Hydroponics & Gardening

ACADEMY CHARTER HIGH SCHOOL

CURRICULUM GUIDE

Table of Contents

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SCHOOL PHILOSOPHY:

In Academy Charter High School, we recognize that each student is unique and that the purpose of education is to enable every student to acquire the learning skills necessary to compete in the global community. It is essential that we provide a rigorous, high-quality curriculum that allows each student's talents and abilities to be developed to their full potential. The Academy Charter High School Board of Education believes that language is fundamental for all other learning. This curriculum allows children to explore the many facets that construct the richness of language and the many genres through which authors express ideas about the world with the ultimate goal of preparing students to read, write, speak and think critically.

PURPOSE AND VISION:

The purpose of the Academy Charter High School Curriculum Guide is to provide a blueprint for organizing instructional strategies, methodologies and activities that provide an opportunity for every child to meet and exceed the New Jersey Students Learning Standards. It will guide the implementation of the standards by specifying the design of instructional materials, curriculum and instructional strategies. The standards designate what to teach at specific grade levels, and this guide provides procedures and selected research-based approaches for implementing instruction to meet the diverse needs of the student population, including those with special learning needs and whose native language is other than English.

Educators will use the guide and the content standards as a road map for curriculum and instruction. The ultimate goal is cultivate global, independent thinkers by shifting classroom priorities from teaching to learning, with a focus on student outcomes. This paradigm shift in instructional trends from a teacher-directed model is designed to allow a student-centered learning environment to thrive. The guide will also:

- Provide a vertical and horizontal framework for content and skills in alignment with the standards and district benchmarks
- Provide student outcomes that are developmentally appropriate and measurable
- Provide a flexible framework within which teachers can design instructional strategies and models that address various learning styles for a more individualized student learning environment
- Present the Key Elements of content and skills for the purpose of creating an environment of Enduring Understanding through
- Essential Questions and student-centered learning scenarios

- Provide resources of Best Practices from which teachers can glean examples of instructional strategies upon which they can model their classes

Intentional cross curricular content connections will guide students through the learning process by the use of active learning techniques which include:

- Exploration & Discovery
- Project-based Learning (PBL)
- Essential Questioning
- Collaborative learning groups
- Learning stations

This Curriculum Guide provides a balanced and comprehensive approach that focuses on:

- Explicit teaching of skills as a means of supporting mastery of standard English conventions, comprehension strategies and communication skills to cultivate competent learners
- Acquisition of literacy skills to support efficient readers, writers, speakers, listeners and viewers
- Engagement of students in activities that provide opportunities for students to participate in problem-solving using inquiry skills
- A variety of literary genres to create well rounded readers
- Differentiated instructional strategies to address diverse learning styles and needs
- Project-based, authentic learning activities
- Instructional practices delivered in meaningful contexts in order to enable students to preserve the learning for future use or transfer to other learning activities
- The use of technology as a tool for learning to develop 21st century learners
- Intentional, explicit and systematic instruction in fluency, comprehension, and vocabulary development

Content Area	Hydroponics and Gardening
Interdisciplinary Connections	The updated curriculum documents to reflect interdisciplinary connections. Activities, assessments and/or differentiation strategies were highlighted and coded the specific content area. (Interdisciplinary Connections)
Core Instructional Materials (including digital tools)	Farmative - Fork Farms Curriculum Resources. Specific supplemental instructional materials are located within each unit below. All students are also supplied with a Chromebook with internet access.
21st Century Themes and Skills	Students completing this course will develop the following 21st Century Skills and Themes: **Themes:** - Global Awareness - Civic Literacy **Skills:** Learning and Innovation Skills Creativity and Innovation - Think creatively, work creatively with others Critical Thinking and Problem Solving - Reason effectively, use systems thinking, make judgements and decisions, solve problems Communication and Collaboration - Communicate clearly, collaborate with others Information, Media and Technology Skills Information Literacy - Access and evaluate information, use and manage information Media Literacy - Analyze media products ICT Literacy - Apply technology effectively

	Life and Career Skills Flexibility and Adaptability - Adapt to varied roles, job responsibilities, schedules and contexts - Be Flexible: Incorporate feedback effectively; deal positively with praise, setbacks, and criticism; understand, negotiate and balance diverse views and beliefs to reach workable solutions, particularly in multicultural environments Initiative and Self-Direction - Manage goals and time, work independently, be self-directed learners Social and Cross-Cultural Skills - Interact effectively with others, work effectively in diverse teams Productivity and Accountability - Manage projects and produce results Leadership and Responsibility - Guide and lead others, be responsible to others
Career Readiness Practices and Standards	Students completing this course will develop the following Career Readiness Practices and Standards: CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP3. Attend to personal health and financial well-being. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP10. Plan education and career paths aligned to personal goals. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence.
8.1 Computer Science	Upon completion of Hydroponics and Gardening, students will have developed the following NJSLS Computer Science and Design Thinking Standards:

8.2 Design Thinking	8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources. 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.3: Evaluate several models of the same type of product and make recommendations for a new design based on a cost benefit analysis. 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor). 8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints. 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture. 8.2.12.NT.1: Explain how different groups can contribute to the overall design of a product. 8.2.12.NT.2: Redesign an existing product to improve form or function. 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
New Jersey Student Learning Standards (NJSLS)	**Interdisciplinary Connections NJSLS:** **SCIENCE** HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, the occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral

	resources based on cost-benefit ratios. HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. HS-ETS1-6 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS2-8 Evaluate evidence for the role of group behavior on individuals and species' chances to survive and

	reproduce. HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.	
Pacing Guide	**Unit**	**Timeframe**
	1. The Food We Eat	1-2 weeks
	2. What is Hydroponics?	1-2 weeks
	3. From Seed to Plant	1-2 weeks
	4. The pH of Water	1-2 weeks
	5. Growing in the Flex Farm	1-2 weeks
	6. How to Feed 7.8 Billion People	1-2 weeks
	7. The Plant and the Plant Life Cycle	1-2 weeks
	8. What is Harvesting?	1-2 weeks
	9.Completing the Life Cycle With Composting	1-2 weeks
	10. Sustainability	1-2 weeks
	11. How Is Our Food Packaged?	1-2 weeks
Resource	Students in Resource are exposed to texts that are the same or similar in content, but are scaled to students' Lexile and comprehension levels. Texts may include, but aren't limited to the adapted version of core texts and graphic novels of core texts. Additionally, students in Resource may have a modified pacing guide to meet the needs of individual students.	
Assessments	All students take midterms and finals. Other assessments are indicated throughout the units of study.	

Unit 1: The Food We Eat
21st Century Themes and Skills: **Themes:** Global Awareness, Civic Literacy **Skills:** Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)
NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11
NJSLS Computer Science and Design Thinking: 8.1.12.IC.3, 8.2.12.ED.3, 8.2.12.ED.5, 8.2.12.ED.6
Interdisciplinary Connections: **Science:** HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, the occurrence of natural hazards, and changes in climate have influenced human activity. HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
Approximate Time Frame: 1-2 weeks
Big Ideas: - An overview of farming, where our food comes from and what plants need to grow.
Essential Questions: ● Where does our food come from that feeds our community? ● How do food production methods impact the Earth? ● Who are the world's largest producers of food and what makes them the largest producers of food? ● How far does food travel to get to our community? ● What variables may impact the cost of food? How does this cost affect people's food choices?

Enduring Understandings:

- Students should understand that food comes from other sources prior to humans or animals being able to eat it.
- Students should understand the different ways that food can be grown, such as hydroponic farming or traditional farming, and how this may impact the purchase price.
- Students will be able to identify sources of food and understand where the plants and animals they eat come from.
- Students will understand how food production methods impact the Earth.
- Students will be able to understand that much of the food they consume travels a significant distance before reaching their plates.
- Students will understand what variables may impact the cost of food and how this cost affects people's food choices.
- Students will understand that the cost of food varies from vendor to vendor.

