Unit #1: Earth & Space Science 6- Weather and Water

Content Area: **Science**
Course(s): **Science 6**
Time Period: **First Marking Period**
Length: **September through December**
Status: **Published**

Unit Overview

The FOSS Weather and Water Course focuses on Earth's atmosphere, weather, and water. Students will delve into topics that may seem unrelated to weather, including a good dose of physics and a bit of chemistry. A good understanding of meteorology as an earth science isn't complete without an introduction to concepts that cross into these disciplines.

Understanding weather is more than reading data from a weather center. Students need to grapple with ideas about atoms and molecules, changes of state, and heat transfer before they can launch into the bigger ideas involving air masses and fronts, convection cells and winds, and the development of severe weather.

Earth's atmosphere is composed of a variety of gasses, with nitrogen and oxygen the most abundant. But Earth wouldn't be the same if it weren't for one keystone gas, water vapor, a relatively small a variable component of the atmosphere. Without water vapor and its liquid and solid forms, both on the surface and in the atmosphere there would be no weather. There would be neither clouds nor precipitation. If precipitation didn't occur, we wouldn't have the runoff to create the streams and rivers that erode mountains, deposit deltas, and replenish lakes and oceans. An atmosphere without water vapor would be an alien and hostile place. The importance of water on Earth is a major element of this course.

STAGE 1- DESIRED RESULTS

2020 New Jersey Student Learning Standards- Science

Physical Science

SCI.MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
SCI.MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as

measured by the temperature of the sample.

Earth and Space Science

SCI.MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
SCI.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.
SCI.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.
SCI.MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
SCI.MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
SCI.MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
SCI.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.
SCI.MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Engineering, Technology, and Applications of Science

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

Cross Cutting Concepts

- Cause and Effect
- Energy and Matter

- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

Disciplinary Core Ideas

Physical Sciences

- PS1A: Structure and Properties of Matter
- PS3A: Definitions of Energy
- PS3B: Conservation of Energy and Energy Transfer

Earth and Space Sciences

- ESS1B: Earth and the Solar System
- ESS2C: The Role of Water in Earth's Surface Processes
- ESS2D: Weather and Climate
- ESS3A: Natural Resources
- ESS3C: Human Impacts on Earth Systems
- ESS3D: Global Climate Change

Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution

Essential Questions

Investigation 1: What Is Weather?

Part 1: What is weather?

Investigation 9: The Water Planet

Part 1: What is the water cycle?

Part 2: What affects the direction that ocean water flows?

Part 3: How does the ocean affect climate on land?

Investigation 10: Climate over Time

Part 1: How have climates changed over time?

Part 2: How do greenhouse gases in the atmosphere affect Earth's temperature?

Part 3: What are the effects of a slight rise in global temperatures?

Part 4: What is the difference between weather and climate?

Enduring Understanding

The **FOSS Weather and Water Course** focuses on Earth's atmosphere, weather, and water. A good understanding of meteorology as an earth science isn't complete without an introduction to the physics and chemistry that drive weather. Understanding weather is more than reading a thermometer and recording air-pressure measurements. The course consists of nine investigations. Students first learn about atoms and molecules, changes of state, and heat transfer. Then they investigate the water cycle, air masses and fronts, winds, and severe weather.

- Weather centers measure atmospheric conditions such as temperature, atmospheric pressure, and humidity.
- Plan experiments to determine that air has mass.
- Use a particle model to compare a gas at standard pressure and a gas under increased pressure.
- Explain how experimental results provide evidence that air has mass.
- Apply pressure to a system and observe the compression of gas.
- Interpret a pressure map.
- Describe the relationship between air pressure and wind.
- Compare salt solutions to determine their relative density
- Use mass and volume data to calculate densities (g/ml)
- Explain density as a relation between a mass and its volume.
- Observe convection in liquid and gas environments.
- Describe how materials of different densities interact.
- Explain how energy transfer drives the process of convection.
- Compare temperature data from cities at different latitudes.
- Use light sources and surfaces to model solar angle.
- Explain how solar angle affects the intensity of solar radiation.
- Measure the heating and cooling of earth materials when moved into and out of sunshine.

