

Program Concentration: Agriculture
Career Pathway: Agriscience
Course Title: Plant Science and Biotechnology

Course Description: Plant science is a basic component of the agriscience pathway. This course introduces students to the scientific theories, principles, and practices involved in the production and management of plants for food, feed, fiber, conservation and ornamental use. Classroom and laboratory activities are supplemented through supervised agricultural experiences and leadership programs and activities.

AG-PSB-1 The student analyzes and explains the importance of plant science, agriscience and biotechnology in agriculture and society.

- a. Describes the role of plants in the food chain.
- b. Describes the role plants play in the environment.
- c. Explains how plants are used in the food and fiber system and ornamental purposes.
- d. Traces the origin of common crop and ornamental plants.
- e. Discusses the economic importance of plant production.
- f. Describes at least three advances in agriculture resulting from agricultural research.
- g. Describes the historical events related to agricultural research and development.

Academic Standards:

SSEF1 The student will explain why limited productive resources and unlimited wants result in scarcity, opportunity costs, and trade offs for individuals, businesses, and governments.

- b. Define and give examples of productive resources as land (natural), labor (human), capital (capital goods), entrepreneurship.*

SSEF6 The student will explain how productivity, economic growth, and future standards of living are influenced by investment in factories, machinery, new technology, and the health, education, and training of people.

- a. Define productivity as the relationship of inputs to outputs.*

SSEMI2 The student will explain how the Law of Demand, the Law of Supply, prices, and profits work to determine production and distribution in a market economy.

- a. Define the Law of Supply and the Law of Demand.*

SBO6 Students will analyze the economic and ecological importance of plants in society.

- a. Explain the uses and values of plants in different societies (agriculture, horticulture, industry, medicine, biotechnology).*
- b. Explain how plants impact the environment providing diverse habitats for birds, insects, and other wildlife in ecosystems.*

c. Investigate ethical issues related to genetic engineering of plants.

AG-PSB-2 The student differentiates between plants utilizing scientific plant classification.

- a. Explains and demonstrates how a universal classification system is used to group plants in different levels.
- b. Explains the use of the plant patent system.
- c. Uses a dichotomous key to identify unknown plants and other items.
- d. Identifies plant species within the major plant types.
- e. Discusses the differences between vascular and nonvascular plants.
- f. Explains the evolutionary basis of plants modern classification system.

Academic Standards:

ELA10LSV1 The student participates in student-to-teacher, student-to-student, and group verbal interactions. The student

- b. Asks relevant questions.
- c. Responds to questions with appropriate information

SBO1 Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions.

- a. Describe the major structures and evolutionary changes of major organs, tissues, cells, and organelle types in nonvascular/seedless and vascular/seed plants.
- c. Use, compare, and contrast the methods and purposes of plant classification.

SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

- c. Examine the evolutionary basis of modern classification systems.

AG-PSB-3 The student identifies the major structures of plants and describes their functions.

- a. Explains the various structures and tissues of the root and the advantages of different root systems (e.g. taproots, lateral roots, adventitious roots, and fibrous roots).
- b. Describes and explains the function of internal and external plant structures (e.g. roots, stems, flowers, and leaves).
- c. Explains the process of photosynthesis and its importance in plant growth and development.
- d. Discusses and gives examples of adaptations plants have made.

Academic Standards:

- SB1 Students will analyze the nature of the relationships between structures and functions in living cells.*
- a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.*
- SB2. Students will analyze how biological traits are passed on to successive generations.*
- e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.*
- SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.*
- a. Explain the cycling of energy through the processes of photosynthesis and respiration.*
- SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.*
- e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.*

AG-PSB-4 The student explains the role of plant cell structures.

- a. Identifies and describes plant cell structures and functions.
- b. Distinguishes between plant cells and animal cells.
- c. Compares and contrasts the three kinds of plant cell activity (division, enlargement, and differentiation).
- d. Describes the life cycle of a plant cell.
- e. Identifies the zone of elongation and differentiation and analyzes its importance in the development of a cell.
- f. Explains how water moves into and out of plant cells (e.g. osmosis, diffusion, active transport) and its impact on cell processes.

