Fair Lawn

Public Schools

Fair Lawn, NJ

Science

Grade 6

August

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Middle School science is a integrated, spiraled science program developed by a committee of Fair Lawn middle school science teachers. It is aligned to the NJSLS-S which are correlated to the NJSLS-ELA and NJSLS-M. There is a focus on learning science through investigation and through reading non-fiction texts and inquiry-based science exploration.

Science Department

Fair Lawn School District

Committee Credits

Written By

Jeanmarie Anicito, Lindsey DeBellis,

Laura Goldberg, & Kim Males

With Extensive Input from the Committee

Drew Altorfer, Craig Cohen, Kaitlyn Forsythe, Susan Goldstein,
Troy Knudsen, Paul Steiner & Mike Teehan

Ronald Durso, Science Supervisor

Science Grade 6

I. Course Synopsis

Our middle school science program reflects and integrated, thematic approach to the study of the field of science which supports the philosophy of the NJSLS-S. Students will develop an understanding of the core principals of physical, earth, space, and life science while engaging in engineering and technology through exposure to rich, non-fiction text and a rich application of mathematical skills through data analysis and problem solving.

II. Philosophy & Rationale

This course has been aligned to and developed with the NJSLS-S as its focus.

All NJSLS-S aligned courses in the Fair Lawn Schools demonstrate a commitment preparing students to become college and career ready as well as the other guiding assumptions of the Frameworks for Science Education (NRC, 2011) and the NJSLS-S including

- Students are born investigators;
- Science instruction should focus on core ideas and practices;
- An understanding of science develops over time;
- Science and engineering require both knowledge and practice;
- Science education must connect to students' interests and experiences; and
- Promoting equity for all students must be a focus of science education.

Additionally, all NJSLS-S aligned courses in the Fair Law Schools integrate the three dimensions discussed in the Frameworks for Science Education and the NJSLS-S, including

- Science & Engineering Practices which describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems; (NGSS PDF)
- Cross Cutting Concepts which link all domains of science and provide an organizational schema for interrelating knowledge from various science fields into a coherent and scientifically-based view of the world; (NGSS PDF) and
- Disciplinary Core Ideas which focus and unite K-12 science, have a broad importance across multiple sciences or engineering disciplines or are a key organizing concept within a single discipline; provide a key tool for understanding or investigating more complex ideas and solving problems; relate to the interests and life experiences of students; are connected to societal or personal concerns that require scientific or technological knowledge; and are teachable and learnable over multiple grades at increasing depth and sophistication. (NGSS PDF)

Since coherence is a main dimension of the NJSLS-S, consider reviewing the "story line" for the middle school physical science, life science, earth and space science, and engineering, technology and applications of science, as well as the high school physical science, life science, earth and space science, and engineering, technology and application of

science for a full picture of the NJSLS-S philosophy. For a full picture of how these programs are implemented in the Fair Lawn Schools, visit the district curriculum website.

As described in the NJSLS-S, technical writing and reading non-fiction is also a focus of our elementary science curricula as required by the NJSLS-ELA and Math. Students are expected to think critically about data they collect or read about and then express their thoughts through text-based narratives, journal entries, short-constructed response, argument-based writing, and/or in-class discussion.

Differentiated instruction for students at different levels of achievement and specific learning needs (e.g. special education, English Language Learners (ELL), at-risk, and Gifted & Talented) is embedded in targeted scaffolding based on knowledge of each student's interests, needs, and assessment data, including, but not limited to, in class formative and summative assessments.

When deemed appropriate, department teachers will engage students in purposeful paired discussions to share information more effectively, such as the "turn and talk" (Harvey & Daniels, 2009). "Text annotation" could be used, for example to optimize reading comprehension (Daniels & Steineke, 2010).

III. Scope & Sequence

The Grade 6 Science program consists of thematic units reflective of the NJSLS-S. Each unit develops new content with consistent emphasis on the science and engineering processes, disciplinary core ideas, and cross cutting concepts reflective of the Next Generation Science Standards and the Frameworks for Science Education.

Grade 6	Grade 7	Grade 8
Intro to MS Science *2 Weeks*	**Chemistry of Materials** *7 Weeks*	**Energy** *8 Weeks*
Waves *6 Weeks*	**Water** *8 Weeks*	**Force & Motion** *8 Weeks*
Ecology *8 Weeks*	**Erosion & Deposition** *8 Weeks*	**Plate Tectonics** *6 Weeks*
Cell Biology *8 Weeks*	**Genetics*** *6 Weeks*	**Evolution** *5 Weeks* **May be interrupted by last unit.*
Weather & Atmosphere *8 Weeks*	**Space**** *6 Weeks*	**Review of MS Science** *2 Weeks*

*Note: Due to the sequence change, "Genetics" will be replaced with "Waves" during the 2016-2017 school year.

**Efforts will be made to include a field trip to the FLHS Planetarium.

Unit 1: Introduction to Middle School Science

Enduring Understanding:

1. The process of science requires an understanding of science and engineering practices.
2. It is important to practice science safely.

Essential Questions:

1. How do we apply science and engineering practices?
2. How do we practice science safely?

Learning Objectives:

1. Students will be familiar with the science and engineering practices.
2. Students will be familiar with and able to practice science safely.

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

- **ELL/Special Education Students:**
  - Provide ELL students with short lists of essential academic vocabulary terms to assist with language development such as word walls;
  - Provide ELL students with opportunities for peer to peer interactions;
  - Explicitly teach ELL students academic language and link to main ideas;
  - Support ELL students through the use of graphic organizers, modeling, and visual aides.
  - Support special education students through the use of physical activity, modeling, role-play, dialogue, reading assignments based on ability, etc.