- Design and conduct experiments to obese heat transfer by conduction through solids and liquids.
- Describe heat transfer through multiple materials in terms of particulate activity.
- Describe how the atmosphere is heated
- Explain how differential heating of Earth by Sun creates local winds.
- Cool down humid air to produce condensation (Dew, Fog, Cloud).
- Observe changes in temperature due to pressure change
- Manipulate pressure to produce a cloud in a bottle.
- Explain how condensation (cloud forms when humid air cools to its dew point)
- Predict cloud formation by analyzing radiosonde data.
- Analyze weather-map data (temperature, wind speed, air pressure, fronts, precipitation) to determine a weather report fro given location.
- Consider forecasting of sever weather events based on multiple sources of data.

Students will know…

VOCABULARY

Investigation 1: What Is Weather?

air pressure, climate, forecast, humidity, meteorologist, meteorology, precipitation, prediction, severe weather, temperature, weather, wind

Investigation 2: Where's the Air?

air, atmosphere, compress, exosphere, expand,mass,matter, mesosphere, particle, permanent, gas, pressure, state, stratosphere, thermosphere, troposphere, variable, gas, weight

Investigation 3: Air Pressure and Wind

atmospheric pressure, bar,barometer,density, equilibrium, isobar,kinetic energy, millibar (mb)

Investigation 4: Convection

convection, convection cell, energy transfer, fluid, model

Investigation 5: Heat Transfer

absorb, climatologist, climatology, differential heating, evidence, heat,latitude, radiant energy, radiation, ray,solar angle, wave

Investigation 6: Air Flow

air mass, conduction, Coriolis effect, jet stream,land breeze, prevailing winds, sea breeze

Investigation 7: Water in the Air

condensation, condensation, nucleus, dew point, evaporation, precipitation, saturated, transpiration

Investigation 8: Meteorology

cold front, radiosonde, warm front

Investigation 9: The Water Planet

El Niño, groundwater, gyre,ocean current, salinity, water cycle

Investigation 10: Climate over Time

carbon dioxide, carbon sequestration, climate change, emission,global warming, greenhouse effect, greenhouse gas,ice core,infrared, paleoclimatology, pollutant

Misconceptions About Weather

STUDENTS MAY THINK…	***INSTEAD OF THINKING…***
The seasons cause the weather to change.	Certain weather patterns and temperatures are assoc classification, not a force that causes weather.
Clouds form because cold air doesn't hold as much water as warm air.	Cloud formation depends on the balance between w continually changing state between solid, liquid, an the atmosphere than can condense on earth.
Clouds are made of water vapor.	Clouds are mainly tiny water droplets or ice crystal
Clouds always predict rain.	Clouds may predict, but do not guarantee rain.
Raindrops look like tear drops.	Raindrops are spherical.
Rain falls when clouds become too heavy.	Rain falls when the water droplets in the cloud becc
Rain falls because we need it.	Rain falls whether we need it or not.
Lightning never strikes the same place twice.	Lightning tends to strike the highest place in an area
Thunder occurs when two clouds collide.	Thunder (and lightning) are the result of a large tran
Air and oxygen are the same thing.	Air is a mixture of gases.
Humidity is moisture in the air.	Humidity is the amount of water vapor in the air.
Humid air is heavy or more dense than dry air.	Humid air is less dense than dry air. Students are pr
Hot air weighs less than cold air.	Both hot and cold air have the same weight.
The atmosphere is made up solely of air.	There are many particles in the atmosphere which w
Clouds block wind and slow it down.	Winds are a result of the uneven heating of Earth's air masses.
Cold temperatures produce fast winds.	Winds are a result of the uneven heating of Earth's air masses.
Snow and ice make it cold.	Snow and ice are a result of cold temperatures, not t
Cold days are caused by the clouds covering the sun.	Temperature depends on many factors, such as time

Students will be able to...

Investigation 1: What Is Weather?

- Measure atmospheric conditions such as temperature, atmospheric pressure, and humidity using the Weather Center.

Investigation 2: Where's the Air?

- Plan experiments to determine that air has mass.
- Use a particle model to compare a gas at standard pressure and a gas under increased pressure.
- Explain how experimental results provide evidence that air has mass.

Investigation 3: Air Pressure and Wind

- Apply pressure to a system and observe the compression of the gas.
- Interpret a pressure map.
- Describe the relationship between air pressure and wind.