Academic Standards:

- SB1. Students will analyze the nature of the relationships between structures and functions in living cells.*
- a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.*
 - d. Explain the impact of water on life processes (i.e., osmosis, diffusion).*
- SBO1. Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions.*

b. Identify and evaluate plant structures in relation to their functions.

SBO3. Students will explore the structures and processes necessary for the mutual survival of plants and animals.

a. Describe and relate plant structures (organs, tissues, cells, organelles) to plant processes (photosynthesis, respiration, transport, growth, reproduction, dispersal).

AG-PSB-5 The student explains the impact technological advancements in plant development, reproduction and protection.

- a. Traces the development of modern species and varieties of plants.
- b. Compare different processes used to domesticate wild plant species through time.
- c. Explains the role of biotechnology and bioengineering in modern plant production.
- d. Compares traditional plant breeding and genetic engineering of plants.
- e. Explains the importance of nitrogen fixing bacteria to legumes.
- f. Describes the importance of using legumes in agricultural operations.
- g. Compares the effect of growth inhibitors, stimulants, and cultural practices on plant growth.
- h. Explains the function of the major plant hormones that are important to plant growth.
- i. Explains why forcing (speeding up) of plants is important to the horticulture and related plant industries.
- j. Discusses the uses, and fears of using genetically modified organisms.

Academic Standards:

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).

SB2. Students will analyze how biological traits are passed on to successive generations.

- c. Using Mendel's laws, explain the role of meiosis in reproductive variability.*
- f. Examine the use of DNA technology in forensics, medicine, and agriculture.*
- g. Compare the advantages of sexual reproduction and asexual reproduction in different situations.*

ELA10RC3 The student acquires new vocabulary in each content area and uses it correctly. The student

a. Demonstrates an understanding of contextual vocabulary in various subjects.

SSEF1 The student will explain why limited productive resources and unlimited wants result in scarcity, opportunity costs, and trade offs for individuals, businesses, and governments.

- b. Define and give examples of productive resources as land (natural), labor (human), capital (capital goods), entrepreneurship.*

AG-PSB-6 The student identifies and describes plant nutritional needs, essential nutrients and prescribes nutritional programs for plants.

- a. Explains the role of nutrients (macro and micro) in plant growth and development.
- b. Explains the advantages and disadvantages of different methods of supplying plants with nutrients.
- c. Identifies and prescribes artificial sources of plant nutrients.
- d. Describes the effect of using too many or too few nutrients in plants and prescribes remedies.
- e. Evaluates different soil tests and the application of prescribed remedies.
- f. Interprets plant tissue sample results.
- g. Describes the process of nutrient transport.

Academic Standards:

SBO3 Students will explore the structures and processes necessary for the mutual survival of plants and animals.

- a. Describe and relate plant structures (organs, tissues, cells, organelles) to plant processes (photosynthesis, respiration, transport, growth, reproduction, dispersal).*

AG-PSB-7 The student evaluates soil characteristics, factors and components that influence plant growth and evaluates land plots and soil types for production capability.

- a. Discuss the effects of soil composition (pH, organic matter content, and mineral content) on crop production.
- b. Describes the characteristics of soil structure and texture and its effects on crop production.
- c. Discusses the major horizons of mineral soils and identifies their characteristics.
- d. Identifies problems with soils that are not in the proper physical condition for plant growth.
- e. Explains the effect of macro and micro animal and plant life in soils.
- f. Outlines the ways humans, animals and machinery can affect soil structure.
- g. Compare and contrast commonly used artificial soils.
- h. Formulates and prescribes artificial soil mixes for specific plants.

Academic Standards:

SES3. Students will explore the actions of water, wind, ice, and gravity that create landforms and systems of landforms (landscapes).

b. Explain how soil results from weathering and biological processes acting on parent rock.

SPS6. Students will investigate the properties of solutions.

d. Compare and contrast the components and properties of acids and bases.

AG-PSB-8 The student describes the role of plant structures in plant reproduction.

a. Compares and contrasts sexual and asexual reproduction in plants.

b. Relates plant organs to their function on plant reproduction.

c. Describes the processes of pollination, fertilization, and germination in plants.

d. Describes the formation and role fruits play in reproduction.

e. Discusses how seeds are dispersed and the importance of seed dispersal.

f. Identifies factors necessary for seed germination (e.g. dormancy, water, oxygen, temperature, and light).

g. Categorizes important agronomic and ornamental plants based on commercial propagation methods.

