpreted, and used to make predictions;

i) patterns are identified in data and are interpreted and evaluated; and

j) current applications are used to reinforce life science concepts.

Essential Understandings/ Big Ideas

The concepts developed in this standard include the following:

- The nature of science refers to the foundational concepts that govern the way scientists formulate explanations about the natural world. The nature of science includes the following concepts
  a) the natural world is understandable;
  b) science is based on evidence - both observational and experimental;
  c) science is a blend of logic and innovation;
  d) scientific ideas are durable yet subject to change as new data are collected;
  e) science is a complex social endeavor; and half the genetic material of the parent.
  f) scientists try to remain objective and engage in peer review to help avoid bias.

- Expected results are reflected in the organization of a data table, which includes areas to record the number of repeated trials, levels of the independent variable, measured results for the dependent variable, and analysis of the results, by calculation of mathematical means.

- Scientists create and apply classification systems to organize information and discern patterns.

- Appropriate tools and techniques are used to gather data during scientific investigations. Measurements are collected using the International System of Units (metric units) of measurement.

- Mental and physical models, including computer and other simulations, can be helpful in explaining even or sequences of events that occur. They can be used as part of scientific explanations to support data or represent phenomena, especially those that are not easily seen directly or must be inferred from data.

- Potential sources of error in the experimental design must be identified.

- To communicate the plan of an experiment accurately, the independent variable, dependent variable, and constants must be explicitly defined.

- To establish that the events of an experiment are the result of manipulating the independent variable, the experiment must be controlled by observing the effects without the application of the independent variable. The results can be compared with this standard or control. Not all experiments have a control.
- Multiple trials of an experiment must be conducted to verify the results.

- Analysis of observed results of systematic investigations includes construction and interpretation of graphs. Such interpretation can be used to make predictions about the behavior of the dependent variable in other situations and to explore potential sources of error in the experiment. This analysis can be used to support conclusions about the results of the investigation.

- Investigations can be classified as observational (descriptive) studies (intended to generate hypotheses), or experimental studies (intended to test hypotheses).

- Science concepts are applied through observations and connections with everyday life and technology.

Key Essential Skills and Knowledge

In order to meet this standard, it is expected that students will

- Make connections between the components of the nature of science and their investigations and the greater body of scientific knowledge and research.
- Design a data table to organize all components of an investigation in a meaningful way.
- Develop and use a classification system that uses numerous attributes to organize information and discern patterns.
- Select and use appropriate tools and techniques for collecting qualitative and quantitative data in classroom and field investigations.
- Create and use mental and physical models (including simulations) as ways to visualize explanations of ideas and phenomena.
- Identify potential sources of error in the design of an experiment.
- Evaluate the design of an experiment and the events that occur during an investigation to determine which factors may affect the results of the experiment. This requires students to examine the experimental procedure and decide where or if they have made mistakes.
- Identify what is deliberately changed in the experiment and what is to be measured as the dependent variable.
- Analyze the variables in an experiment and decide which ones must be held constant (not allowed to change) in order for the investigation to represent a fair test. This requires students to comprehend what "variables" are and to apply that idea in new situations related to the Life Science Standards of Learning concepts.
- Determine the specific component of an experiment to be changed as an independent variable and control the experiment by conducting trials for the experiment in which the independent variable is not applied. This

requires the student to set up a standard to which the experimental results can be compared. The student must use the results of the controlled trials to determine whether the hypothesized results were indeed due to the independent variable.

- Construct appropriate graphs, using data sets from investigations. This requires the student to recognize that a line graph is most appropriate for reporting continuous or real time data. This also requires a student to comprehend which points along the line that are not actual data points can be used to make predictions. Students should be able to interpret and analyze these graphs.

- Distinguish between observational and experimental investigations.

- Develop conclusions based on a data set and verify whether the data set truly supports the conclusion. This requires students to cite references to the data that specifically support their conclusions.