Investigation 4: Convection

- Compare salt solutions to determine their relative density.
- Use mass and volume data to calculate densities (g/mL).
- Explain density as a ratio between a mass and its volume.
- Observe convection in liquid and gas environments.
- Describe how materials of different densities interact.
- Explain how energy transfer drives the process of convection.

Investigation 5: Heat Transfer

- Compare temperature data from cities at different latitudes.
- Use light sources and surfaces to model solar angle.
- Explain how solar angle affects the intensity of solar radiation.
- Measure the heating and cooling of earth materials when moved into and out of sunshine.

Investigation 6: Air Flow

- Design and conduct experiments to observe heat transfer by conduction through solids and liquids.
- Describe heat transfer through multiple materials in terms of particulate activity.
- Describe how the atmosphere is heated.
- Explain how differential heating of Earth by the Sun creates local winds.

Investigation 7: Water in the Air

- Cool down humid air to produce condensation (dew, fog, cloud).
- Observe changes in temperature due to pressure change.
- Manipulate pressure to produce a cloud in a bottle.
- Explain how condensation (cloud) forms when humid air cools to its dew point.

Investigation 8: Meteorology

- Predict cloud formation by analyzing radiosonde data.

- Analyze weather-map data (temperature, wind speed, air pressure, fronts, precipitation) to determine a weather report for a given location.
- Consider forecasting of severe weather events based on multiple sources of data.

Investigation 9: The Water Planet

- Explain with words and drawings how phase change and other processes produce many variations of the water cycle.
- Evaluate how increases in human population and use of natural resources impact Earth's fresh water.
- Infer ocean current patterns from global wind patterns.
- Analyze data to consider how distance from the ocean affects climate.

Investigation 10: Climate over Time

- Evaluate evidence related to change of Earth's climate.
- Explain how a global temperature increase could affect Earth's climate.
- Survey recent findings in climate science and evaluate sources of this information.

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- A-B-C Summaries
- Analogy Prompt
- Choral Response
- Debriefing
- Exit Card / Ticket
- Hand Signals
- Idea Spinner
- Index Card Summaries
- Inside-Outside Circle Discussion (Fishbowl)
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- One Word Summary
- Portfolio Check

- Questions & Answers
- Quiz
- Self-Assessment
- Student Conference
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

- follow lab procedures
- complete assignments
- develop and utilize models
- cooperate in groups and with partners
- complete a written science journal
- maintain class notes and vocabulary in MacBook Airs
- complete data tables
- complete and interpret graphs

Benchmark Assessments

- Final module exam.
- End of investigation assessments.

STAGE 3- LEARNING PLAN

Instructional Map

Investigation 1: What Is Weather?
Investigation 2: Where's the Air?
Investigation 3: Air Pressure and Wind
Investigation 4: Convection
Investigation 5: Heat Transfer
Investigation 6: Air Flow
Investigation 7: Water in the Air
Investigation 8: Meteorology
Investigation 9: The Water Planet

INVESTIGATION 1: WHAT IS WEATHER?

Part 1: Into the Weather (3 Sessions)

Students delve into the question, "What is weather?" They view video segments of severe weather, and generate inquiry questions stimulated by the video and discussions. Meteorology is introduced as the science of weather.

Content:

• Weather is the condition of Earth's atmosphere at a given time in a given place.

• Severe weather has the potential to cause death and destruction in the environment.

• Meteorology is the science of weather, and meteorologists are the people who study Earth's weather.

Part 2: Local Weather (2 Sessions)

Students view local weather reports and determine the factors that combine to produce what we know as weather. They are introduced to a digital weather center to measure temperature, air pressure, and humidity. They use the tools to acquire daily data for their local site, and use media tools to track weather in another city.

Content:

• Weather and climate are different.

INVESTIGATION 2: WHERE'S THE AIR?

Part 1: The Air Around Us (2 Sessions)

Students work with syringes and tubing to discover that air takes up space and is compressible. They tackle the

question, “Does air have mass?” Using available classroom materials, they design a procedure that will demonstrate that air has mass.

Content:

- Air is matter; it occupies space, has mass, and can be compressed.