Academic Standards:

SB2. Students will analyze how biological traits are passed on to successive generations.

e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.

SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

b. Compare how structures and function vary between the six kingdoms (archaebacteria, eubacteria, protists, fungi, plants, and animals).

SBO1 Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions.

c. Use, compare, and contrast the methods and purposes of plant classification.

SBO3. Students will explore the structures and processes necessary for the mutual survival of plants and animals.

b. Explore how flowering plants and animals have co-evolved in pollination, which confers genetic and evolutionary advantages.

- c. Explore how fruit and seed adaptations help promote dispersal, which prevents competition between plants and helps in colonization.*

SBO6. Students will analyze the economic and ecological importance of plants in society.

- a. Explain the uses and values of plants in different societies (agriculture, horticulture, industry, medicine, biotechnology).*

ELA10RC2 The student participates in discussions related to curricular learning in all subject areas.

- c. Relates messages and themes from one subject area to those in another area.*

AG-PSB-9 The student explains the use and importance of genetics in plant breeding.

- a. Uses Mendel's experimental ideas to show how inherited traits are passed from one generation to the next.
- b. Describes Law of Independent Assortment.
- c. Predicts genetic outcome using a Punnett Square.
- d. Describes the structure of a DNA molecule.
- e. Discusses and gives examples of major advances in agronomic production due to heterosis.
- f. Generate crossbred plants through plant breeding.

Academic Standards:

SB2. Students will analyze how biological traits are passed on to successive generations.

- a. Distinguish between DNA and RNA.*
- b. Explain the role of DNA in storing and transmitting cellular information.*
- c. Using Mendel's laws, explain the role of meiosis in reproductive variability.*

ELA10RC2 The student participates in discussions related to curricular learning in all subject areas.

- c. Relates messages and themes from one subject area to those in another area.*

MM1D1 Students will determine the number of outcomes related to a given event.

- b. Calculate and use simple permutations and combinations.*

AG-PSB-10 The student relates environmental conditions to their effects on plant development and use.

- a. Describes the different types of climate and the potential and limitations for plant production.

DRAFT

- b. Explains climatic effects on soils and the resulting effect on plant production.
- c. Describes the effects of weather change and climatic effects on plants.
- d. Relates different stimuli to various tropisms (e.g. geotropism, phototropism, and chemotropism) and their influence in plant growth.
- e. Contrast different climatic regions of Georgia and their natural plants.
- f. Determines the best location for orchards, greenhouses, etc. based on climatic conditions.
- g. Use the plant hardiness zoning map to determine the more appropriate plants to grow on a particular region.

Academic Standards:

SES5. Students will investigate the interaction of insolation and Earth systems to produce weather and climate.

- d. Describe how temperature and precipitation produce the pattern of climate regions (classes) on Earth.*

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

- e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.*

SBO5 Students will analyze the diversity of plant adaptations and responses to environmental extremes.

- a. Describe the diversity of plants and their adaptations in relation to differing ecosystems and changing environments, both long term (climate) and short term (seasonal and diurnal).*
- b. Examine plant growth and development in relation to plant hormones and responses to external signals such as light, gravity, and touch.*
- c. Describe and relate plant adaptations to the ability to survive stressful environments (water extremes, saline environment, and extreme temperature).*

ELA10RL1 The student demonstrates comprehension by identifying evidence (i.e., examples of diction, imagery, point of view, figurative language, symbolism, plot events and main ideas) in a variety of texts representative of different genres (i.e., poetry, prose [short story, novel, essay, editorial, biography], and drama) and using this evidence as the basis for interpretation.

- a. Analyzes and explains the structures and elements of nonfiction works such as newspaper articles and editorials, magazine articles, journal articles, and/or other informational text.*

SSEF1 The student will explain why limited productive resources and unlimited wants result in scarcity, opportunity costs, and trade offs for individuals, businesses, and governments.

- b. Define and give examples of productive resources as land (natural), labor (human), capital (capital goods), entrepreneurship.*

SSWG1 The student will explain the physical aspects of geography.

- a. Describe the concept of place by explaining how physical characteristics such as landforms, bodies of water, climate, soils, natural vegetation, and animal life are used to describe a place.*

AG-PSB-11 The student explains the uses of plants in medicine, food crops, animal feeds, and ornamental applications.

