

On Farm Food Safety Manual: School Garden



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Introduction

Hello! Thank you for your interest in learning how to ensure the safety of those working in the gardens and safety and quality of the products grown.

Biological, chemical, and physical hazards potentially associated with school or community gardens are the real threat to your students.

This instructor manual will outline each section of the module (as topics are displayed on the screen), and go into detail about vocabulary terms used throughout the presentation, module outcomes, what you will need to get started, additional exercises not already included in the module, benefits of engaging in the garden safety module, and a risk management plan. This manual will also include answer keys to the four quizzes administered throughout the module.

This project has been funded by the Leopold Center for Sustainable Agriculture at Iowa State University grant program and is titled “Development of an Online Food Safety Training for Employees of University Farms and School Gardens”.

Vocabulary terms used in the module:

Bacteria – small, single- celled organisms that are able to replicate with other bacteria; they can grow just about anywhere, including soil, water, and in/on food products.

Compost – decomposed organic materials made from garden refuse or kitchen food scraps; used to improve garden soil.

Cross- contamination – transfer of harmful microorganisms, chemicals, or physical hazards from a contaminated source to another surface that was previously clean.

Harvest – process or period of gathering crops; the action of pulling crops from the garden and preparing them for further processing.

Herbicides – a chemical substance used to kill weeds.

Immune system – a body system that protects humans from foreign substances or microorganisms that can lead to harmful side effects.

Microorganisms – a living organism (such as a bacteria, fungi, or virus) that is too small to be seen by the naked eye. To be seen, the use of a microscope is needed.

Parasite – a small living animal that needs another organism (known as the host) to survive; the parasite benefits by taking nutrients from the host which can lead to harmful side effects for the host.

Pesticide – a general term for a chemical substance used to kill pests, such as weeds, insects, bacteria and fungi.

Produce – a general term for fruits, vegetables and herbs.

Sanitizer – a chemical agent applied to surfaces to reduce presence of microorganisms to safe levels.

Virus – a non-living particle that is microscopic in size that is unable to reproduce without a living host, such as a plant and animal.

State Educational Requirements:

Some material in this training module may be too complex or detailed for students that have not been exposed to similar subject matter earlier in their education. Educational requirements are based on age and grade, as shown below. Educational Requirements found at <https://www.educateiowa.gov>

Kindergarten-Grade 2

Students should be able to:

- Ask questions about objects, organisms, and events in the environment.
 - Students should answer their questions by seeking information from their own observations, investigations and from reliable sources of scientific information.
- Plan and conduct simple investigations.
 - Students should be able to design and conduct simple investigations to answer questions.
- Use tools to gather data and extend the senses.
 - Students should use tools, such as magnifiers or microscopes to extend their senses and their abilities to gather data.
- Communicate investigations and explanations.
 - Students should begin to develop the abilities to communicate, critique, and analyze their work and the work of other students. Communication should be conducted orally, through writing or through drawings.
- Understand and apply knowledge of characteristics of living things and how living things are both similar to and different from each other and from non-living things.
 - Living things share some common characteristics that are both similar to and different from non-living things.
- Understand and apply knowledge of the basic needs of plants and animals and how they interact with each other and their physical environment.
 - Organisms have basic needs. Animals need air, water, and food. Plants require air, water, nutrients and light.
 - Organisms can survive only in environments in which their needs can be met.
 - The world has many different environments, and distinct environments in which their needs can be met.
- Understand and apply knowledge of ways to help take care of the environment.
 - Humans depend on their natural and constructed environments.
 - Humans change environments in ways that can be either beneficial or detrimental to themselves or other organisms.
- Understand and apply knowledge of good health habits.
- Understand and apply knowledge of observable and measurable properties of objects.
 - Objects can be described by material from which they are made (Size, weight, shape, color, and temperature).