Part 2: Earth’s Atmosphere (3 Sessions)

Students study Earth’s atmosphere using diagrams, photos from space, and a reading. They are introduced to the atmosphere as a mixture of gases with properties that change with altitude above Earth’s surface.

Content:

• The atmosphere is the layers of gases surrounding Earth.
• Weather happens in the troposphere, the layer of the atmosphere closest to Earth’s surface.

• The troposphere is a mixture of nitrogen (78%), oxygen (21%), and other gases (1%), including argon, carbon dioxide, and water vapor.

INVESTIGATION 3: Air Pressure and Wind

Part 1: Air Pressure Inquiry (2 Active Sessions)

Students assemble pressure indicators (clear tubes in bottles filled with green water). They investigate the effect of air pressure on the system and consider how density is affected by air pressure. They view a demonstration of how changing air pressure affects a barometer.

Content:

Pressure exerted on a gas reduces its volume and increases its density.

Inv. 3: Part 2 Pressure Maps– (1 Active Session, 1 Assessment Session)

Students are introduced to pressure maps and isobars as a means for representing air pressure over a large

region. They locate high- and low- pressure areas on maps and predict where winds will blow and in what direction. What students predict does not exactly match what occurs because of other factors, which are introduced in a later investigation to clear up the mystery.

Content:

Wind is a large-scale movement of air.

Air tends to move from regions of high pressure to regions of low pressure.

Air pressure is represented on a map by contour lines called isobars.

INVESTIGATION 4: Convection

INV 4: Part 1- Density of Fluids (3 Sessions)

Students investigate density of fluids by layering colored salt solutions in a straw. They determine the relative densities of the salt solutions by comparing the masses of equal volumes. They calculate the density of each solution, using the ratio of mass to volume.

Content:

- Density is the ratio of a mass to its volume.
- If two fluids have equal volumes but differ in mass, the one with the greater mass is more dense.

INV 4: Part 2- Convection in Water (2 Sessions)

Students are introduced to convection in liquids as a mechanism for energy transfer. They observe the interaction of colored water of different temperatures to determine that warm water rises and cold water descends.

Content:

- As matter heats up, it expands, causing the matter to become less dense.
- Convection is the circulation of fluid (liquid or gas) that results from energy transfer; relatively warm

masses rise and relatively cool masses sink.

INV 4: Part 3- Convection in Air (3 Sessions)

Students observe a model convection chamber to confirm that convection cells operate in air. The observations are extrapolated to the real world, where warm air masses move upward and cool air masses sink.

Content:

- Convection is the circulation of fluid (liquid or gas) that results from energy transfer; relatively warm masses rise and relatively cool masses sink.

INVESTIGATION 5: HEAT TRANSFER

INV 5: Part 1- LATITUDE (2 Sessions)

Students examine weather data from two groups of cities to compare cities at different latitudes where other variables have been controlled. They make a greater distinction between weather and climate, then draw conclusions about the effect of latitude on climate.

Content:

• Latitude is a factor that affects local weather and climate.

INV 5: Part 2- Solar Angle (2 Sessions)

Light is introduced as a form of energy. Students observe a demonstration of solar angle that uses a flashlight shining on surfaces at various angles and a beam of light shining on a globe. They compare the effect of a beam of light when it falls on surfaces at different angles and determine that the greater the solar angle, the greater the energy transfer.

Content:

• The angle at which light from the Sun strikes the surface of Earth is the solar angle.

• The lower the solar angle is, the less intense the light is on Earth's surface.

• The Sun is the major source of energy that heats the atmosphere, and solar energy is transferred by radiation.

INV 5: Part 3- Heating Earth (3 Sessions)

Students are introduced to energy transfer by radiation. They investigate what happens to different earth materials (sand, soil, water, air) when placed in sunshine and then in shade. They set up an experiment and collect and analyze the data. Students observe the differential heating of earth materials, one factor that contributes to weather.

Content:

• The Sun is the major source of energy that heats the atmosphere, and solar energy is transferred by radiation.

• Heat is the increase of kinetic energy of particles.

INVESTIGATION 6: AIR FLOW

INV 6: Part 1- Conduction (3 Sessions)

Students observe two examples of heat transfer by conduction: movement of heat from a container of hot water to a container of cold water, and movement of heat from one end of a metal strip to the other. Students identify conduction as energy transfer between particles as a result of contact.