The Food We Eat	**RELEVANT RESOURCES/MATERIALS**
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
• Prior to Day 1: Provide each student with the Lesson 1 Student Guide and ask them to either visit a grocery store and/or research products that can go into a salad and/ or fresh meal. Give an example for the students of food items: Bolthouse Farm carrots are from Michigan, costing ~$1.93, and have no preservatives. • Present Slide Deck on The Food We Eat • Introduce Vocabulary: Traditional farming, hydroponic farming, produce, harvest, processing, marketing, retailers, food industry, crops, technology, transporting, agriculture, consumers, sustainable, food miles, socioeconomic, food production	FOR TEACHERS • Prepare: Prior to "Day 1" have students research and record items they would typically put in a salad and/or fresh meal from any of the following: convenience store, large grocery chain, local grocery chain, and/or local market. • Slide deck: The Food We Eat [in elective folder/Farmative] • Access to the internet to share online resources: Walmart, Target, NPR article FOR STUDENTS • Student Guide: The Food We Eat [in elective folder/Farmative]
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
THINK-PAIR-SHARE • Have students discuss in groups, where their food comes from, how long they think that it takes to get from where it is produced to their tables, similarities, and differences on the labels, and differences in cost. Students can also research a	FOR STUDENTS • Student Guide: The Food We Eat • Copy of US Map or similar map WEBSITES • Know Where Your Food Comes From With USDA Foods

specific food/brand and where the food comes from if they are unable to visit a grocery store. Students should share the list they created prior to this assignment. MAPS ● Students will be provided with a blank map. Printable world and US maps available online. https://www.printableworldmap.net/ ● Teachers can determine, based on grade level the types of map to provide: local, regional, national, global. RESEARCH ● Teachers will share how to access the following articles and websites talking about where the food originated. More in adjacent column → a. A Map Of Where Your Food Originated May Surprise You : The Salt : NPR US Department of Agriculture	● 40 Maps That Explain Food in America ● Where Has Your Food Been? ● Mapped: Food Production Around the World (interactive) VIDEO ● Investopedia Video: Who Produces the World's Food? (2:05)
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
GROUPS ● Students will be broken up into groups. ● Each group will identify one food that they researched, as their focus food, to present to the class. (presentations can be on Google Slides, paper, oral etc.) ● Student teams will use the map to identify where that specific food comes from. Students can reference their list, the map from the article, and information collected from the video. ● Students will create a presentation that includes the following information regarding one type of food: 1. Type of food 2. Native location the food is grown 3. How the food is harvested	FOR STUDENTS ● Student Guide: The Food We Eat ● Copy of US Map or similar map ● Resources to create presentation: presentation software, optional notecards

4. How the food is processed 5. How the food is packed 6. How the food is shipped/transported 7. Initial cost of food compared to what it is sold for 8. How cost may influence which socioeconomic group will purchase the food 9. Identify the final destination of the foods and how the destination affects cost PRESENTATIONS ● Students will share the following: ● The information placed on their map pertaining to the food. The information placed in their presentation pertaining to the food. EXTENSIONS ● Create a comic strip showing where your food comes from before it becomes a meal. Where does it start? Steps it takes to get to you?	
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Chromebook for Internet, Research, Articles, & Presentations

Unit 2:
What is Hydroponics?

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.5, 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ETW.2

Interdisciplinary Connections:
Science:
HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- An overview of Hydroponics and how it relates to the Flex Farm.

Essential Questions:
- How do plants grow through hydroponic farming?
- What types of mediums and aggregates can be used?
- What do plants need that are the same for hydroponic farming and traditional farming?
- How does the shelf life of plants grown in soil and bought from the store compare to the shelf life of plants grown in hydroponic systems?
- What are the benefits of hydroponic farming compared to growing plants in soil?

Enduring Understandings:

- Students will be able to discuss how to grow food in soil and be able to compare that to the process of growing food in a hydroponic farm.
- Students will understand what shelf-life is for produce and food.
- Students will understand the process of photosynthesis.
- Students will be able to compare and contrast the difference between growing food through hydroponic farming vs. growing food in the soil.
- Students will be able to understand the benefits of hydroponic farming compared to traditional growing methods.
- Students will be able to use problem-solving and critical thinking skills.
- Students will be able to determine the shelf life of fresh lettuce and/ or produce grown in a hydroponic farm vs. the shelf life of store bought fresh lettuce/produce.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
WATCH ● Students will watch the video from the Fork Farms Vertical Hydroponics Learning Module and take notes. ● Video: Fork Farms Vertical Hydroponics Learning Module → ● Go over Slide Deck: What is Hydroponics? → ● Introduce Vocabulary: Water, soil, aggregates, resources, shelf-life, photosynthesis, hydroponics, medium, Flex Farm	FOR TEACHERS ● Access to the internet and projector to share various videos with students and to share students' presentations with the whole group. ● Video: Fork Farms Vertical Hydroponics Learning Module ● Slide deck: What Is Hydroponics? [in elective folder/Farmative] FOR STUDENTS ● Student Guide: What is Hydroponics? [in elective folder] ● Resource link: USDA National Agricultural Library: Hydroponics ● Access to a presentation making software (ie. Google Slides, Powerpoint) IN DRIVE FOLDER & FARMATIVE ACCOUNTS ● FLEX FARM ACTIVITY GUIDE #2 - How Does Your Garden Grow? (Intro to Hydroponics) ● FLEX FARM GROWING GUIDE ● FORK FARMS VERTICAL HYDROPONICS LEARNING MODULE - Video made in partnership with Fox Valley Technical College on Vertical Farming/Hydroponics

Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
GROUPS ● Students will be divided into groups to engage in discussion and research regarding similarities and differences between hydroponic farming with the Flex Farm vs. plants grown through traditional farming (produce grown in soil). ● Students in their groups will place the information they have researched and discussed to complete the compare and contrast graphic organizer located on the ● Complete Student Guide: What is Hydroponics? CREATE ● Students will create a group presentation to use as a visual to share the similarities and differences between produce grown through hydroponic farming and traditional farming. ● Students can submit work to the teacher for review or present research with the class. It is encouraged to engage students in a discussion around their research on the benefits of hydroponics as it compares to traditional farming.	FOR STUDENTS ● Student Guide: What is Hydroponics? [in elective folder] ● Resource link: USDA National Agricultural Library: Hydroponics ● Access to a presentation making software (ie. Google Slides, Powerpoint)
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
OPTIONAL EXTENSIONS: ● CREATE a. Students will complete the presentation that they began last class and will plan out their oral presentation of the information. ● PRESENT a. Teams will use their presentation slides as a visual for their oral presentation on hydroponic farming versus traditional farming (growing food in the soil).	Additional Resources ● INFORMATION ○ Students, if needed, may watch the Google Slides for Kids video as a review on how to create a presentation. Google Slides for Kids - Episode 1 ● WEBSITES ○ What Are Hydroponic Systems and How Do They Work ○ Explain That Stuff!: Hydroponics

<table>
<tr>
<td>ASSESSMENT OPTIONS:
● OPTION 1
○ Students can create an infographic (visual poster) comparing and contrasting hydroponic farming vs. traditional farming.
○ Goal: Visually summarize the benefits of hydroponic Farming.
● OPTION 2
○ Students can create a hydroponic system using household material.
○ Fork Farms President At Home Hydroponic System Video
○ Goal: To create a successful hydroponic system using low- cost supplies.</td>
<td>○ One Green Planet: How Hydroponics Works And What To Know About Using It
○ How Stuff Works: How Hydroponics Works
○ Top 15 Reasons Why You Should Grow Vegetables in a Hydroponic Garden</td>
</tr>
<tr>
<td>STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions</td>
<td>INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY: Chromebook for Internet, Videos, Articles, & Presentations</td>
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Unit 3:
From Seed to Plant

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.5, 8.2.12.ED.6, 8.2.12.ITH.3, 8.2.12.ETW.1

Interdisciplinary Connections:
Science:
HS-LS2-8 Evaluate evidence for the role of group behavior on individuals and species' chances to survive and reproduce.
HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-8 Evaluate evidence for the role of group behavior on individuals and species' chances to survive and reproduce.
HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- An overview of the parts of a seed and what each part does to help the seed survive and grow into a plant.