Grades 3-5

Students should be able to:

- Identify and generate questions that can be answered through scientific investigations.
 - Students ask questions that they can answer with scientific knowledge combined with their own observations.
 - Students recognize that different questions lead to different types of investigations.
- Recognize that scientists perform different types of investigations.
 - Types of objects include describing objects, events, and organisms; classifying them; and doing a fair test (experimenting), depending on the types of questions they want to answer.
- Plan and conduct scientific investigations.
 - Students should engage in systematic observation, making accurate measurements, and identifying and controlling variables.
 - Students understand the concept of a fair test.
- Use appropriate tools and techniques to gather, process, and analyze data.
 - Students enhance their skills with tools such as a magnifier or microscope.
 - Students are introduced to the use of computers and calculators for conducting investigations.
 - Students' use of appropriate tools is guided by the question asked and the investigations students design.
- Use evidence to develop reasonable explanations.
 - Students should judge the merits or strengths of the data and information used to make explanations.
 - Students' explanations should reflect the evidence they have obtained in their investigations.
 - Students should check their explanations against scientific knowledge, their own experiences, and observations of others.
- Communicate scientific procedures and explanations.
 - Students should communicate, critique, and analyze their work and the work of other students.
 - Students should share procedures and explanations through various means of communication.
- Understand and apply knowledge of organisms and their environments.
 - Students should understand the structures, characteristics, and adaptations of organisms, and what allows them to function and survive within their habitats.
 - Understanding of how individual organisms are influenced by both internal and external factors.
 - Students should understand the relationship among living and non-living factors in terrestrial and aquatic ecosystems.
 - An organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the physical characteristics of the environment. When the environment changes, some plants and animals survive and reproduce, others die or move to new locations.
 - All organisms cause changes in the environment in which they live. Some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.
- Understand and apply knowledge of personal health and wellness issues.

- Understand and apply knowledge of how to describe and identify substances based on characteristic properties.
 - The properties of a substance can be measured using tools and technology.
 - It may be necessary to use magnification to observe the component parts of some materials.

Grades 6-8

Students should be able to:

- Identify and generate questions that can be answered through scientific investigations.
 - Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of clarifying questions and inquiries and directing them toward objects and phenomena that can be described, explained, or predicted by scientific investigations.
 - Students should develop the ability to connect their questions with scientific ideas, concepts, and quantitative relationships that guide investigations.
- Design and conduct different kinds of scientific investigations.
 - Students should develop general abilities such as making systematic observations, taking accurate measurements, and identifying and controlling variables.
 - Students should develop the ability to clarify ideas that are influencing and guiding their inquiry, and to understand how those ideas compare with current scientific knowledge.
 - Students formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.
- Understand that different kinds of questions suggest different kinds of scientific investigations.
 - Some investigations involve observing and describing objects, organisms and events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
- Select and use appropriate tools and techniques to gather, analyze and interpret data.
 - The use of tools and techniques, including computers, will be guided by the questions asked and the investigations students design. Students should be able to access, gather, store, retrieve, and organize data, using computer hardware and software designed for these purposes.
- Use evidence to develop descriptions, explanations, predictions, and models.
 - Students should base their explanations on observations and they should be able to differentiate between description and explanation.
 - Developing explanations establishes connections between the content of science and the context in which students develop new knowledge.
 - Models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.
- Think critically and logically to make the relationship between evidence and explanations.
 - Students decide what evidence should be used and develop the ability to account for anomalous data.
 - Students should be able to review data from an experiment, summarize the data, and form a logical argument between cause and effect relationships.
 - Students should begin to state some explanations in terms of relationships between two or more variables.
- Recognize and analyze alternative explanations and predictions.

