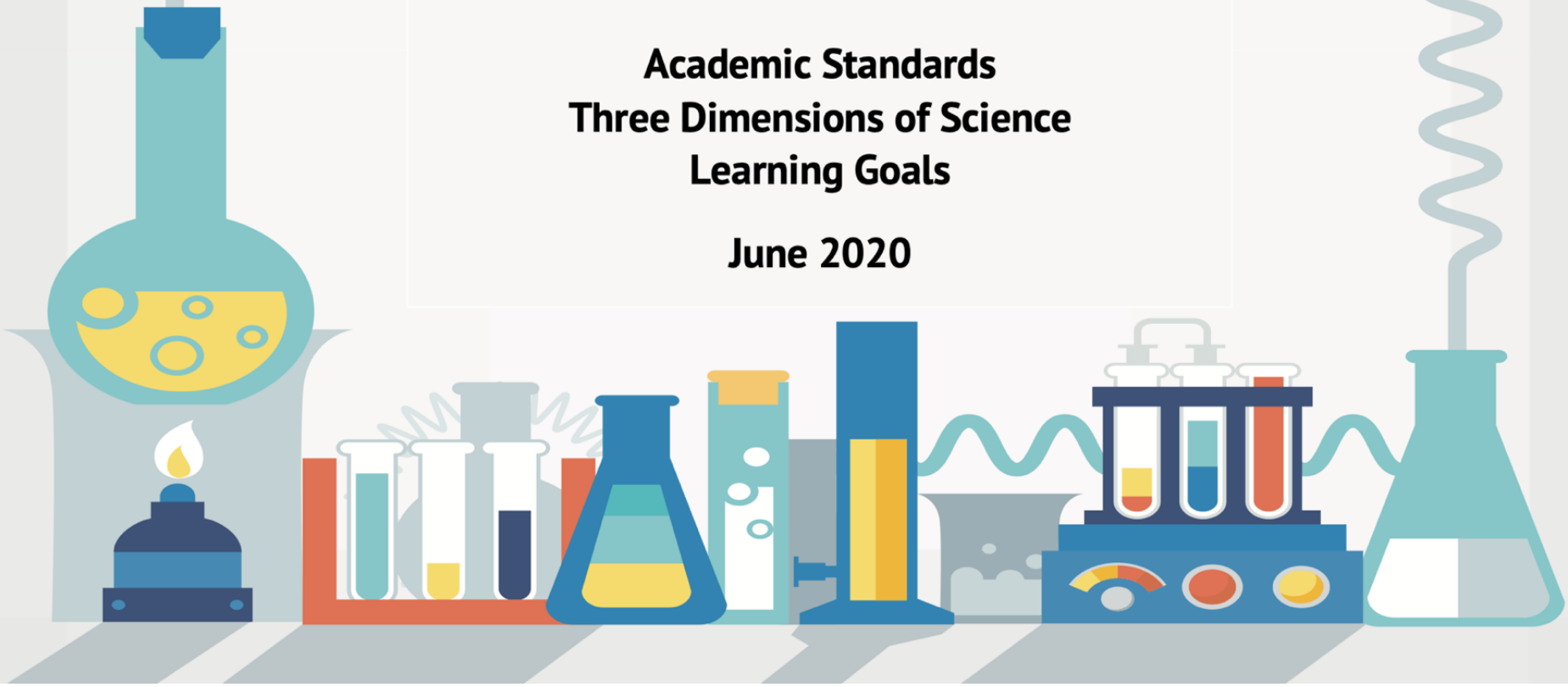
ENVISION 21

DEEP LEARNING • CFSD

SCIENCE

Academic Standards
Three Dimensions of Science
Learning Goals

June 2020



CATALINA FOOTHILLS SCHOOL DISTRICT
GRADE 4 SCIENCE STANDARDS

OVERVIEW

By the end of fourth grade, students deepen their understanding of forces and energy; explore different types of energy and the ways in which energy is used and transferred; learn how geological systems change and shape the planet and provide resources; and develop an understanding of the internal and external structures that support survival, growth, and reproduction. Student investigations focus on collecting and making sense of observational data and simple measurements using the science and engineering practices. While individual lessons may include connections to any of the crosscutting concepts, the standards in fourth grade focus on helping students understand phenomena through the crosscutting concepts of *systems and system models*, *energy and matter*, and *stability and change*.