Essential Questions:
- What are environmental factors that help a seed to grow?
- What are plant hormones and how do they affect plant growth, development, ripening, and response to various stimuli?
- What are the parts and functions within a seed and parts of a plant?
- What is rockwool and what purpose does it serve?

Enduring Understandings:

- Students should be able to list the basic needs of an organism (plant, human, animal) to live (water, air, etc).
- Students should be able to state why an organism needs air, water, etc. to live and grow.
- Students should be able to identify the environmental needs for seeds to grow.
- Students should have a basic understanding of photosynthesis.
- Students will be able to identify the parts of a seed.
- Students will be able to explain the process of seed germination.
- Students will understand the purpose of plant hormones.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
INTRODUCTION ● Introduce the topic using the slide deck: Seed to Plant ● Review: Key Vocabulary: Seed, seed coat, food storage, embryo, embryo shoot, embryo root, life cycle, germination, hydro, primary root, rockwool, hormones, auxins, gibberellins SHARE ● Indoor Seed Starting (PBS Let's Grow Stuff) (6:43) ● How is the information about growing indoors in the video the same as growing in the Flex Farm? How is it different? ● The host of the video mentions various materials for growing indoors. What are the comparable materials for the Flex Farm? (ie. potting soil / rockwool, south-facing window/light tower) ● What are the benefits of using the Flex Farm method for indoor growing over the growing methods the host mentioned in the video? (More growth cycles, recycling water, etc). ● What are the disadvantages? (ie. more variety of plants)	FOR THE CLASSROOM ● For planting: Rockwool, nursery tray, water, plastic cover or humidity dome, seeds ● Optional: Magnifying glass or microscope FOR TEACHERS ● Slide deck: Seed to Plant ● Access to the internet to share the video Indoor Seed Starting (PBS Let's Grow Stuff) (6:43) ● Optional: Camera to show a close-up of a dissected seed. ○ Flex Farm Data Log
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**

READ ● Have the students read 7 Essential Steps to the Most Successful Seed Germination or Seed and Seedling Biology LIST ● Have students list new seed/plant-related words that were in the article. (ie. viable, optimum, germination, drainage, etc) DISCUSS ● Discuss the article with students. What did the article say a plant needs to grow? DISCOVER ● Dissect two varieties of seeds and point out the similarities and differences OR using a magnifying glass or microscope, have students view the seed on their own. LABEL ● Have the students label the seed diagram on the Student Guide using the completed seed diagram from the slide deck.	FOR STUDENTS ● Student Guide: From Seed to Plant ● Internet to access articles: ○ 7 Essential Steps to the Most Successful Seed Germination ○ Article Seed and Seedling Biology - Penn State University
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
OBSERVE ● View a side-by-side comparison of a Flex Farm seed and a "regular" seed using a document camera. What do students notice? ● Answer: Flex Farm seeds are clay-coated or "pelleted," are easy to handle, and helps seeds retain the appropriate amount of moisture. ● Optional: Crush a pelleted seed to remove the clay covering to observe the lettuce seed. DISCUSS ● What is rockwool? What purpose does the rockwool serve? DEMONSTRATE	Additional Assessment Options ● Seed Germination Quiz - Online Additional Resources ● Seed Germination ● Biology Dictionary: Germination ● Seed Germination Requirements ● Science 101: Germination

• Demonstrate the proper procedure of how a seed is planted in the rockwool. Have each student plant a seed. Follow the procedure for planting seeds from the Flex Farm Grow Guide and/or The Flex Farm Grow Videos. RECORD • Flex Farm Data Log. Have students record information regarding planting the seeds.	
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Chromebook for Internet, Videos, Articles, & Presentations

Unit 4:
The pH of Water

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

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Interdisciplinary Connections:
Science:
HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, the occurrence of natural hazards, and changes in climate have influenced human activity.
HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- This lesson investigates what pH is and how to determine what the pH of a liquid is. It includes a lab activity where students determine the pH of several liquids. The teacher will also demonstrate how to take the pH level of the water in the Flex Farm. Students will learn why the pH level of the water is so important to plant growth.

Essential Questions:
- What is pH?
- What affects the pH of a solution?
- How can changes in water impact plants and animals?
- What are buffers and how do they impact pH?
- What actions can be taken to make sure the water stays consistent in the Flex Farm?
- How will changes in pH of the water in the Flex Farm impact the growth of plants?

Enduring Understandings:

- Students should be able to ask questions based on their observations.
- Students should be able to record their thoughts and ideas.
- Students should be able to communicate basic scientific principles.
- Students should be able to understand the basic properties of a liquid.
- Students should have an understanding of the properties of water.
- Students will understand that different liquids have a different pH (potential of Hydrogen).
- Students will understand chemistry associated with pH.
- Students will understand what buffers are, the importance and the effect on living things.
- Students will test various samples of liquid to determine whether it is an acid or a base using an indicator and test strips.
- Students will develop an understanding of water quality and how that can impact a plant.
- Students will be able to test the pH of the water in the Flex Farm.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
INTRODUCE vocabulary ● Liquid, hydrogen, pH/pH scale, acid, base, neutral, properties, density, viscosity, transparency, indicator, solution, buffers THINK-PAIR-SHARE ● Student teams will research pH (acids and bases) and indicators. Students will create/draw and label a pH scale for their notebook. Students will create a color- coded acid/base indicator chart. DIVIDE ● Divide students into small lab groups. Each group will have ten plastic cups/beakers (labeled 1-10) filled with different liquids. (For example, chocolate milk, vinegar, orange juice, soapy water, regular tap water, ammonia water, baking soda water, coffee, iced tea, and clear soda.) Students should observe the liquids in the various cups and write down the scientific properties in the chart template.	FOR TEACHERS ● Chart: pH lab activity with indicator and test strip comparison; also included in the Google Slide Deck ● pH indicator liquid from Flex Farm Supply Kit and indicator solution ● How to make purple cabbage juice indicator ● Slide deck: The pH of Water

ASK ● Ask students to compare and contrast the liquids by their properties (color, density, viscosity, transparency). Using the template, students should record their observations and predictions about the various liquids. What predictions can they make about whether the liquids are acid, base, or neutral? What observation led them to their prediction?	
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
EXPERIMENT ● Have the students in each group complete the lab activity using indicator and pH testing strips to determine the pH of each liquid. Students should record the information on their chart using the 0-14 scale for pH strips and color scale for the indicator. EXPLORE ● This part of the activity should be demonstrated in front of the Flex Farm. Explore the Flex Farm system. What liquid do we use in the Flex Farm? (water) What kind of water? ● Why do you think it might be important to know the pH of the water we use in the Flex Farm? How can we keep our water balanced so the plants will grow? How can changes in pH affect the growth of plants in our Flex Farm? Explain the steps you would take if the pH of our Flex Farm was not optimal.	FOR STUDENTS ● Student Guide: The pH of Water ● For Testing: pH testing kit, purple cabbage juice, pH Up & pH Down, TDS Meter, Nutrient A & B, measuring scoop ● Liquids for the Experiment: milk, vinegar, orange juice, clear soda, baking soda, iced tea, coffee, ammonia, soap, water ● Clear plastic cups
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
DEMONSTRATE ● Demonstrate for students where the water is in the system.	Additional Assessments ● Short Answer Essay: Research and explain why knowing the pH of water in the environment is important? (4-5 sentences).