- Students should develop the ability to listen to and respect the explanations proposed by other students. They should remain open to and acknowledge different ideas and explanations, be able to accept the skepticism of others, and consider alternative explanations.
- Communicate and defend procedures and explanations.
 - Students should become competent in communicating experimental methods, describing observations and summarizing results of investigations. Explanations can be communicated through various methods.
- Understand and apply knowledge of the basic components and functions of cells, tissues, organs, and organ systems.
 - Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.
 - All organisms are composed of cells. Most organisms are single cells; other organisms, including humans are multi-cellular.
 - Cells carry on the many functions needed to sustain life. They grow and divide, thereby producing more cells. This requires that they take in nutrients, which they use to provide energy for work that cells do and to make the materials that a cell or an organism needs.
 - Specialized cells perform specialized functions in multi-cellular organisms. Groups of specialized cells cooperate to form a tissue, such as muscle. Different tissues are, in turn, grouped together to form larger functional units, called organs. Each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.
- Understand and apply knowledge of the complementary nature of structure and function and the commonalities among organisms.
 - Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, organs, tissues, organ systems, whole organisms, and ecosystems.
- Understand and apply knowledge of interdependency of organisms, change in environmental conditions, and survival of individuals and species.
 - All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing external environment.
 - Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive.
 - Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations.
 - Biological adaptations include changes in structures, behaviors, or physiology that enhance survival and reproductive success in a particular environment.
- Understand and demonstrate knowledge of the social and personal implications of environmental issues.
 - The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans) increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.
- Understand and apply knowledge of the functions and interconnections of the major human body systems including the breakdown in structure or function that disease causes.

- The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease. These systems interact with one another.
- Disease is a breakdown in structure or functions of an organism. Some diseases are the result of intrinsic failures of the system. Others are the result of damage by infection by other organisms.

Grades 9-12

Students should be able to:

- Identify questions and concepts that guide scientific investigations.
 - Students formulate a testable hypothesis and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. They should demonstrate appropriate procedures, a knowledge base, and conceptual understanding of scientific investigations. The key is that the student demonstrates knowledge of the scientific concepts through the investigation.
- Design and conduct scientific investigations.
 - Designing and conducting a scientific investigation requires introduction to the major concepts in the area being investigated, proper equipment, safety precautions, assistance with methodological problems, recommendations for use of technologies, clarification of ideas that guide the inquiry, and scientific knowledge obtained from sources other than the actual investigation. The investigation may also require student clarification of the question, method, controls, and variables; student organization and display of data; student revision of methods and explanations; and a public presentation of the results with a critical response from peers. Regardless of the scientific investigation performed, students must use evidence, apply logic, and construct an argument for their proposed explanations.
- Formulate and revise scientific explanations and models using logic and evidence.
 - Student inquiries should culminate in formulating an explanation or model. Models should be physical, conceptual, and mathematical. In the process of answering the questions, the students should engage in discussions and arguments that result in the revision of their explanations. These discussions should be based on scientific knowledge, the use of logic, and evidence from their investigation.
- Think critically and logically to make the relationship between evidence and explanations.
 - Thinking critically about evidence includes deciding what evidence should be used and accounting for anomalous data. Specifically, students should be able to review data from a simple experiment, summarize the data, and form a logical argument about the cause-and-effect relationships in the experiment.
- Recognize and analyze alternative explanations and predictions.
 - This aspect of the standard emphasizes the critical abilities of analyzing an argument by reviewing current scientific understanding, weighing the evidence, and examining the logic so as to decide which explanations and models are best. In other words, although there may be several plausible explanations, they do not all have equal weight. Students use scientific criteria to find the preferred explanations.
- Communicate and defend scientific procedures and explanations.

- Students in school science programs should develop the abilities associated with accurate and effective communication. These include writing and following procedures, expressing concepts, reviewing information, summarizing data, using language appropriately, developing diagrams and charts, explaining statistical analysis, speaking clearly and logically, constructing a reasoned argument, and responding appropriately to critical comments.
- Understand and apply knowledge of the cell.
 - Cells have particular structures that underline their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules, which form a variety of specialized structures, notably the nucleus, mitochondria, ribosomes, chloroplasts, and the endoplasmic reticulum. Some cells have external structures facilitating movement (cilia and flagella).
 - Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by protein catalysis, called enzymes.
 - Cells grow and divide.
 - Cell regulation allows cells to respond to their environment and to control and coordinate cell growth and division. Environmental factors can influence cell division.
 - Plant cells contain chloroplasts as sites of photosynthesis. Plants and many microorganisms use solar energy to combine molecules of carbon dioxide and water into complex, energy rich organic compounds and release oxygen to the environment.
- Understand and apply knowledge of biological evolution.
 - Species evolve over time.
 - Evolution is a consequence of: population potential, genetic variability, finite resources and environmental selection.
 - Natural selection and its evolutionary consequences provide a scientific explanation for the fossil record of ancient life forms, as well as for the striking molecular similarities observed among the diverse species of living organisms. The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.
 - The millions of different species of plants, animals, and microorganisms that live on earth today are related by descent from common ancestors.
 - Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities in development and DNA sequences, which reflect their evolutionary relationships. Species is the most fundamental unit of classification.
- Understand and apply knowledge of the interdependence of organisms.
 - Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
 - Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology, and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.
- Understand and apply knowledge of the behavior of organisms.
 - Multicellular animals have nervous systems that generate behavior. Nervous systems are formed from specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific

excitatory and inhibitory molecules. In sense organs, specialized cells detect light, sound, and specific chemicals and enable animals to monitor what is going on in the world around them.

- The human immune system protects against microscopic and foreign substances entering the body and from cancer cells arising within.

Tools Needed:

A few specific tools and devices are needed to have a successful experience with this training module. They include:

- A lecture computer or other computers capable of accessing the Internet.
- Functioning speakers on computers or additional audio equipment.
- Printer access to print online quizzes for students or computer lab where online quizzes can be taken.
- For Activity #1 in the module, the tools that will be required are:
 - A bottle fluorescent lotion (Brand names include Glo Germ and Glitter Bug – available at www.glogerm.com or www.glitterbug.com. A 12 oz. bottle costs about \$15. Internet recipes for making this lotion are available).
 - A black light for visual inspection of hands (These can be purchased from the same sources; prices range from \$7 to \$35).
 - Easily accessed hand-washing station with soap and clean potable hot and cold water.
- For Activities #2 (“When should we wash our hands?”) & #3 (“Produce Detectives: Good or Bad”) in the module, the tools required will be:
 - Writing utensils (pens or pencils).
 - Printed worksheet available on the module website.

Getting Started:

Follow these steps to successfully begin running the module:

- Acquire a computer or classroom of computers with Internet capability and sound. Turn the computer(s) on.
- Once the computer(s) are ready, start up the Internet.
- When the Internet is ready, go to <https://www.safeproduce.cals.iastate.edu/videos/elementary>
- After you have accessed the link, play each video individually.
- The quizzes and activities can be downloaded and printed individually or as a group. Find them at <https://www.safeproduce.cals.iastate.edu/elementary-school-gardens-program>

Outcomes:

By the end of this training module, students should be able to:

- Understand the importance of a healthy diet.
- Identify the number of servings of fruits and vegetables they should consume at every meal.
- List general differences between three different types of harmful microorganisms
- Identify examples of each type (Bacteria, Viruses, and Parasites).
- Understanding the different chemical hazards that can be present when gardening.
- Identify a “physical hazard,” and know what to do if they find these in a school or community garden.
- Describe how cross- contamination can occur in the garden (contaminated water, soil, and direct animal contact, and improper hygienic practices).
- Follow good hygienic practices/ hand washing practices before and after handling the produce.
- Store produce appropriately after it has been harvested.

- Understand the importance of having safe produce items for those that have weakened or lowered immune systems.

Benefits:

Additional benefits for students as a result of participation in this learning module are:

- Knowledge of how to properly behave when working in a school or community garden.
- Knowledge of how to handle and use tools for specific purposes.
- Knowledge of how and where to report hazards if they are seen in the garden.
- Active engagement in learning activities (both written and hands on).
- Increased exposure to introductory science vocabulary.
- Knowledge of how to follow proper hygienic practices.

Overall outline of online module:

Summaries of the slides in the module are divided into sections and identify learning outcomes for each. The summaries outline basic principles behind each section as well as what information the students should learn when viewing the module. Additional information not covered directly in the module is listed below to help divide the module into smaller portions.