PHYSICAL SCIENCE

4.P2U1.1 Ask questions and investigate the relationship between light, objects, and the human eye.

- Ask questions about the relationship between light, objects, and the human eye (*i.e., light, reflection, lenses, sight, color*):
    - Ask scientific (testable) questions based on careful observations of phenomena and information.
    - Ask questions to clarify ideas or request evidence.
- Investigate the relationship between light, objects, and the human eye (*e.g., through experimentation, texts, media, demonstrations*):
    - Formulate a reasonable prediction based on patterns such as cause and effect relationships.
    - Gather information from grade-level texts in response to the testable question(s).
    - Make direct and/or indirect observations about light, objects, and the human eye.
    - Collect appropriate data about the relationship between light, objects, and the human eye.
    - Identify patterns that provide evidence for an explanation of the phenomenon.

4.P4U1.2 Develop and use models to describe how light and sound waves transfer energy.

- Develop models (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show how light and sound waves transfer energy.
    - Develop models using an analogy, example, or abstract representation to show how sound and/or light waves transfer energy.
    - Represent how energy can be moved from place to place through sound or light waves.
    - Represent how the collision of objects can produce sound waves.
    - Represent the regular patterns of motion of light and/or sound waves.
    - Represent the role of heat in energy transfer.
    - Represent wavelength and amplitude in light and/or sound waves.
    - Compare models to identify common features and differences.
    - Use criteria to collaboratively revise models to improve their representation of how light and/or sound waves transfer energy.
- Use models to describe how light and sound waves transfer energy.

- Use models to describe how energy can be moved from place to place through sound or light waves.
- Use models to describe how the collision of objects can produce sound waves.
- Use models to describe the regular patterns of motion of light and/or sound waves.
- Use models to describe the role of heat in energy transfer.

4.P4U1.3 Develop and use a model to demonstrate how a system transfers energy from one object to another even when the objects are not touching.

- Develop a model (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show how a system transfers energy from one object to another even when the objects are not touching.
    - Develop models using an analogy, example, or abstract representation to show how a system transfers energy from one object to another.
    - Represent energy transfer from one object to another when the objects are touching (*i.e., collisions*).
    - Represent energy transfer from one object to another when the objects are not touching (*i.e., light, sound*).
    - Compare models to identify common features and differences.
    - Use criteria to collaboratively revise models to improve their representation of how a system transfers energy from one object to another.
    - Identify limitations of models.
- Use models to demonstrate how a system transfers energy from one object to another.
    - Use models to demonstrate how energy transfers from one object to another when the objects are touching (i.e., collisions).
    - Use models to demonstrate how energy transfers from one object to another when the objects are not touching (i.e., light, sound).
    - Use models to demonstrate the relationship between movement and energy.

4.P4U1.4 Analyze and interpret data to determine how and where energy is transferred when objects move.

- Analyze and interpret data (*e.g., from texts, investigations, demonstrations, models, etc.*) about how and where energy is transferred when objects move:
    - Ask questions about energy transfer to frame the data analysis and interpretation.
    - Organize data into meaningful categories regarding energy transfer through sound, light, and heat.
    - Organize data into meaningful categories regarding changes in energy that occur when objects collide.
    - Display data in tables and graphs, using digital tools when feasible, to reveal patterns and relationships.
    - Use data to evaluate relationships between energy transfer and motion.
    - Compare data collected by different groups in order to discuss similarities and differences in their findings.
    - Interpret data to make sense of how and where energy is transferred through sound, light, and heat.
    - Interpret data to make sense of changes in energy that occur when objects collide.

4.P4U1.5 Develop and use a model that explains how energy is moved from place to place through electric currents.

- Develop a model (e.g., diagram, drawing, physical replica, diorama, dramatization, or storyboard) to show how energy is moved from place to place through electric currents:
    - Use an analogy, example, or abstract representation to show how energy is moved from place to place through electric currents.
    - Use evidence from observations, investigations, and/or other resources to represent how energy is moved from place to place through electric currents.
    - Compare models to identify common features and differences.
    - Use criteria to collaboratively revise models to improve the representation of how energy is moved from place to place through electric currents.
- Use a model to explain how energy is moved from place to place through electric currents.

4.P4U2.6 Design and evaluate ways to increase or reduce heat from friction between two objects.