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- Explain to students how and when the water should be tested. Show students how to take the pH of the water in the Flex Farm water tanks.

ASSESS

- Wrap up with a quick assessment to determine student understanding.

TEST

- Test the pH of the water in the Flex Farm. Follow the procedure for testing pH in the Grow Guide. Have students make adjustments to the pH if necessary. Make adjustments to the water's pH if necessary.
- NOTE: The water in the Flex Farm should be 6 - yellow test color.

RECORD

- Have students record the pH test data in the Flex Farm
- Data Log.

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Explain the need and importance of buffers in plant cells. How do buffers affect the overall health of the plant?

- Quiz Online: Acids, Bases, and the pH Scale Practice

Additional Resources

WEBSITES

- Acids and Bases: Cabbage Juice Indicator - PBS
- pH and Water | US Geological Survey
- What is pH?

VIDEOS

- Khan Academy: Introduction to pH (5:12)
- Buffers, the Acid Rain Slayer (11:40)

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<td>STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions</td>
<td>INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY: Chromebook for Internet, Videos, Articles, & Presentations</td>
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Unit 5:
Growing in the Flex Farm

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.5, 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ETW.1, 8.2.12.ETW.3

Interdisciplinary Connections:
Science:
HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.
HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- Students will investigate what a plant needs to grow and learn the process of how plants get their nutrients in the Flex Farm.

Essential Questions:
- What do plants need to grow? What do plants produce as a result of this growth?
- How do plants grow and survive in a Flex Farm (hydroponics system)?
- What is photosynthesis?
- What is the importance of the light-dependent reaction and light-independent reactions (Calvin cycle) in photosynthesis?

Enduring Understandings:

- Students should be able to understand what plants need to grow. Students should be able to understand free energy.
- Students should be able to understand what ATP and NADH are and their purpose.
- Students should be able to explain how plants grow in a hydroponics system - Recap Lesson 2: What is Hydroponics?
- Students will be able to describe what plants need to grow and what is produced as a result of this growth.
- Students will be able to define photosynthesis.
- Students will understand the importance of the light-dependent reaction and the light-independent reaction of photosynthesis.
- Students will understand the purpose of chlorophyll and why different types are necessary.
- Students will be able to identify different types of growing methods. Students will be able to correctly measure the number of nutrients in the Flex Farm system and understand how to add appropriate amounts of nutrients.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
INTRODUCE ● Vocabulary: Seedling, glucose, survive, adapt, resources, carbon dioxide, oxygen, nutrients, photosynthesis, chlorophyll, chloroplast, light dependent reaction, light independent reaction THINK-PAIR-SHARE ● Students will discuss with their groups what plants need, what plants produce, and why. Students will make a list in their notebooks of what they believe plants need and produce and why RESEARCH ● Student teams will research: What do plants need to grow and survive, what the purpose of each is, and where we find those resources in the Flex Farm. Students will complete the chart: What do Plants Need to Grow? located on their Student Guide. (See chart	FOR TEACHERS ● Slide deck: Growing in the Flex Farm For exploration and demonstration: rockwool, Grower Toolkit, Flex Farm nutrients

and answers below)

WHAT DO PLANTS NEED TO GROW?	WHAT IS THE PURPOSE?	WHERE IN THE FLEX FARM?
Light	Plants need energy, light energy converted to chemical energy "photosynthesis"	Light Tower
Carbon dioxide	Plants need Carbon Dioxide (CO_2) - necessary for photosynthesis	The air around the Flex Farm
Water	Plants need water - necessary for photosynthesis	Water tanks, circulated by the water pump
Nutrients	Plants need "food" - necessary for photosynthesis	Dissolved in the water, circulated by the water pump Nutrient A + B
Space	Plants need space to grow, absorb more light (energy) through leaves	Rockwool, grow ports, root chamber

WHAT DO PLANTS PRODUCE?	WHY IS THIS NEEDED IN ORDER TO KEEP THE PLANT ALIVE?
Oxygen	Oxygen is needed for organisms to go through aerobic cellular respiration in order to make ATP
Glucose	The energy stored in glucose is needed to make ATP

DISCUSS

- As a class: What do plants need to grow and what is produced? What is the purpose of each resource, and where is it found in the Flex Farm? Display the chart on the board and fill it in as a class.

Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
EXPLORE ● What is photosynthesis? WATCH ● Independently or as a group watch the following video on photosynthesis: Photosynthesis, and answer questions located on the Student Guide. REVIEW	FOR STUDENTS ● Student Guide: Growing in the Flex Farm To record observations: paper, pencils, pens

• Using the slide deck: Growing in the Flex Farm, review the following topics. What is photosynthesis? (On slide deck) What is chlorophyll? What is the importance of having different types of chlorophyll? What are chloroplasts? What is the importance of the light-dependent and light independent reactions?	
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
DISCOVER • Place the rockwool, nutrients, directions for measuring nutrients, and the Flex Farm where the students can interact with the materials. The students will examine the materials and discuss what purpose those materials serve in the Flex Farm. • Answers: The rockwool acts like the soil or sand. It is a substance or media for the plant's roots to grow in. The rockwool does not provide nutrients. Remember, the nutrients are dissolved in the water, therefore, the nutrients come from the water. • Answers: Nutrients A and B are dissolved in the water when poured into the tank. The amount of nutrients needed is determined and measured by a TDS meter. The water is circulated through the Flex Farm via the water pump. Water passes over the roots and nutrients are absorbed by the plant's roots. SHOW • Show the students the nutrients (Nutrient A and Nutrient B). Discuss where the nutrients can be found in the Flex Farm. How do the plants get these nutrients? DEMONSTRATE	Additional Extension Option • Set up a Flipgrid prompt: "Explain how a plant gets nutrients without soil. How does this benefit the earth?" Have students log into Flipgrid using the provided class code or QR code to explain their thinking regarding the prompt. (Flipgrid is a free web-based video/voice recording application.) WEB RESOURCES • Smithsonian Science Education Center - What is Photosynthesis? • University of Minnesota Extension: Small Scale Hydroponics • The Five Best Plants for Hydroponic Gardens • Hydroponics Basics: 16 Beginner Questions Answered

● Use the TDS meter from the Grower Toolkit to test the concentration of minerals in the Flex Farm water and establish a target nutrient level. ● Press the ON/OFF button to turn on the TDS meter. The reading should be 0 PPM (parts per million). ● Dip the lower third of the TDS meter into a beaker or cup filled with water from the Flex Farm. ● Wait 5 seconds to take a reading. With the TDS meter still submerged, press and hold the HOLD button. ● Remove the meter. ● The number that appears on the screen is your Base Number (TDS reading of plain water). ● **NOTE: If the TDS meter has a blinking "X10", multiply the reading by 10 before recording your base number.** ● Calculate your nutrient Target Number by adding 700 to your Base Number. ● *Example:* Base Number: 200 200 + 700 = 900 Target Number = 900 ● **Adding Nutrients:** ● Always add equal parts of Nutrient A and B. A 1:1 ratio of 1 tablespoon Nutrient A and 1 tablespoon of Nutrient B equals a rise in approximately 230 ppm. ● With a fresh tank of water, we recommend starting with 3 tablespoons of Nutrient A and 3 tablespoons of Nutrient B. ● Fill your beaker/measuring cup with 2 cups of water and add 3 tablespoons of Nutrient A. Stir until the nutrients are dissolved. Pour the nutrient mixture into the left tank (with the water pump). ● repeat process for Nutrient B. Fill your beaker/measuring cup with 2 cups of water and add 3 tablespoons of Nutrient B. Please note, Nutrient B will take longer to dissolve in the water	