- a. Identifies plants and describes plant structures use for medical purposes.
- b. Describes the importance of food crops and identifies food crops grown locally.
- c. Explains the economic impact of food crops on the economy.
- d. Examine the economic importance of ornamental plants.

Academic Standards:

ELA10RC4 The student establishes a context for information acquired by reading across subject areas.

- b. Explores life experiences related to subject area content.*

SSEF6 The student will explain how productivity, economic growth, and future standards of living are influenced by investment in factories, machinery, new technology, and the health, education, and training of people.

- a. Define productivity as the relationship of inputs to outputs.*

SSEMI2 The student will explain how the Law of Demand, the Law of Supply, prices, and profits work to determine production and distribution in a market economy.

- a. Define the Law of Supply and the Law of Demand.*
- b. Describe the role of buyers and sellers in determining market clearing price.*
- d. Explain how prices serve as incentives in a market economy.*

SBO1. Students will use current plant phylogenetic principles and describe the structural changes used to delineate the plant divisions.

- b. Identify and evaluate plant structures in relation to their functions.*

AG-PSB-12 The student propagates plants using methods of vegetative cloning and sexual reproduction.

- a. Describes the materials and methods of cloning.
- b. Explains the benefits of cloning plants.
- c. Prescribes plant propagation procedures based on economics and reproduction success rate.

- d. Selects and utilizes plant hormones in plant propagation.
- e. Propagates plants through sexual and asexual reproduction.

Academic Standards:

SB2. Students will analyze how biological traits are passed on to successive generations.

- e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.*

ELA10RC3 The student acquires new vocabulary in each content area and uses it correctly.

- a. Demonstrates an understanding of contextual vocabulary in various subjects.*
- c. Explores understanding of new words found in subject area texts.*

AG-PSB-13 The student identifies and classifies weeds, prescribes control methods, and describes the economic and environmental effects that weeds have on agricultural production.

- a. Classifies weeds according to plant characteristics.
- b. Identifies the economic and aesthetic impact of weeds.
- c. Explains how weeds compete with plants in fields, greenhouses, landscapes, etc.
- d. Calculates crop losses to weeds.
- e. Calculates the economic threshold for weed control measures to be implemented.
- f. Describes actions, conditions, vectors and weed characteristics that help in distribution of weed seeds.
- g. Identifies characteristics of weeds that affect treatment type and effectiveness of treatment.
- h. Identifies common weed plants and the crops/locations they infest.
- i. Prescribes methods of weed control and the appropriate use of weed control measures.
- j. Explains the importance of Integrated Pest Management (IPM).
- k. Interprets and implements pesticide label application instructions.
- l. Infers potential and futuristic methods of weed control.
- m. Interprets environmental concerns of the public related to weed control.
- n. Prescribes alternative methods to chemical weed control.
- o. Compares and contrasts advantages and disadvantages of specific weed control measures.
- p. Discusses and explains methods of safe herbicide use.
- q. Demonstrates the proper application method of herbicides.

Academic Standards:

SEV5. Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems.

- d. Describe the effects and potential implications of pollution and resource depletion on the environment at the local and global levels (e.g. air and water pollution, solid waste disposal, depletion of the stratospheric ozone, global warming, and land uses).*
- e. Describe how political, legal, social, and economic decisions may affect global and local ecosystems.*

SB5. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

- d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.*
- e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.*

MA1P3 Students will communicate mathematically.

- a. Organize and consolidate their mathematical thinking through communication.*
- b. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*
- c. Analyze and evaluate the mathematical thinking and strategies of others.*
- d. Use the language of mathematics to express mathematical ideas precisely.*

MM4P1 Students will solve problems (using appropriate technology).

- d. Solve problems that arise in mathematics and in other contexts.*
- e. Apply and adapt a variety of appropriate strategies to solve problems.*

MM3A3 Students will solve a variety of equations and inequalities.

- b. Solve polynomial, exponential, and logarithmic equations analytically, graphically, and using appropriate technology.*
- d. Solve a variety of types of equations by appropriate means choosing among mental calculation, pencil and paper, or appropriate technology.*

AG-PSB-14 The student identifies, determines control methods, and defines the environmental and economic impact that insects have on plant production.