The first three slides of the module are used to emphasize the importance of a healthy diet, introduce the topic of where produce comes from, and explain why produce is important in the diet. The Food Guide Plate or My Plate information is included in this section so students can visually see the impact fruits and vegetables have on daily life. For more specific details on the Food Guide Plate, visit <http://www.choosemyplate.gov>.

These slides are intended to introduce students to gardening and ease them into the module, which may be helpful if they are less familiar with gardening or food safety practices. These slides also introduce students to the remaining sections of the module.

Lastly, the introductory section emphasizes why produce food safety is necessary. Students must grasp the concept that if we don't clean the produce well enough, other individuals who consume it have a higher chance of becoming ill.

Particularly vulnerable populations with lower immune systems are pregnant women, young children, elderly, and immune-compromised individuals. Pregnant women have a lower immune system because they have to protect their unborn infant as well as themselves. Infants and young children have lower immunity because they are still developing their immune systems. The elderly have a lowered immunity because their bodies are aging and cannot fight off threats to their health as well as other adults. Immune-compromised individuals (such as those with HIV or diabetes) have difficulty fighting off harmful microorganisms.

Students need to understand that it is likely some or all of these groups of people may be consuming the produce they are handling and that it is important to take proper steps to prevent people from becoming sick.

The upcoming section of this training module will emphasize what action steps can be taken to prevent risks from biological, chemical and physical threats and how students can ensure the produce is clean after it has been harvested.

For more information on immune-compromised individuals, please view resources below.

Resources on Immune-compromised individuals:

- http://www.tchd.org/pdfs/immunosuppressed_precautions_to_prevent_disease.pdf
- <https://www.foodsafety.gov/people-at-risk>

Quiz 1

The first quiz focuses on information covered in the introductory slides. The 10 multiple choice questions on the quiz will give students a general understanding of why produce safety is important and how food safety can be assured with food. Below is the answer key for the first quiz over introduction to the training module.

Quiz questions for elementary module: QUIZ 1

1) Why is it important for us to eat fruits and vegetables?

- a. Because my parents told me to.
- b. Because they can help keep me healthy and strong.
- c. Because I can't find any other food.
- d. It's not important to eat fruits and vegetables.

Answer: As mentioned early in the training module, fruits and vegetables provide us with nutrients that our body needs to stay healthy.

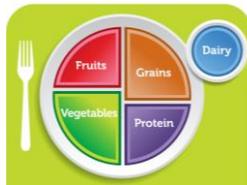
2) What will eating fruits and vegetables help do?

- a. Keep me from getting some diseases when I am older.
- b. Keep me from becoming obese or gaining weight.
- c. Keep important vitamins and minerals in my diet.
- d. All of the above.

Answer: Fruits and vegetables offer many benefits in addition to keeping us healthy and strong. Biochemically, the nutrients, vitamins, and minerals will work in the body and will reduce the chances of various diseases from occurring later in life. Fruits and vegetables are a healthy choice instead of candy. By eating produce items instead, becoming obese is much more unlikely.

3) What is this diagram called?

- a. MyFood.
- b. MyDiagram.
- c. MyPlate.
- d. MyCourse.



Answer: This diagram is called the "MyPlate." This diagram shows each food group, and how much should be consumed per meal.

4) According to the MyPlate diagram, I need to eat _____.

- a. More fruits than vegetables
- b. More vegetables than fruits
- c. The same amount of fruits and vegetables
- d. It doesn't matter as long as I eat something

Answer: Even though fruits and vegetables are both important to stay healthy, we should be eating more vegetables than fruits. The MyPlate diagram shows that $\frac{1}{2}$ of the plate should be focused on fruits and vegetables, but more vegetables should be eaten when looking specifically at fruits and vegetables.

5) About what percent of our food should be made up of vegetables according to this diagram?

- a. 1/4 of the plate.
- b. 1/3 of the plate.
- c. 1/2 of the plate.
- d. 7/8 of the plate.

Answer: After analyzing the MyPlate diagram, we can see that half of total food eaten should come from fruits and vegetables. The other half should be dedicated to grains and protein (with dairy as a subsection).