mixture. Continue to stir until the nutrient is almost completely dissolved. Pour into the left tank. ● **If the TDS reading is within +/-100 of the Target Number recorded:** It is within range and no additional nutrients are necessary. ● **If the TDS reading is more than 100 ppm below the Target Number recorded:** Continue to add equal parts of Nutrient A and Nutrient B in 1 tablespoon increments. 1 tablespoon each of Nutrient A and B approximately equals an increase of 230 ppm. Let your Flex Farm run for a few hours before taking a new TDS reading. Repeat until your TDS reading is within 100 ppm of your Target Number. ● **If the TDS reading is more than 100 ppm above the Target Number recorded:** Remove some of the water in the tank and refill with plain water. After running your Flex Farm for a few hours, take a new TDS reading. Repeat until your TDS reading is within 100 ppm of your Target Number. ● Recheck the nutrient levels after a couple of hours and adjust as needed. ● **Light Timer. Correctly setting the light timer to provide 18 hours worth of light (minimum 14).** ● Set the timer to the current time by rotating the dial in the direction of the arrow until the triangular mark points to the present time. ● Program the timer to turn on for 18 hours per day. To program your timer, push in the black trippers around the dial to set the amount of time for the light tower to be on.	
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Chromebook for Internet, Videos, Articles, & Presentations

Unit 6:
How to Feed 7.8 Billion People

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ITH.2, 8.2.12.ITH.3, 8.2.12.ETW.3

Interdisciplinary Connections:
Science:
HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

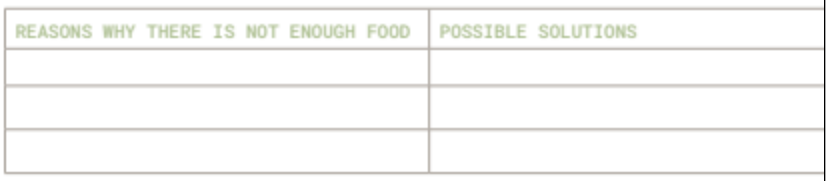
Approximate Time Frame: 1-2 weeks

Big Ideas:
- An overview of the world's food gap/ food insecurity and what solutions are available to help us reduce the gap. How do we realistically feed 7.8 billion people?

Essential Questions:
- What can be done to ensure that there is enough food for our growing global population?
- What is a food gap? What can be done to close the food gap?
- What can we do to increase agricultural production?
- How can we make the most of what we have? How can we best use our resources?

Enduring Understandings:

- Students should be able to understand how many people are in the world.
- Students should be able to understand the vast difference between one million and one trillion.
- Students should be able to understand that there are global issues involving hunger and the availability of fresh healthy food.
- Students should be able to identify factors that affect food shortages around the world.
- Students will be able to identify different sources of food.
- Students will be able to define food gap and food insecurity.
- Students will be able to list reasons for the global food gap and food insecurity.
- Students will be able to list various ways the food gap and food insecurities can be reduced.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
INTRODUCE ● Food gap, food insecurity, conserve, agricultural production, hunger, population, natural resources BRAINSTORM ● Brainstorm causes and solutions to the world food gap and why it is increasing: What happens when we don't have the resources to keep getting the food we need? How do we make sure there is enough nutritious food for people everywhere? ● Ask students to think of reasons why there's not enough food and what they can do about it. Have them read the following article for inspiration: How to Feed 10 Billion People.  SHARE ● Slide deck: How to Feed 7.8 Billion People	● FOR TEACHERS ● Access to the internet and a projector to share the video Food & United Nations (2:37) ● Website: How to Feed 10 Billion People ● Slide deck: How to Feed 7.8 Billion Humans

• Compare the causes and solutions to the food gap and food insecurity mentioned in the Slide Deck to the causes and solutions the students determined in the brainstorming portion of the lesson.	
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
DISCUSS • Have students imagine how much food is needed to feed everyone around the world. Where does all of that food come from? What might have an effect on food production? (weather, war, population increase). How does food production impact different consumers (poor vs wealthy, geographic location of consumer)? SHARE AND DISCUSS • The United Nations video The State of the World's Land and Water Resources for Food and Agriculture (2:36) • What solutions did the video provide for protecting our land and water resources? • How does using our Flex Farm help protect our resources and add to the solutions mentioned in the video?	FOR STUDENTS • Student Guide: How to Feed 7.8 Billion Humans • Supplies for students to create a poster, pamphlet, infographic, etc. about their action item. Includes paper, coloring materials, poster board, scissors, etc.
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
CREATE • Students will work in groups to take one action item (food, drive, food banks, community gardens, decrease food waste, better food storage, alternative farming methods) and spread the word. They can make a poster, create a public service announcement, or build something that will let others know the things they can do to help make a difference in closing the food	WEB RESOURCES • World Resources Institute • National Geographic: Feeding 9 Billion • Feeding America Map the Meal Gap Data VIDEO • A 100 People: A World Portrait -Through Our Lens: Food (5:15) • Food & Agriculture Organizations of the United Nations:

gap. Encourage all groups to share their action items with the class. Additional Extension Options ● ACTION ITEM PROJECT ○ Poster, pamphlet, poem, infographic, etc. on a solution on how to feed people. ● RESEARCH OPPORTUNITY ○ What are other schools doing to help? How can larger organizations help to make a difference? What has been working successfully in other countries? How can we learn from these examples? ● WRITING OPPORTUNITY ○ Have students write about some different actions they can take at home to help close the food gap. ● DESIGN OPPORTUNITY ○ Students can create a proposal for a school/community garden. Have them brainstorm how the Flex Farm can be a part of this community project. ● PUBLIC SERVICE ANNOUNCEMENT ○ Students can create a public service announcement video to educate the public on world food shortages and what they can do to help.	● Hunger and Food Insecurity Includes video The State of ● Food Insecurity and Nutrition in the World (3:04) ARTICLES ● USDA: Economic Research Service U.S. Department of Agriculture: Food Insecurity - Key Statistics & Graphics ● Save the Children: Food Insecurity in America ● Causes, Effects and Solutions to Food Insecurity ● 5 Ways to Improve Global Food Security
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Chromebook for Internet, Videos, Articles, & Presentations

Unit 7:
The Plant and the Plant Life Cycle

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.6, 8.2.12.ETW.1, 8.2.12.ETW.2

Interdisciplinary Connections:
Science:
HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- An overview of the parts of a plant, what a plant needs to grow and the plant life cycle.

Essential Questions:
- What are the different phases of a plant's life cycle?
- What are hormones?
- What plant hormones are responsible for germination and plant growth?
- What hormones are responsible for seed dormancy and why are these important?
- What does a seed need to grow into a full-grown plant?
- What is pollination and why is it important to plants?