Vocabulary

chart		individual trials
constants		infer
dependent variable		interpret
drawing conclusions		mean
explanation		prediction
graph		repeated trials
group trials		theory
hypothesis		variable
independent variable		hypothesis

Assessment Evidence ~ What is evidence of mastery? What did the students master & what are they missing?

Assessment/ Evidence

TSWBAT: (Choose **ONE** or more to collect evidence of mastery)

1. Demonstrate proficiency on a teacher-generated assessment created on Interactive Achievement
2. Complete GIZMO Assessment with passing score
3. Scientific Method Quiz with a passing rate of 80% or above.
4. Identify the independent variable, dependent variable, constant, control and experimental group in scenarios created by teacher.
5. Students will be required to locate a science related article. They will be able to identify and explain how the scientific method is involved in the pursuit of knowledge or in the solving of a problem? Students will present a summary of their articles to the class, along with their own thoughts on the importance of the information.

Learning Plan ~ What are the strategies and activities you plan to use

Learning Experiences/ Best Practice

- Students will answer questions such as; What is a hypothesis? What are the different parts of a hypothesis?
- The teacher will present a power point presentation on the Scientific Method and how to create a hypothesis and students will fill in their Cornell notes as they listen. Students will then practice writing a hypothesis based on a scenario the teacher develops.
- Students will conduct an experiment in class that relates to how the temperature of water affects the rate in which ice melts?
- Students will collect temperature data for their cities over five days, determine the most effective way to organize their data on a chart, and create the chart for display.
- Performance-based tasks
- Teacher observation of students engaged in cooperative learning investigations
- Use of vocabulary in the classroom discussions and as they carry out science investigations.
- Research papers can include topic such as: new scientific discoveries, famous scientist and their path to discovery

MWEE Connection: Using the steps involved with scientific inquiry, students will have the opportunity to test how acid rain affects plant germination and growth. Groups of students will use Bottle Biology (http://www.bottlebiology.org/) to grow radish plants with neutral and acidic water. Radishes grow quickly and easily. The teacher will provide the procedure, and students will gain practice forming hypotheses, evaluating data, and making conclusions.

Technology Integrations

Brain Pop:
Username: rpschools Password: 4me2use
Scientific Method
Science Projects
Metric Units
Standard and Scientific Notation
Precision and Accuracy

Gizmos:
Mean, Median and Mode:
Triple Beam Balance:
Effect of Environment on New Life Form:
Pendulum Clock:
Effect of Temperature on Gender:
Seed Germination:
Disease Spread:
Graphing Skills:

Videos:
United Streaming/Discovery Education

- Video Title: Scientific Method and Measurement
- Video Title: How Scientist Work: What is Scientific Inquiry
- Video Title: The Scientific Method

Trade Books:

- *Scientific Method Investigation: A Step-by-Step Guide for Middle-School Students (Science Activity Books)* by Schyrlet Cameron, Carolyn Craig & Sherryl Soutee
- *Case Closed?* by Susan Hughes
- *The Robin Makes a Laughing Sound* by Sallie Wolf
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Resources

Lessons and Worksheets:

- Experimental Design Analysis
- M&M Lab: The Scientific Method
- Thumb Wrestling
- Bikini Bottom Olympics
- Senses Lab
- The New Scientific Method
- Real World Science: Scientific Method
- Biology & The Characteristics of Life
- Scientific Inquiry
- Helena Easter- Live Binder

Cross Curricular Connection

Math – Students will be given various thermometers (oven, freezer and medical thermometers) to measure temperature to see differences in range of scale and design.

English – Students will create a Haiku based on vocabulary words in standard

History – Pupils will investigate the different ways ancient civilizations dyed fabrics and determine whether different vegetables such

as red cabbage, parsley, spinach, turmeric, tea, coffee grounds and etc would make good dyes.

Art –Students will create a poster illustrating the steps involved with the scientific method.