- 6) Michael and Laura are eating lunch. They are the same age and are both physically active. Who should eat more produce?
- a. Michael because he's a boy.
 - b. Laura because she's a girl.
 - c. Michael and Laura should eat the same amount of produce.
 - d. Michael because Laura had hash browns (potatoes) for breakfast.

Answer: Nutritional requirements differ depending on the sex of the individual. Men require higher amounts of fruits and vegetables than women at the same age and physical activity level. In this example, Michael would require more fruits and vegetables than Laura.

- 7) What should be done to make sure people don't get sick from eating contaminated fruits and vegetables?
- a. Handle fruits and vegetables properly, by washing hands frequently.
 - b. Wash fruits and vegetables before we eat them.
 - c. Throw away fruits and vegetables that look bad.
 - d. All of these can help make sure people remain healthy and safe.

Answer: All of these steps should be followed to reduce the risks of illness. Many foodborne illnesses occur due to poor personal hygiene. By washing hands frequently, the likelihood of transmitting harmful agents to produce items is much reduced. Rinsing off fruits and vegetables before they are consumed will reduce the chances of having other physical, chemical, or biological hazards on the produce. Throwing away fruits and vegetables that look bad is a good idea. These produce items are more than likely rotten or contaminated. These should not be eaten. Bad fruits and vegetables should be properly thrown away or placed in a designated compost for use at a later time.

- 8) Sophia grabs an apple out of the fridge and takes a bite. Is this healthy?
- a. Yes, apples make us healthy and strong!
 - b. No, apples are too sugary to be healthy.
 - c. No, she should have sliced the apple to make sure it was fresh.
 - d. No, she should have washed the apple before eating it.

Answer: Even though fruits and vegetables are good for us, we have to make sure to be safe when eating them. In this example, Sophia doesn't know how the apple was handled or where it has been prior to her refrigerator. She should make sure to wash it before eating to reduce any harmful chemicals, debris, or microorganisms that may be on the surface of the apple.

- 9) Jose's older brother, Miguel, is mad that their mom gave him an extra scoop of vegetables. Should Miguel be mad?

- a. Yes, the boys should have gotten the same amount of vegetables.
- b. Yes, the extra vegetables took the space where he was going to put his dessert.
- c. Yes, Jose should have gotten the extra scoop.
- d. No, Miguel should have more vegetables because he is older.

Answer: As people get older, they require more vegetable intake. In this example, Miguel should not be mad. He is older than Jose, and requires more vegetables at his older age.