Enduring Understandings:

- Students will be able to state the different phases of a plant's life cycle.
- Students will be able to label the different parts of a plant and state the part's purpose.
- Students will understand the different types of plant hormones and their impact on germination and plant growth.
- Students should be able to identify various plant types.
- Students should be able to identify basic plant parts.
- Students should have a basic understanding of the function of hormones.
- Students should be able to identify the parts of a flower.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
• INTRODUCE Root, stem, buds, blossom, flower, shoot, leaf, life cycle, pollination, chlorophyll, photosynthesis, glucose, chloroplast, hormones, gibberellins, auxins, abscisic acid (ABA), meristem • THINK-PAIR-SHARE Students will discuss and write down their answers about the following questions. 1. What function do the different parts of a plant serve? 2. How do plants reproduce? • LABEL Students will work in groups to research and label diagrams of plant parts, plant life cycle, and pollination in their Student Guide. Once completed, review the diagrams as a group.	• FLEX FARM BADGE: PLANT SCIENCE • FOR TEACHERS Access to the internet Slide deck: The Plant and Plant Cycle • FOR STUDENTS Student Guide: The Plant and • Plant Cycle Access to a device and the internet for research
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**

• RESEARCH AND DISCUSS Have students independently or in pairs research the following topics: Explain the importance of plant hormones. Explain the relationship between gibberellins and abscisic acid. Explain the process of pollination. Include parts of a flower in your answer. Why are pollinators important to plants and humans? • Optional Resource: Bees	• WEBSITES The Life Cycle of Fast Plants How Plants Make Food Science4Fun: Life Cycle of Plants Life Cycle of a Plant Plant Life Cycle (easier) National Geographic: Photosynthesis • Articles: Bees
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
• SHARE Share the slide deck: The Plant and Plant Cycle. Have students compare their research to the information in the slide deck. • ASSIGN Ask students what else can be grown in the Flex Farm. Is pollination possible in the Flex Farm? Instruct students to research pollination in hydroponics.	• Slide Deck • Student Handouts
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Internet, Chrombooks, Websites

Unit 8: What is Harvesting?
21st Century Themes and Skills: **Themes:** Global Awareness, Civic Literacy **Skills:** Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)
NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11
NJSLS Computer Science and Design Thinking: 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ED.3
Interdisciplinary Connections: **Science:** HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
Approximate Time Frame: 1-2 weeks
Big Ideas: - What is a harvest? Timeline for the Flex Farm harvest and procedures for safely harvesting the Flex Farm crop.
Essential Questions: ● When should you harvest a crop? When do farmers usually harvest their crops? ● What is crop failure? ● What procedures should you follow when harvesting? Why are following these procedures important? ● What are the different types of harvesting? ● What is unsustainable farming and what impact does it have on humans?
Enduring Understandings: ● Students will understand how farmers use the harvest from their crops and how they will use their Flex Farm harvest. ● Students will be able to list proper harvesting procedures for the Flex Farm. ● Students will understand the impact of unsustainable farming on the environment and humans. ● Students will discuss better ways to farm and how the Flex Farm is an example of a sustainable growing system.

- Students should understand what it means to harvest and have a basic understanding of different methods of harvesting.
- Students should understand the concept of sustainability.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
● THINK-PAIR-SHARE What is harvesting? How are crops harvested on a large farm compared to a small farm? ● RESEARCH AND DISCUSS Discuss ways in which crops are harvested on both small farms and large farms and create a list as a class on paper or the board. ● PRESENT Slide deck: What is Harvesting? ● DISCUSS As a class what can we do with our Flex Farm harvest? How can our harvest positively impact our community? Create a list on paper or the board. Vote as a class on what will be your community contribution with your harvest.	● FLEX FARM ACTIVITY GUIDE #6: Reap What You Sow (Harvesting) ● FLEX FARM BADGE: HARVESTING, SUPPLYING ● FLEX FARM FOOD SAFETY CHECKLIST ● FLEX FARM GROW GUIDE ● FLEX FARM GROW VIDEO: HARVESTING ● FLEX FARM DATA LOG
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
HARVESTING FLEX FARM ● DISCUSS Discuss safety procedures for harvesting and storing the crop. Have the students think of solutions to increase the safety and storage of harvested Flex Farm production in the classroom or school. Create a list of Solutions. ● ESTIMATE	● FOR TEACHERS Access to the internet Slide deck: What is Harvesting? ● FOR STUDENTS Student Guide: What is Harvesting? ● FOR HARVEST Flex Farm Grow Guide: Harvest Section

Have students take a guess! How many pounds (grams) of produce was grown in the Flex Farm? Have students post their guesses on the board or a shared document. ● HARVEST Classroom Management: Allow students to rotate/ take turns harvesting the Flex Farm. While one group is harvesting the Flex Farm, the other group(s) can be working on the additional tasks. ● HARVEST GROUP Follow procedures in Badge: Harvesting (5-8 min per group). OTHER GROUPS WAITING TO HARVEST ● MEASURE Student groups will use a triple beam balance or digital scale to measure the mass of their harvest. Students will add their measured amount to the class totals chart. Can be on board or paper copy.	Food safety gloves, bags or containers to store harvest, scale/ balance to measure the weight of harvest
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
● CREATE Student groups will create a timeline of planting, growth, and harvesting (with pictures/drawings) for the Flex Farm. Refer to Flex Farm Data Log to help facilitate discussion. This can be done with paper/pencil or on the computer. ● INVENT Invent a machine/tool that could help you harvest the produce in the Flex Farm. What would your invention look like? How would it work? ● Assessment Options Short Answer Essay: Which form of harvesting is the most sustainable? The most efficient? Which form of harvesting would be best?	● Food Safety From A To Z Reference Guide ● Food Safety Information

Write a procedure for harvesting the Flex Farm that incorporates the Food Safety Standards. Are there ways to improve the harvesting process to make it more efficient?	
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Internet, Chrombooks, Canva, Slides, Websites

Unit 9:
Completing the Life Cycle With Composting

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ED.3

Interdisciplinary Connections:
Science:
HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- An overview of composting. How to create a compost. Introduction to green and brown materials, decomposers, micro and macro organisms. What are the benefits to composting?

Essential Questions:
- What is composting? How does the process of composting work? What materials from the Flex Farm can go into a compost? What ingredients do you need to make compost? What are the benefits of using compost materials?

Enduring Understandings:
- Students will be able to define compost, decompose, and decomposer.
- Students will be able to state the purpose of compost and how it is helpful to plant growth and our environment.
- Students will be able to identify different “ingredients” of compost.
- Students will understand the proper way to create a compost heap.

- Students will understand what can not go into compost and why.
- Students should know the difference between garbage and compost.
- Students should be able to state what a plant needs to grow.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
• INTRODUCE Compost, bacteria, decompose, decomposer, macroorganisms, microorganisms, organic materials, carbon, nitrogen • Start by breaking students out into research teams, or ask students to research independently. • RESEARCH Student teams research what compost is, what ingredients are needed for compost and what ingredients should not be added to compost. Students will fill in the graphic organizer Ingredients of Compost in their Student Guide. • INTRODUCE Introduce the lesson topic and vocabulary with the slide deck: Completing the Life Cycle With Composting. • VIEW (OPTIONAL) Have the students watch the following video: How to Compost	• FOR TEACHERS Access to the internet Slide deck: Completing the Life Cycle With Composting • FOR STUDENTS • Student Guide: Completing the Life Cycle With Composting • COMPOSTING EXPERIMENT MATERIALS Five or six medium plastic transparent containers with lids Rubber gloves Plastic knives or other cutting utensil Compost materials (brown & green materials) saved from the Fork Farm harvest Outside materials collected by students at lunchtime (fruit peels, etc.) or coffee grounds from the teacher's room, old newspapers, etc.
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
• DISCUSS What "green material" and "brown materials" come from the Flex Farm when crops are harvested? When harvesting from the Flex Farm, keep the green materials to add to the class/group compost. Create a list on the board or paper. • EXPERIMENT Prepare group compost bins. Divide the students into five or six small groups. Have the students create a mini compost using medium plastic containers. Each group should keep a log of what types of scraps (green materials and brown materials) they add to their container. They should	• Why is composting important? • EPA: Composting At Home • NRDC: Composting 101 • Recycle Now: Why Compost? • Better Home & Gardens: Your Step by Step Guide to Making Compost That Will Enrich Your Garden (video & information) (5:22) • Penn State Extension: Home Composting: A Guide For Home Gardeners

observe the contents daily as they place new scraps into the container. Using their sense of sight and smell, they can describe how the compost looks and smells, writing their observations in their Student Guide. Experiment Steps: 1. Collect food scraps (organic materials: discarded fruit, vegetables, etc) from the lunchroom every day in a small container. Refer to the Student Guide to make sure you only include appropriate materials safe for composting. 2. Cut up the scraps and place them in the medium size container. 3. Use triple beam balance or digital scale to find the mass of the material to be added. 4. Mix in green and brown materials. Put the lid on the container. 5. With the lid on, turn or shake the container once or twice a week over the next 6-8 weeks. You can monitor longer if needed. optional: Add macroorganisms (worms) and poke holes in the container's lid to see if these changes aid the process.	
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
● DISCUSS Have each group share their observations and present them to the class. ● Additional Assessment Options ● Group compost presentations (this activity will take place at the end of the composting experiment - approximately 3 weeks after the experiment begins).	● Student Guides ● Presentations ● Charts