- **Gifted Students**
  - Provide students with supplemental enrichment activities which afford them an opportunity to independently enhance their understanding of the science and engineering practices, such as through experimental design or the analysis of science research.

Cross-Content Connections:

NJSLS- Math: Students will make observations, measure, collect data, and interpret data related to experimental design.
NJSLS-Literacy: Students will analyze text.

8.1: Use technology to collect and analyze data and to communicate findings with local peers and peers from other classes.

9.2: Explore careers directly related to this unit.

Unit 2: Waves

Enduring Understanding:

1. Waves carry sound and light.

Essential Questions:

1. How can waves damage my eyesight or hearing?

Learning Objectives:
Based on the MS Evidence Statements

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.]

MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

See unit 1 for suggestions to meet needs of diverse learners.

Cross-Content Connections:

NJSLS- Math: Students will make observations, measure, collect data, and interpret data related to properties of waves.
NJSLS-Literacy: Students will read, write, and analyze text, related to the science content.

8.1: Use technology to collect and analyze data and to communicate findings with local peers and peers from other classes. **9.2:** Explore careers directly related to this unit.

Unit 3: Ecology

Enduring Understanding:

1. A delicate balance exists in nature which can be upset by living or non-living things.

Essential Questions:

1. How can the balance in nature be upset?
2. How can humans maintain the balance of nature?

Learning Objectives:
Based on the MS Evidence Statements

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

See unit 1 for suggestions to meet needs of diverse learners.

Cross-Content Connections:

NJSLS- Math: Students will make observations, measure, collect data, and interpret data related to measurements of populations, particularly graphing.
NJSLS-Literacy: Students will read, write, and analyze text, related to the science content.

8.1: Use technology to collect and analyze data and to communicate findings with local peers and peers from other classes. **9.2:** Explore careers directly related to this unit.

Unit 4: Cell Biology

Enduring Understanding:

1. All living things are made of cells.
2. Cell functions are specialized based on their functions.

Essential Questions:

1. How does cell specialization enable organisms to be complex?

Learning Objectives:
Based on the MS Evidence Statements

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living cells, and understanding that living things may be made of one cell or many and varied cells.]

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]

If time permits, disease transmission, prevention, and treatment will be addressed during this unit.

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

See unit 1 for suggestions to meet needs of diverse learners.

Cross-Content Connections:

NJSLS-Literacy: Students will read, write, and analyze text, related to the science content.

8.1: Use technology to collect and analyze data and to communicate findings with local peers and peers from other classes. **9.2:** Explore careers directly related to this unit.

Unit 5: Weather & Atmosphere

Enduring Understanding:

1. Climate is regulated by energy from the sun.
2. Data can be used to predict the weather.
3. Weather patterns determine climates.

Essential Questions:

1. How can data be used to predict and prepare for weather?

Learning Objectives:
Based on the MS Evidence Statements

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

See unit 1 for suggestions to meet needs of diverse learners.

Cross-Content Connections:

NJSLS- Math: Students will make observations, measure, collect data, and interpret data related to data collection and analysis of weather.
NJSLS-Literacy: Students will read, write, and analyze text, related to the science content.

8.1: Use technology to collect and analyze data and to communicate findings with local peers and peers from other classes. **9.2:** Explore careers directly related to this unit.

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V. Course Materials

SEPUP/LAB-AIDS is a curriculum resource which provides each classroom with a variety of reading books, a teacher's guide, and inquiry supplies, which should be used along with this curriculum. A pacing guide is provided to teachers on the Google Share Drive. The scope of our curriculum encourages teachers to enrich the SEPUP/LAB-AIDS program with technology tools, for example, and not all activities in the SEPUP/LAB-AIDS program will be completed.

VI. Assessments

Assessment of student learning in science at the elementary level should be formative in nature. Rubrics are provided in the Knowing Science program. The focus of assessment should be of students mastery of the Science and Engineering Processes of the NJSLS-S. The teacher should keep in mind the expected progression of their understandings.

VII. Interdisciplinary Connections and Alignment to Technology standards

By the nature of the SEPUP/Lab-Aids program, students are consistently being asked to address engineering design challenges, which address the following standards, throughout the middle school curriculum.

MS-ETS1-1.	**Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**
MS-ETS1-3.	**Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.**
MS-ETS1-4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

(http://www.state.nj.us/education/cccs/standards/8/); Workplace readiness standards (http://www.state.nj.us/education/archive/frameworks/ccwr/appendixb.pdf); and 21st Century Content Standards (http://www.state.nj.us/education/cccs/standards/9/#91):

English/Social Studies

Based on English and Social Studies Department collaboration, the following topics have been identified across the American Literature and US History II curricula:

- Civil Rights
- Class Separation/Division
- Education System
- Poor/Wealthy
- Gates/Koch Brothers
- Ferguson

In turn, integrated curriculum has been created based on the essential question:

- How is our American culture shaped by socioeconomic class distinction?

English/Media Arts

Students choose books for independent reading projects in collaboration with the high school media specialist.

Technology-based process supports the construction of the MLA-research paper. This includes a media-driven lesson on acceptable academic sources and computer-based production of a formal research paper.

For alignment to Technology standards (http://www.state.nj.us/education/cccs/standards/8/); Workplace readiness standards (http://www.state.nj.us/education/archive/frameworks/ccwr/appendixb.pdf); and 21st Century Content Standards (http://www.state.nj.us/education/cccs/standards/9/#91),

Copy and paste standards below