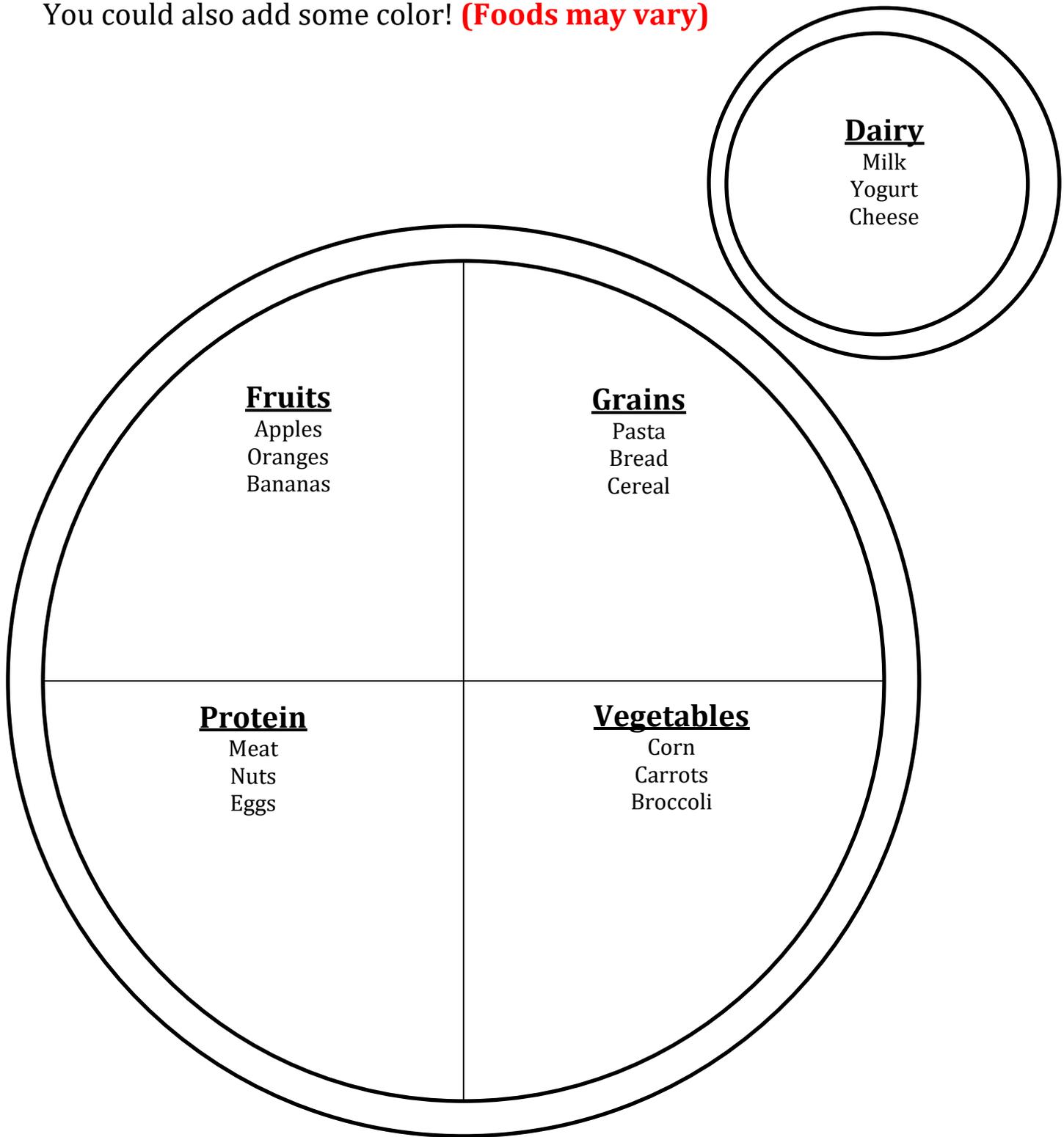
10) Why is it important for us to do everything we can to keep the fruits and vegetables safe?

- a. Because we could get in trouble by the teacher if we don't.
- b. Because we don't want to make ourselves or others sick if we don't follow these steps.
- c. Because the fruits and vegetables will look better if we do.
- d. None of the above are very important.

Answer: We have to keep produce safe so we don't make ourselves or others sick. Remember, everybody has different immune systems. Some people will be more sensitive to harmful microorganisms than others (young, elderly, pregnant, immune-compromised). The fruits and vegetables have to be kept safe enough for all immune systems.

Part 1 Activity KEY

During the first part of the training, you learned about the MyPlate Diagram. Label each section and list/draw some foods that you may find in that section. You could also add some color! **(Foods may vary)**



Section 2

The next section of the module provides more in depth information about biological hazards associated with fruit and vegetable production. After viewing the online module, students should learn the overall meaning of a microorganism, the different types of microorganisms that can contaminate produce items in the garden, and understand why prevention of harmful microorganisms on produce is extremely important. Students should understand that just because we can't see them, harmful microorganisms could still be on the produce.

Students are not expected to already know examples of each type of microorganism, but this module introduces them to a few harmful common microorganisms that can lead to illness or death in consumers.

The three bacterial microorganisms that are listed as examples in the training module are: *E. coli* (pronounced ee-coe-lie), *Listeria* (list-ear-ee-a) *monocytogenes* (mono-site-aw-gen-ee), and *Salmonella* (sal-ma-nel-a). These examples were chosen because they are some of the most harmful pathogens that have been associated with fresh produce. The specific strain of *E. coli* of concern is *E. coli* 0157:H7. This pathogen has a very low infectious dose, which means it takes very few cells to cause illness in consumers. Some common symptoms associated with *E. coli* 0157:H7 are: bloody diarrhea and abdominal cramps. In the elderly and young children, hemolytic uremic syndrome (HUS) can occur, which will lead to death of red blood cells, and will eventually result in kidney failure.