Content:

• Energy can move from one material to another by conduction.

INV 6: Part 2- Local Winds (1 Session)

Groups create diagrams that show what happens in the atmosphere to create wind. They label their diagrams to represent differential heating, energy transfer, convection, change of density, change of atmospheric pressure, and wind.

Content:

• Differential heating of Earth's surface by the Sun can create high- and low- pressure areas.

• Local winds blow in predictable patterns determined by local differential heating.

INV 6: Part 3- Global Winds (3 Sessions)

Students revisit their wind predictions from Investigation 3, and start to explore reasons that could explain the unpredicted wind movement. They compare data to their models and determine that convection cells and the Coriolis effect are responsible for the wind patterns on Earth.

Content:

• Convection cells and Earth's rotation determine prevailing winds on Earth.

INVESTIGATION 7: WATER IN THE AIR

INV 7: Part 1- Is Water Really There? (2 Sessions)

Students are challenged to come up with investigations to show that water vapor is in the air around them. Materials are provided, and each group plans an investigation, conducts it, and reports to the class in a short presentation

Content:

• Water changes from gas to liquid by condensation.

INV 7: Part 2- Phase Change and Energy Transfer (2 Sessions)

Students experience a temperature change as water evaporates, and ponder the energy transfers involved as water changes from liquid to gas. Humidity is introduced as the measure of water vapor in the air, and students consider dew point.

Content:

• Water changes from liquid to gas (vapor) by evaporation.
• Temperature change, which is evidence of energy transfer, accompanies evaporation. • Dew point is the temperature at which air is saturated with water vapor and vapor condenses into liquid.

INV 7: Part 3- Clouds and Precipitation (4 Sessions)

Students investigate the relationship between pressure and temperature, using 2 L plastic bottles and thermometer strips. They discover that the greater the pressure in a gas, the higher the temperature. They apply this idea to air rising in the atmosphere. Air pressure drops as elevation increases, so a mass of air would expand as it ascends. As it expands, it cools. They use this understanding of pressure and temperature to explore cloud formation.

Content:

- Water changes from gas to liquid by condensation. •
- Dew point is the temperature at which air is saturated with water vapor and vapor condenses into liquid.
- Increasing the pressure of a given volume of air increases the temperature of air.

INVESTIGATION 8: METEOROLOGY

INV 8: Part 1- Weather Balloons (1 Session)

Students use an online simulation to analyze data collected by weather balloons launched in Phoenix, AZ, and Chicago, IL. They analyze charts of data collected by weather balloons launched in four cities.

Content:

• Weather balloons travel high in the atmosphere and collect physical data using a radiosonde.

• Data from weather- balloon radiosondes can be used to determine dew point and the likelihood of clouds forming.

INV 8: Part 2- Weather Maps (4 Sessions)

Students consider all the factors that cause weather, and apply their knowledge to interpret a weather map. After learning about fronts, they pull together data about temperature, precipitation, surface wind, air pressure, and fronts to give a weather report for a given location.

Content:

• Weather maps combine many kinds of atmospheric and surface data, including pressure, temperature, wind direction, wind speed, and precipitation.

• Fronts are areas where large air masses collide.

INVESTIGATION 9: The Water Planet

Inv. 9: Part 1 -Water-Cycle Simulation (2 Active Sessions)

Water-Cycle Simulation

Students consider why Earth is called the water planet. They observe a demonstration that shows how Earth's water is distributed. They participate in a simulation of the travels of a water particle through the water cycle. They compare the results of the simulation to their understanding of how the water cycle operates on Earth. After exploring an online version of the simulation, students use what they learned to diagram the water cycle and consider the implications of human water use and human population growth.

Content:

• Most of Earth's water is saltwater in the ocean, and Earth's fresh water is found in many locations.

• A water particle might follow many different paths as it travels through the water cycle.

Inv. 9: Part 3 - Ocean Currents– (1 Active Session)

Ocean Currents

Students predict patterns of ocean currents, based on their experience with global winds, then explore actual patterns and causes of ocean currents.

Content:

• Ocean currents are caused primarily by winds, convection of ocean water, and the Coriolis effect.