- Design ways to increase or reduce heat from friction between two objects (*e.g., by changing texture, amount of time, amount of pressure*):
    - Identify the design challenge.
    - Identify goals for the design.
    - Use tools and materials to develop multiple designs.
    - Communicate designs through sketches, drawings, or physical models.
- Evaluate the effectiveness of different designs:
    - Test multiple designs.
    - Make observations about the amount of heat produced through different designs.
    - Describe the strengths and weaknesses of the designs.
    - Compare two or more designs based on observations, strengths, and weaknesses.

4.P4U3.7 Engage in argument from evidence on the use and impact of renewable and nonrenewable resources to generate electricity.

- Evaluate perspectives regarding the use and impact of renewable resources to generate electricity:
    - Respectfully provide and receive critiques on arguments with peers by citing relevant scientific evidence and posing specific questions.
    - Cite relevant evidence and pose specific questions to peers regarding the use and impact of renewable and nonrenewable resources to generate electricity.
    - Identify and explain different perspectives regarding the use and impact of renewable and nonrenewable resources to generate electricity.
- Construct, use, and present oral and written arguments regarding the use and impact of renewable and nonrenewable resources to generate electricity:
    - State and defend a claim regarding the use and impact of renewable and nonrenewable resources to generate electricity.
    - Construct and/or support arguments with scientific evidence, data, and/or a model.
    - Compare and refine arguments based on the strengths and weaknesses of the evidence presented.
    - Compare natural resources, their sources, and ways they are used to generate electricity.
    - Use data to justify uses of renewable and nonrenewable resources to generate electricity.

EARTH AND SPACE SCIENCES

4.E1U1.8 Use models to explain seismic waves and their effect on the Earth.

- Use evidence from models (*e.g., diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations*) to explain seismic waves and their effect on the Earth:
    - Explain how energy from earthquakes produces seismic waves.
    - Describe the wavelength and amplitude of seismic waves.
    - Explain how seismic waves travel through the Earth.
    - Explain how seismic waves affect the Earth (*e.g., landslides, ground rupture, tsunamis, liquefaction, etc.*).
    - Describe the effects of earthquakes of varying magnitude and intensity.

4.E1U1.9 Develop and/or revise a model using various rock types, fossils location, and landforms to show evidence that Earth's surface has changed over time.

- Develop and/or revise a model (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show evidence that Earth's surface has changed over time.
    - Develop and/or revise models using an analogy, example, or abstract representation to show evidence that Earth's surface has changed over time.
    - Develop and/or revise models using various rock types (*e.g., sedentary, metamorphic, igneous*), fossil locations (*e.g., above or below rock layers, in particular geographic locations*), and landforms (*e.g., rivers, glaciers, faulting/fractures*) to show how the Earth's surface has changed over time.
    - Compare models to identify common features and differences.
    - Use criteria to collaboratively revise models to improve their representation of how the Earth's surface has changed over time.
    - Identify limitations of models.

LIFE SCIENCE

4.L1U1.10 Develop and use models to explain that plants and animals (including humans) have internal and external structures that serve various functions that aid in growth, survival, behavior, and reproduction.

- Develop models (*e.g., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards*) to show the internal and external structures and functions of plants and animals to support growth, survival, behavior, and reproduction:
    - Use an analogy, example, or abstract representation to show the relationship between internal and external structures of plants and animals and the functions they serve.
    - Represent the relationship between internal structures of plants (*i.e., vascular system, roots)* and their functions (*i.e., for growth, survival, behavior, and reproduction*).
    - Represent the relationship between external structures of plants (*i.e., leaves, stems, flowers, seeds*) and their functions (*i.e., for growth, survival, behavior, and reproduction*).
    - Represent the relationship between internal structures of animals (*e.g.,, bones, organs,*

veins, nerves, etc.) and their functions (*i.e., for growth, survival, behavior, and reproduction*).
    - Represent the relationship between external structures of animals (*e.g., shells, fur, feathers, skin, claws, gills, etc.)* and their functions (*i.e., for growth, survival, behavior, and reproduction*).
    - Compare models to identify common features and differences.
    - Use criteria to collaboratively revise models to improve the representation of the relationship between structure and function.
- Use models to explain how the internal and external structures and functions of plants and animals support growth, survival, behavior, and reproduction:
    - Use models to explain the relationship between structures and functions in plants and animals.
    - Use models to explain how internal and external structures support growth, survival, behavior, and reproduction in plants and animals.