- a. Identifies common agricultural pests by sight and describes the damage done by insects.
- b. Describes the ways in which beneficial insects control pests.
- c. Identifies common beneficial insects by sight and prescribes measures to encourage their continued presence.
- d. Discusses the importance of insects in relation to pollination.
- e. Classifies insects using a dichotomous key, and reference materials.

DRAFT

- f. Describes and identifies body parts of insects.
- g. Describes chemical and mechanical insect control measures available to producers to protect plants.
- h. Discusses how natural pest control measures can be utilized by producers to protect plants.
- i. Compares and contrasts the advantages and disadvantages of using insecticides with non-chemical, organic plant production.
- j. Explains why environmentally safe insect controls are needed.
- k. Discusses the use of Integrated Pest Management for controlling insects.
- l. Demonstrates the safe use of pesticides.

Academic Standards:

SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystem.

- d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.*

ELA10RC2 The student participates in discussions related to curricular learning in all subject areas.

- c. Relates messages and themes from one subject area to those in another area;*

SEN3 Students will investigate the impact of insects on the production of food and other products.

- a. Explain how humans use insect biology to make commercial products (e.g., silk, honey, lacquer, and dyes).*
- b. Evaluate the benefits of insects to ecosystem functioning for food production (e.g., pollinators of agricultural crops).*
- c. Evaluate the costs of insects as pests of crops, stored food, and housing (e.g., termites).*

AG-PSB-15 The student identifies diseases, related organisms, and physiological disorders affecting plants, and prescribes methods of prevention and control.

- a. Discusses the impact of diseases, nematodes, and physiological disorders on plant production.
- b. Classifies the types of plant diseases and casual organism.
- c. Prescribes methods of preventing and controlling plant disease, nematodes and physiological disorders.
- d. Explain factors necessary for disease infection in plants.
- e. Diagrams the life cycle of common diseases.
- f. Explains how fungi, bacteria, and viruses are spread.
- g. Identifies common plant diseases by symptoms and signs.

DRAFT

- h. Traces the history and importance of plant pathology.
- i. Describes the types of nematodes and how they damage plants.
- j. Explains how unfavorable environmental conditions can affect disease or disease-like infestations in plants.
- k. Differentiates between pathogenic and non-pathogenic diseases.

Academic Standard:

SBO4 Students will explore the defense systems of plants and recognize the impact of plant diseases on the biosphere.

- a. Identify plant diseases and management strategies.*
- b. Examine how plant diseases affect humans and animals.*
- c. Examine how plants respond to diseases caused by pathogens (i.e. insects, fungi, bacteria, viruses) and attempt to protect themselves from those disease causing agents.*

ELA10RC3 The student acquires new vocabulary in each content area and uses it correctly.

- a. Demonstrates an understanding of contextual vocabulary in various subjects.*
- c. Explores understanding of new words found in subject area texts.*

AG-PSB-16 The student explains the water-plant relationship and describes how water and other materials move through the plant.

- a. Describes the three categories of water that may be present in the soil.
- b. Describes hydraulic conductivity, infiltration, and percolation.
- c. Distinguishes between soil texture and bulk density and how they affect soil-water.
- d. Defines absorption and describes how absorption takes place.
- e. Explains how soil solution enters root hairs.

Academic Standards:

SB1. Students will analyze the nature of the relationships between structures and functions in living cells.

- d. Explain the impact of water on life processes (i.e., osmosis, diffusion).*

SBO3 Students will explore the structures and processes necessary for the mutual survival of plants and animals.

- a. Describe and relate plant structures (organs, tissues, cells, organelles) to plant processes (photosynthesis, respiration, transport, growth, reproduction, dispersal).*

AG-PSB-17 The student describes environmentally controlled plant growth systems and prescribes their use based on plant environmental needs and economic factors.

- a. Discusses why environmentally controlled structures are used and describe their advantages.
- b. Diagrams the environmental control components of greenhouses, cold frames, and other plant growth structures.
- c. Describes how hydroponic systems are used in horticulture and plant science.
- d. Describes the essential elements of a hydroponic system.

Academic Standard:

SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources

- b. Describe how technology is increasing the efficiency of utilization and accessibility of resources.*

ELA10RC4 The student establishes a context for information acquired by reading across subject areas.