Inv. 9: Part 3 - Ocean Climate– (2 Active Sessions, 1 Assessment Session)

Students review climate data for pairs of cities and determine what effect distance from the ocean has on

temperature range and average annual rainfall. They consider what properties of the ocean would cause these climate effects.

Content:

• A location's proximity to a large body of water generally results in less temperature variation and more precipitation.

Inv. 10: Part 1-Climate Change (1 Session)

Students analyze climate graphs for four different geographical locations and look for changes over a 50-year period. They consider evidence of climate changes over geological time periods.

Content:

- Weather is the condition of the atmosphere at a specific time and location; climate is the average weather in a region over a long period of time.
- Climate can change over time because of natural Earth cycles or human-induced changes.

Inv. 10: Part 2-The Role of Carbon Dioxide (1 Active Session, 1 Reading Session)

Using a computer simulation, students explore the effects of carbon dioxide and other greenhouse gases in the atmosphere. They use data to build a case that an increase in greenhouse gases in Earth's atmosphere can lead to an increase in Earth's average temperature (global warming).

Content:

- When greenhouse-gas concentrations in the atmosphere increase, the global temperature rises.
- Human activity can affect Earth's weather and climate.

Inv. 10: Part 3-Climate News (1 Active Session)

Students read summaries of news stories from the past decade, looking for evidence of climate change and whether that change is caused by humans.

Content:

- Human activity can affect Earth's weather and climate.

Inv.10: Part 4-Identify Key Ideas (1 Active Session, 1 Assessment Session)

Students look back on the entire Weather and Water Course to review the Weather and Water big ideas they've recorded along the way, and in particular to review the distinction between weather and climate.

Content:

- Weather is the condition of the atmosphere at a specific time and location; climate is the average weather in a region over a long period of time.
- Climate can change over time because of natural Earth cycles or human-induced changes.

Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials

- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

504 Plans

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep
- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating

- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

Modification Strategies

- Cooperative Grouping
- Extended Time
- Frequent Breaks
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Peer Tutoring
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Tutorials
- Use of Additional Reference Materials
- Use of Audio Resources

Differentiation Strategies

High Preparation

- Alternative Assessments

- Choice Boards
- Games and Tournaments
- Group Investigations
- Guided Reading
- Independent Research / Project
- Interest Groups
- Learning Contracts
- Leveled Rubrics
- Literature Circles
- Multiple Intelligence Options
- Multiple Texts
- Personal Agendas
- Project Based Learning (PBL)
- Stations / Centers
- Think-Tac-Toe
- Tiered Activities / Assignments
- Varying Graphic Organizers

Low Preparation

- Choice of Book / Activity
- Cubing Activities
- Exploration by Interest (using interest inventories)
- Flexible Grouping
- Goal Setting With Student
- Homework Options
- Jigsaw
- Mini Workshops to Re-teach or Extend Skills
- Open-ended Activities
- Think-Pair-Share by Readiness, Interest, or Learning Style
- Use of Collaboration
- Use of Reading Buddies
- Varied Journal Prompts
- Varied Product Choice
- Varied Supplemental Materials
- Work Alone / Together

Horizontal Intergration- Interdisciplinary Connections

New Jersey Student Learning Standards for Mathematics

Grades 6

6.RP.A. Understand ratio concepts and use ratio reasoning to solve problems.

6.NS.B. Compute fluently with mulit-digit numbers and find common factors and multiples.

6.NS.C. Represent and analyze quantitative relationships between dependent and independent variables.

6.G. A. Solve real world and mathematical problems.

6.EE.A. Apply and extend previous understanding of arithmetic to algebraic expressions.

6.SP.B. Summarize and describe distributions.

Reading Science and Technical Subjects

RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.

RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*.

RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.

RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

RST.6-8.7.Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

RST.6-8.8.Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.

Writing History, Science and Technical Subjects

WHST.6-8.1. Write arguments focused on *discipline-specific content*.

A. Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.

B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.

C. Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.

D. Establish and maintain a formal/academic style, approach, and form.

E. Provide a concluding statement or section that follows from and supports the argument presented.

WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

A. Introduce a topic and organize ideas, concepts, and information using text structures (e.g. definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g. headings, graphics, and multimedia) when useful to aiding comprehension.