• Address the following questions: What worked and why? What didn't and why? What would you do differently? How could you improve your group's compost? • Compost Daily Observation Charts • Create a homemade compost bin using household items. Link as a reference: DIY Compost Bin	
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Internet, Chrombooks, Canva, Slides, Websites

Unit 10:
Sustainability

21st Century Themes and Skills:
Themes: Global Awareness, Civic Literacy
Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.6, 8.2.12.ITH.1, 8.2.12.ED.3, 8.2.12.ETW.3

Interdisciplinary Connections:
Science:
HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-6 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.
HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

Approximate Time Frame: 1-2 weeks

Big Ideas:
- Students will understand why sustainability is important in the world today and how the Flex Farm is a sustainable farming option. Students will investigate how we can increase sustainability.

Essential Questions:
- What is sustainability?
- What factors indicate the sustainability of a resource?
- What is sustainable agriculture and what are food production practices?
- How can humans obtain resources (crops) while increasing sustainability?
- How does our Flex Farm help with sustainability?

Enduring Understandings:

- Students will understand the environmental factors that guide humans to sustainability such as biological diversity, food production, average global surface temperatures, and carbon dioxide concentrations.
- Students will understand how to create a sustainable farm and the techniques used to keep that farm sustainable.
- Students should have basic knowledge of the diversity of life, global warming and the role CO2 plays, and environmental issues related to pollution, energy waste, water waste, etc.

	RELEVANT RESOURCES/MATERIALS
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
• INTRODUCE Sustainability, recycling, environment, pollution, reusable, renewable resource, conservation, maximum sustainable yield • THINK-PAIR-SHARE Teams will discuss what sustainability is and how the Flex Farm is helping with sustainability. (Students make lists in teams.) To help define and understand global sustainability goals have students explore the following resources: 1. UN Global Goals Website 2. Zero Hunger • SHARE Introduce the lesson topics by sharing the slide deck: Sustainability	• FLEX FARM BADGE: SUSTAINABILITY • FOR TEACHERS Access to the internet Slide deck: Sustainability • FOR TEACHERS • Student Guide: Sustainability • Access to a device and the internet to be able to create a digital poster, meme, or infographic on the topic of sustainability. (Note: access to possible software for creation: Adobe Spark, Google Slides, or Pic Collage EDU)
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**
• RESEARCH Have students continue to independently or in groups research information about sustainability and why it is important. Ask students to focus their research on providing answers to the following questions: How are farms using sustainable farming methods to conserve and improve soil quality, conserve water, provide habitats, decrease erosion, and increase food production? What can you do to help sustain and conserve our natural resources?	• Student Guide • Websites

• BRAINSTORM Reconvene as a class and brainstorm the following topic: In what ways is the Flex Farm sustainable?	
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
• GENERATE Generate a list as individuals or a whole group of all the ways the Flex Farm is sustainable. In what ways does the Flex Farm help with these global goals? How does the Flex Farm increase food production, reduce CO2 production, and decrease waste? • DISCUSS Discuss how using the Flex Farm supports agricultural sustainability. • CREATE Using the Flex Farm as inspiration students will create a presentation on a resource of their choosing and ways it can be protected, preserved, or made sustainable through innovative product design. Students can use Google Slides, Pic Collage EDU, Adobe Spark, Canva or another application to create their visuals. • PRESENT (OPTIONAL) Have students present their visuals to the class or submit for assessment. • ASSESSMENT OPTION: Sustainability projects and presentations centered around how we can protect our natural resources and environment for the future with a special concentration on sustainable farming solutions.	• What Is Sustainable Farming and Why Is It Important to Our Well Being • Sustainability in Agriculture • Sustainable Agriculture Research and Education (info & video) • Food and Agriculture Organization of the United Nations • Interactive Map: Tracking World Hunger and Food Insecurity • Vertical Farming (Video) (11:04) Purple Plow Sustainability Challenge
STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide, Presentation, Benchmarks, Writing, Optional Extensions	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Internet, Chrombooks, Canva, Slides, Websites

Unit 11:
How Is Our Food Packaged?

21st Century Themes and Skills:

Themes: Global Awareness, Civic Literacy

Skills: Learning and Innovation Skills (Creativity & Innovation, Critical Thinking & Problem Solving, Communication & Collaboration), Information, Media & Technology Skills (Information Literacy, ICT [Information, Communications & Technology] Literacy), Life & Career Skills (Flexibility & Adaptability, Initiative & Self-Direction, Social & Cross-Cultural Skills, Productivity & Accountability)

NJSLS 21st Century Life and Career Practices: CRP1, CRP2, CRP4, CRP6, CRP7, CRP8, CRP11

NJSLS Computer Science and Design Thinking: 8.2.12.ED.1, 8.2.12.ED.3, 8.2.12.ED.5, 8.2.12.ED.6, 8.2.12.ITH.18.2.12.ITH.2, 8.2.12.ITH.3, 8.2.12.NT.1, 8.2.12.NT.2, 8.2.12.ETW.1, 8.2.12.ETW.2, 8.2.12.ETW.3

Interdisciplinary Connections:

Science:

HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, the occurrence of natural hazards, and changes in climate have influenced human activity.

Approximate Time Frame: 1-2 weeks

Big Ideas:

- An overview on food packaging and labeling. Why is it important?

Essential Questions:

- What is the purpose of food packaging?
- What can we learn about our food through its packaging and labels?
- What are the main types of food packaging?
- Why should food packaging be considered when preparing food for distribution?
- What is the FDA and what is its purpose?

Enduring Understandings:

- Students will be able to describe different ways foods can be packaged.
- Students will be able to identify key information on food labels.
- Students will understand consumption amounts for an average adult.
- Students will be able to create a food label for lettuce grown in the Fork Farm.
- Students will be able to explain the importance of the FDA.
- Students should have previous knowledge of different types of packaging used to store and market food.
- Students should have basic hygiene knowledge.
- Students should understand aseptic procedures.