4.L2U1.11 Plan and carry out investigations to demonstrate ways plants and animals react to stimuli.

- In collaboration with peers, design an investigation to explore how plants and/or animals react to stimuli:
    - Form scientific (testable) questions based on careful observations of phenomena and information.
    - Formulate a reasonable prediction based on patterns such as cause and effect relationships.
    - Based on prior knowledge, formulate a prediction in response to the testable question(s).
    - Design a procedure that will produce data in response to the testable question(s).
    - Identify controlled variables.
    - Determine an appropriate number of trials for the investigation.
    - Determine how observations and/or measurements will be made in order to answer the investigative question.
- In collaboration with peers, conduct a simple investigation to explore how plants and/or animals react to stimuli:
    - Follow a procedure with precision.
    - Make observations about how plants and animals react to stimuli.
    - Collect data from the investigation.
    - Identify patterns to make meaning of the data.

COMPUTER SCIENCE: COMPUTATIONAL THINKING

3-5.AP.A.1 Compare, test, and refine algorithms for the same task and determine which is the most efficient.

- Select the most efficient algorithm to accomplish a task.
- Accomplish a programming task using the most efficient algorithm(s).

3-5.AP.V.1 Identify variables in applications where data is stored and modified to accomplish a task.

- Identify a count or score as variables that can be programmed to change in a digital game.

3-5.AP.C.1 Create programs that include sequences, loops, and conditionals to express ideas or solve a problem.

- Create a program to accomplish a task that requires a repeated sequence of commands (i.e., loop).
- Create a program to accomplish a task that requires execution of a portion of code when a specific condition (i.e., sensor) is true.

3-5.AP.M.1 Decompose problems into smaller, manageable subproblems to facilitate the program development process.

- Identify the steps required to solve a problem.
- Code the multiple small steps to solve a problem in order one by one.
- Create command sequences (i.e., subroutines) that can be reused or combined to accomplish a complex task.

3-5.AP.M.2 Modify, remix, or incorporate portions of an existing program into one's own work to add more advanced features.

- Make use of examples and text features on the assignment sheets to develop the subroutines for a multi-step program.
- Reuse programming sequences to accomplish new tasks.

3-5.AP.PD.1 Use an iterative process to plan the development of a program *(i.e., soliciting feedback, others' perspectives, user preferences).*

- Use command cards and diagrams to discuss and plan a program with my partner.
- Review code with partner to check for programming errors before testing.
- Make and test improvements until the program works as intended.

3-5.AP.PD.2 Observe intellectual property rights and give attribution when remixing programs or utilizing the work of others.

- Share ideas and programming strategies to facilitate learning.
- Credit others when their ideas and work is utilized.

3-5.AP.PD.3 Test and debug (identify and fix errors) a program/app or algorithm to ensure it runs as intended.

- Establish a routine to isolate and analyze errors during testing.
- Evaluate accuracy of input values (parameters).

3-5.AP.PD.4 Describe choices made during program development using code comments, presentations, and demonstrations.

- Discuss decisions throughout the process of planning, testing and refining a program with a partner.
- Use comments to document a section of code to identify and explain it to others.
- Reflect on the solutions to problems encountered and the number of trials needed to reach the programming goal.

COMPUTER SCIENCE: DATA AND ANALYSIS

3-5.DA.CVT.1a Use a digital tool to collect, organize, manipulate data.

- Collect data for an investigation using a digital tool *(i.e., table, spreadsheet, digital camera, cell phone, IPAD app or simulation).*
- Create a table to sort and compare the values in a data set.

3-5.DA.CVT.1b Present data visually through multiple representations to highlight relationships and support a claim.

- Create a visual representation of a data set using a digital tool *(e.g., graph, photo, video, slide show, simulation).*
- Use a digital tool to generate a graphical representation *(e.g., pictograph, bar graph, pie chart, line plot)* of a data set.
- Choose a graphical representation (type of graph and scale) to reveal the relationship between two variables.

3-5.DA.IM.1 Use a computational tool to make predictions, propose cause-and-effect relationships, draw conclusions, and answer questions from the data.

- Read a visual or graphical display of data to make a prediction or inference.
- Analyze a graph generated from a data set for evidence to support a claim.
- Evaluate a claim using evidence from a graphical display to draw a conclusion.
- Compare the results of a simulation to a real-world observation.