- a. Explores life experiences related to subject area content.*

AG-PSB-18 The student analyzes the affect of plant production on the environment and quality of life factors.

- a. Describes how conventional agricultural practices affect the environment.
- b. Describes new agricultural practices that are environmentally friendly.
- c. Compares and contrasts the advantages and disadvantages of conventional versus organic farming.
- d. Describes how composting works and the procedures for creating a compost pile.
- e. Describes uses for plant by-products and the environmental benefits to using them.
- f. Explains the importance of compost in the production of plants.
- g. Defines methods of erosion prevention and prescribes erosion control measures for a specific site in the community.

Academic Standards:

SEV5. Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems.

- d. Describe the actual and potential effects of habitat destruction, erosion, and depletion of soil fertility associated with human activities.*

ELA10RC4 The student establishes a context for information acquired by reading across subject areas.

- a. Explores life experiences related to subject area content.*

AG-PSB-19 The student becomes oriented to the comprehensive program of agricultural education, learns to work safely in the agriculture lab and work sites, demonstrates selected competencies in leadership through the FFA and agricultural industry organizations, and develops plans for a supervised agricultural experience program.

- a. Explains the role of the Agriculture Education program and the FFA in personal development.
- b. Demonstrates knowledge learned through a Supervised Agricultural Experience Program (SAEP).
- c. Develops leadership and personal development skills through participation in the FFA.
- d. Explores career opportunities in plant science.
- e. Explores the professional agricultural organizations associated with the course content.

Academic Standard:

ELA10C1 The student demonstrates understanding and control of the rules of the English language, realizing that usage involves the appropriate application of conventions and grammar in both written and spoken formats.

- a. Demonstrates an understanding of proper English usage and control of grammar, sentence and paragraph structure, diction, and syntax.*
- b. Correctly uses clauses (i.e., main and subordinate), phrases (i.e., gerund, infinitive, and participial), and mechanics of punctuation (i.e., end marks, commas, semicolons, quotation marks, colons, ellipses, hyphens).*
- c. Demonstrates an understanding of sentence construction (e.g., subordination, proper placement of modifiers, parallel structure) and proper English usage (i.e., consistency of verb tenses, agreement).*

ELA10LSVI The student participates in student-to-teacher, student-to-student, and group verbal interactions. The student

- d. Actively solicits another person's comments or opinion.*
- e. Offers own opinion forcefully without domineering.*
- f. Contributes voluntarily and responds directly when solicited by teacher or discussion leader.*
- g. Gives reasons in support of opinions expressed.*
- i. Employs group decision-making techniques such as brainstorming or a problem-solving sequence (e.g., recognizes problem, defines problem, identifies*

possible solutions, selects optimal solution, implements solution, evaluates solution)

Characteristics of Science

Habits of Mind

SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.

- a. Follow correct procedures for use of scientific apparatus.
- b. Demonstrate appropriate technique in all laboratory situations.
- c. Follow correct protocol for identifying and reporting safety problems and violations.

SCSh3. Students will identify and investigate problems scientifically.

- a. Suggest reasonable hypotheses for identified problems.
- b. Develop procedures for solving scientific problems.
- c. Collect, organize and record appropriate data.
- e. Develop reasonable conclusions based on data collected.
- f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

SCSh4. Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

- a. Develop and use systematic procedures for recording and organizing information.
- b. Use technology to produce tables and graphs.
- c. Use technology to develop, test, and revise experimental or mathematical models.

SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

- a. Trace the source on any large disparity between estimated and calculated answers to problems.
- b. Consider possible effects of measurement errors on calculations.

SCSh6. Students will communicate scientific investigations and information clearly.

- a. Write clear, coherent laboratory reports related to scientific investigations.
- b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
- c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
- d. Participate in group discussions of scientific investigation and current scientific issues.

The Nature of Science

SCSh7. Students analyze how scientific knowledge is developed.

Students recognize that:

- a. The universe is a vast single system in which the basic principles are the same everywhere.
- b. Universal principles are discovered through observation and experimental verification.
- c. From time to time, major shifts occur in the scientific view of how the world works.
- d. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
- e. Hypotheses often cause scientists to develop new experiments that produce additional data.
- f. Testing, revising, and occasionally rejecting new and old theories never ends.