B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.

D. Use precise language and domain-specific vocabulary to inform about or explain the topic.

E. Establish and maintain a formal/academic style, approach, and form.

F. Provide a concluding statement or section that follows from and supports the information or explanation presented

WHST.6-8.3(See note; not applicable as a separate requirement)

WHST.6-8.4. Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.

WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the

relationships between information and ideas clearly and efficiently.

WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

WHST.6-8.8. Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

WHST.6-8.9. Draw evidence from informational texts to support analysis, reflection, and research.
WHST.6-8.10. Write routinely over extended time frames (time for research, reflection, metacognition/self-correction, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

2020 New Jersey Student Learning Standards- Computer Science and Design Thinking

Computer Science and Design Thinking Practices

CSDT.K-12.CSDTP1	Fostering an Inclusive Computing and Design Culture
CSDT.K-12.CSDTP2	Collaborating Around Computing and Design
CSDT.K-12.CSDTP3	Recognizing and Defining Computational Problems
CSDT.K-12.CSDTP4	Developing and Using Abstractions
CSDT.K-12.CSDTP5	Creating Computational Artifacts
CSDT.K-12.CSDTP6	Testing and Refining Computational Artifacts
CSDT.K-12.CSDTP7	Communicating About Computing and Design

8.2 Design Thinking

8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem. 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team. 8.2.8.ED.5: Explain the need for optimization in a design process. 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product. 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative

design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues. 8.2.8.ITH.2: Compare how technologies have influenced society over time. 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system. 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact. 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another.
8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem. 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function. 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose. 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.
8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs. 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital). 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact. 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.
8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies. 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.

2020 New Jersey Student Learning Standards- Career Readiness, Life Literacies, and Key Skills

Career Readiness, Life Literacies, and Key Skills Practices

CRP.K-12.CRP1	Act as responsible and contributing community members and employee.
CRP.K-12.CRP2	Attend to financial well-being.
CRP.K-12.CRP3	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP4	Demonstrate creativity and innovation.
CRP.K-12.CRP5	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP6	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP7	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP8	Use technology to enhance productivity, increase collaboration and communicate effectively.
CRP.K-12.CRP9	Work productively in teams while using cultural/global competence.

9.2 Career Awareness and Planning

9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest. 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest. 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income. 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
9.2.8.CAP.11: Analyze potential career opportunities by considering different types of resources, including occupation databases, and state and national labor market statistics. 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4 Life Literacies and Key Skills

9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4). 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3). 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2). 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (MS-ETS1-2). 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1). 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.DC.1: Analyze the resource citations in online materials for proper use. 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8). 9.4.8.DC.3: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure. 9.4.8.DC.4: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences. 9.4.8.DC.5: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure. 9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation. 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys. 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a). 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.

9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.

9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).

9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

9.4.8.IML.5: Analyze and interpret local or public data sets to summarize and effectively communicate the data.

9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.

9.4.8.IML.7: Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose (e.g., 1.2.8.C2a, 1.4.8.CR2a, 2.1.8.CHSS/IV.8.AI.1, W.5.8, 6.1.8.GeoSV.3.a, 6.1.8.CivicsDP.4.b, 7.1.NH. IPRET.8).

9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).

9.4.8.IML.9: Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2).

9.4.8.IML.10: Examine the consequences of the uses of media (e.g., RI.8.7).

9.4.8.IML.11: Predict the personal and community impact of online and social media activities.

9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

9.4.8.IML.13: Identify the impact of the creator on the content, production, and delivery of information (e.g., 8.2.8.ED.1).

9.4.8.IML.14: Analyze the role of media in delivering cultural, political, and other societal messages.

9.4.8.IML.15: Explain ways that individuals may experience the same media message differently.

9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.

9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3).

9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.

9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Vertical Integration- Discipline Mapping

Kindergarten-Grade 5

Kindergarten: Trees and Weather

Grade 1: Air and Weather

Grade 3: Water and Climate

Grade 4: Soils, Rocks, and Landforms

Grade 5: Earth and Sun

Preparation for high school science courses

Additional Materials

Discovery Education

Visit FOSSWEB.com for list of websites, and additional readings

Search YouTube for related videos.