Food Packaging	**RELEVANT RESOURCES/MATERIALS**
Tier 1 Activities/Strategies (Knowledge/Comprehension)	**Tier 1:**
• SHARE Share the slide deck: How is Our Food Packaged? Review the important questions and key vocabulary related to the lesson. • THINK-PAIR-SHARE Break out into groups or pairs and have students discuss the following questions. Why do certain types of food come in a package? Do all foods have packages? Brainstorm as many food packages as you can. What type of food would go into those packages? • SHARE The FDA website: How to Read a Label - FDA Nutrition Label. • ASK What does this package tell us about what's inside? Create a list of student responses.	• FLEX FARM BADGE: BUSINESS / ENTREPRENEURSHIP • FOR TEACHERS Access to the internet Slide deck: How Is Our Food Packaged? • How to Read a Label: FDA Nutrition Label (FDA Website) • FOR STUDENTS Student Guide: How Is Our Food Packaged? Different food items (2 per group) or packaging labels Access to a device and the internet to be able to create a digital label. (Note: access to possible software for creation: Adobe Spark, Google Slides, or Pic Collage EDU) OR supplies such as markers, pens, pencils, to hand draw and design labels.
Tier 2 Activities/Strategies (Application/Analysis)	**Tier 2:**

• WATCH Share the following YouTube video: Understanding food labels • EXPLORE Provide small groups of students with two different food options (ie. veggie chips and pretzels). Students should explore the items and decide which item is a better food choice based on the label information. The group should also discuss the packaging choice for the food items. What is attractive about the packaging? Does the package attract consumers? What is practical about the packaging? Does the nutrition information indicate a healthy snack? Why or why not?	• Understanding Food Labels: https://www.youtube.com/watch?v=Orj7p3KQcyQ
Tier 3 Activities/Strategies (Synthesis/Evaluation)	**Tier 3:**
• SHARE Reconvene the large group and have students share their findings of the two items their group explored. • ASK Ask the students: What packaging materials might they need to prepare our Flex Farm crop(s) for "market"? Explain your reasoning. What other interesting facts about our crop(s) should we place on our package? • DESIGN Have students design their own packaging and label for the Flex Farm harvest. What would a food label look like for lettuce grown in a Flex Farm? Create one.	• Your Guide to Food Packaging • Materials Used In Food Packaging • Types of Food Packaging • How to Really Nail Your Packaging Design (video) (5:02) • Top 19 Food Packaging Design Examples

What would our Flex Farm Crop logo look like? Why? Create one. Why is it important for your packaging to appeal to kids? Have students write instructions for a recipe using our Flex Farm crop(s) to include on the package. ● SHARE Share the following design and marketing considerations with the class. Included on Slide Deck. **Packaging Design Considerations:** Containment: Products must be contained in order to be moved from farm to customer. Protection: Products must be protected from physical damage (e.g. drops or falls), environmental effects (e.g. water, light, or oxygen), and contaminants (e.g. dust, microorganisms, or chemicals). Communication: The package must attract consumers for purchase. It also communicates product information such as nutritional content, ingredients, and net weight. Convenience: The package must conveniently fit into the consumer's lifestyle. **Packaging Marketing Considerations** What is attractive about the packaging? Does the package attract consumers? What is practical about the packaging? Assessments: ● ROUGH PROTOTYPE Students create rough prototypes of packaging. How is the packaging better? More efficient? More sustainable? ● RESEARCH OPPORTUNITY There are some packages that you can eat! Research edible packaging to discover how these creative packages are made.	

STUDENT WORK PRODUCTS/ ASSESSMENTS: Student Guide Worksheets, Discussions, Benchmark Assessments, Summative Unit Assessment Options, Prototypes, Presentations	**INTERDISCIPLINARY CONNECTIONS/ USE OF TECHNOLOGY:** Internet, Chrombooks, Canva, Slides, Websites

Differentiation/Accommodations/Modifications			
Gifted and Talented	**Multilingual Learners**	**Students with Disabilities**	**Students at Risk of School Failure**
(content, process, product and learning environment) **Extension Activities** Authentic listening and reading sources that provide data and support for speaking and writing prompts. Exploration of art and/or artists to understand society and history. Use of Higher Level Questioning Techniques Provide assessments that require higher level thinking Varied Lexile levels of reading Increased production in writing assignments Substituting written texts with project based learning	**Modifications for Classroom** Literature-Centered Language Development chapter. **Instructional Supports:** Hands-on materials -bilingual dictionaries -visual aids -teacher made adaptations, outlines, study guides -varied leveled texts of the same content **Modifications for Homework/ Assignments** **Preparing students for the lesson:** • Building Background Information through brainstorming, semantic	***(appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team)*** **Modifications for Classroom** Pair visual prompts with verbal presentations Ask students to restate information, directions, and assignments. Model skills / techniques to be mastered. Extended time to complete class work Provide copy of class notes Preferential seating to be mutually determined by the student and teacher Student may request to use a computer to complete assignments.	**Modifications for Classroom** Pair visual prompts with verbal presentations Ask students to restate information, directions, and assignments. Repetition and practice Model skills / techniques to be mastered. Extended time to complete class work Provide copy of class notes Preferential seating to be mutually determined by the student and teacher Student may request to use a computer to complete assignments.

Varying time requirements to complete assignments Student-directed learning/ independent studies **Extension Activities** Authentic listening and reading sources that provide data and support for speaking and writing prompts. Exploration of art and/or artists to understand society and history. Use of Higher Level Questioning Techniques Provide assessments that require higher level thinking Flexible Grouping: http://www.teachhub.com/flexible-grouping-differentiated-instruction-strategy Jigsaw Activities: http://www.adlit.org/strategies/22371/	webbing, use of visual aids and other comprehension strategies. • Simplifying Language for Presentation by using speech that is appropriate to students' language proficiency level. Avoid jargon and idiomatic speech. • Developing Content Area Vocabulary through the use of word walls and labeling classroom objects. Students encounter new academic vocabulary in English. • Concept Development-Students will be learning about rights and duties, voting, public issues, revolutions, the environment, and many new concepts. Enduring understanding requires thorough and contextualized study of these subjects across grades and courses. • Giving Directions-Stated clearly and distinctly and delivered in both written and oral forms to ensure that LEP students understand the task. In addition, students should be	Student may request books on tape / CD / digital media, as available and Varied Lexile levels of reading ● Increased production in writing assignments ● Substituting written texts with project based learning ● Varying time requirements to complete assignments Student-directed learning/ independent studies appropriate. Assign a peer helper in the class setting Provide oral reminders and check student work during independent work time Assist student with long and short term planning of assignments Provide regular parent/ school communication Teachers will check/sign student agenda daily **Modifications for Homework and Assignments**	Establish expectations for correct spelling on assignments. Extra textbooks for home. Student may request books on tape / CD / digital media, as available and appropriate. Assign a peer helper in the class setting Provide oral reminders and check student work during independent work time Assist student with long and short term planning of assignments Encourage student to proofread assignments and tests Provide regular parent/ school communication Teachers will check/sign student agenda daily Student requires use of other assistive technology device

	provided with/or have access to directional words such as: circle, write, draw, cut, underline, etc **Presenting the Lesson** • Use multiple strategies and varied instructional tools to increase the opportunities for students to develop meaningful connections between content and the language used in instruction. • Provide students with opportunities to express new knowledge and learning using written, verbal, and non-verbal communication. • Provide students with opportunities to participate in numerous social studies discussions to increase ELLs competency and confidence in verbal discourse; frame classroom conversations on subjects of interest and cultural relevance. • Utilize a "reverse chronology" approach to teaching history/social	Extended time to complete assignments Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modifications for Assessments** Extended time on classroom tests and quizzes. Student may take/complete tests in an alternate setting as needed. Restate, reread, and clarify directions/questions	**Modifications for Homework and Assignments** Extended time to complete assignments. Provide the student with clearly stated (written) expectations and grading criteria for assignments. **Modifications for Assessments** Extended time on classroom tests and quizzes. Student may take/complete tests in an alternate setting as needed. Restate, reread, and clarify directions/questions Distribute study guide for classroom tests. Establish procedures for accommodations / modifications for assessments.

	studies to even opportunities for students with and without vast cultural knowledge and make study of the social studies more meaningful. **Modified Assignments** Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) Extended time for assignment completion as needed Highlight key vocabulary Use graphic organizers **Additional Resources** CanDo Descriptors - https://www.wida.us/standards/CAN_DOs/ Colorin Colorado - http://www.colorincolorado.org/educators/ WIDA - https://www.wida.us/		