SCSh8. Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

- a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
- b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.
- c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
- d. The merit of a new theory is judged by how well scientific data are explained by the new theory.
- e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
- f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

Reading Across the Curriculum

Reading Standard Comment

After the elementary years, students engage in reading for learning. This process sweeps across all disciplinary domains, extending even to the area of personal they experience text in all genres and modes of discourse. In the study of various disciplines of learning (language arts, mathematics, science, social studies), students must learn through reading the communities of discourse of each of those disciplines. Each subject has its own specific vocabulary, and for students to excel in all subjects, they must learn the specific vocabulary of those subject areas in context.

Beginning with the middle grades years, students begin to self-select reading materials based on personal interests established through classroom learning. Students become curious about science, mathematics, history, and literature as they form contexts for those subjects related to their personal and classroom experiences. As students explore academic areas through reading, they develop favorite subjects and become confident in their verbal discourse about those subjects.

Reading across curriculum content develops both academic and personal interests in students. As students read, they develop both content and contextual vocabulary. They also build good habits for reading, researching, and learning. The Reading Across the Curriculum standard focuses on the academic and personal skills students acquire as they read in all areas of learning.

CTAE-RC-1 Students will enhance reading in all curriculum areas by:

- a. Reading in all curriculum areas
 - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
 - Read both informational and fictional texts in a variety of genres and modes of discourse.
 - Read technical texts related to various subject areas.
- b. Discussing books
 - Discuss messages and themes from books in all subject areas.
 - Respond to a variety of texts in multiple modes of discourse.
 - Relate messages and themes from one subject area to messages and themes in another area.
 - Evaluate the merit of texts in every subject discipline.
 - Examine author's purpose in writing.
 - Recognize the features of disciplinary texts.
- c. Building vocabulary knowledge
 - Demonstrate an understanding of contextual vocabulary in various subjects.
 - Use content vocabulary in writing and speaking.
 - Explore understanding of new words found in subject area texts.
- d. Establishing context
 - Explore life experiences related to subject area content.
 - Discuss in both writing and speaking how certain words are subject area related.
 - Determine strategies for finding content and contextual meaning for unknown words.

CTAE Foundation Skills

The Foundation Skills for Career, Technical and Agricultural Education (CTAE) are critical competencies that students pursuing any career pathway should exhibit to be successful. As core standards for all career pathways in all program concentrations, these skills link career, technical and agricultural education to the state's academic performance standards.

The CTAE Foundation Skills are aligned to the foundation of the U. S. Department of Education's 16 Career Clusters. Endorsed by the National Career Technical Education Foundation (NCTEF) and the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), the foundation skills were developed from an analysis of all pathways in the sixteen occupational areas. These standards were identified and validated by a national advisory group of employers, secondary and postsecondary educators, labor associations, and other stakeholders. The Knowledge and Skills provide learners a broad foundation for managing lifelong learning and career transitions in a rapidly changing economy.

CTAE-FS-1 Technical Skills: Learners achieve technical content skills necessary to pursue the full range of careers for all pathways in the program concentration.

CTAE-FS-2 Academic Foundations: Learners achieve state academic standards at or above grade level.

CTAE-FS-3 Communications: Learners use various communication skills in expressing and interpreting information.

CTAE-FS-4 Problem Solving and Critical Thinking: Learners define and solve problems, and use problem-solving and improvement methods and tools.

CTAE-FS-5 Information Technology Applications: Learners use multiple information technology devices to access, organize, process, transmit, and communicate information.

CTAE-FS-6 Systems: Learners understand a variety of organizational structures and functions.

CTAE-FS-7 Safety, Health and Environment: Learners employ safety, health and environmental management systems in corporations and comprehend their importance to organizational performance and regulatory compliance.

CTAE-FS-8 Leadership and Teamwork: Learners apply leadership and teamwork skills in collaborating with others to accomplish organizational goals and objectives.

CTAE-FS-9 Ethics and Legal Responsibilities: Learners commit to work ethics, behavior, and legal responsibilities in the workplace.

CTAE-FS-10 Career Development: Learners plan and manage academic-career plans and employment relations.

CTAE-FS-11 Entrepreneurship: Learners demonstrate understanding of concepts, processes, and behaviors associated with successful entrepreneurial performance.