Listeria monocytogenes is a strain of bacteria that can also cause some very serious health issues. If an individual ingests *Listeria monocytogenes*, some common symptoms such as fever, muscle aches, a stiff neck, loss of balance, convulsions and/or diarrhea may be present. *Listeria monocytogenes* is of serious risk to pregnant women because ingestion can lead to miscarriage and stillbirth of the fetus.

Salmonella is another type of bacteria that can be harmful if ingested; common symptoms are bloody diarrhea, fever, and abdominal cramps. These symptoms will usually occur 12 to 72 hours after ingestion of *Salmonella*. Depending on the strain of *Salmonella*, symptoms may either occur shortly after ingestion or may take awhile for the body to process.

The only virus included in the students' training module is Norovirus. Norovirus is used as the virus example because it is one of the most common occurring foodborne outbreak microorganisms. Norovirus is spread by fecally contaminated food or water, or from cross-contamination from one person to another person. According to the Centers for Disease Control and Prevention (CDC), some of the symptoms associated with Norovirus are diarrhea, vomiting, nausea, and stomach pain. Other symptoms may include fever, headache, and body aches.

The last example of harmful microorganisms is the parasite, *Toxoplasma gondii* (tox-o-plasma gone-dee). *Toxoplasma gondii* is a parasite that originates in cats, but can then be transmitted from cats to humans via fecal contamination. For this reason, it is extremely important to keep felines and other wild animals away from the produce and the garden. The symptoms of *Toxoplasmosis* are similar to that of the common flu. People with healthy immune systems may not even know they have been infected.

However, this infection causes bigger problems in pregnant women and those with lowered immune systems.

After being introduced to these different microorganisms, students should understand that there are a wide variety of microorganisms that can cause illness, and that individuals' immune systems offer varying degrees of protection. By the end of this section, students should know the basic differences between bacteria, virus, and a parasite and which are harmful. Not all microorganisms are harmful. However, some of those that are harmful typically live in soil, water, or in humans. Therefore, it is important that those working in the garden understand the raw agricultural products grown in nature do have some risk and they have a role in making sure fresh products are safe.

Please view the resources listed below for additional information on microbial hazards.

Microbial hazards resources:

- <https://www.maricopa.gov/DocumentCenter/View/5900/Gardens---School-Community-and-Food-Establishment-Guidance-PDF>
- <http://www.cdc.gov>

The next section of the module describes the chemical hazards that can occur in gardens. No specific chemical is addressed to the students, but they will learn about the importance of proper application and storage. Students should not be applying chemicals nor be present when this is done, but they should be aware chemicals can be a useful gardening tool, must be handled correctly, and applied only by teachers or certified individuals.

Students should also know that not all plant parts in the garden are edible and some parts of certain plants can make them sick. Some parts of plants that grow in the school garden may contain toxins, such as the unusual tomato-like fruit on a potato plant. Remind students not to eat anything while in the garden and wait to eat any crop until after it has been properly cleaned.

For additional information on chemical hazards, please follow the resources provided below.

Chemical hazard resources:

- http://www.crec.ifas.ufl.edu/extension/trade_journals/2010/2010%20April%20food%20safety%20hazards.pdf
- <https://kidsgardening.org/gardening-basics-safe-gardening-guidelines/>
- <http://www.who.int/ceh/risks/cehchemicals2/en/index1.html>

NOTE: For additional information on chemical application or chemical concerns, please visit: www.epa.gov.

The last type of hazard that may be present in gardens are those of a physical nature. There are many natural physical hazards that can be found in the garden. This module gives examples of natural and manmade waste materials that have potential to be physical hazards. Some of the natural physical hazards in gardens are sticks, stones, rocks, and sharp parts of the plant. Some potentially harmful manmade waste products that could be in the garden soil are broken glass, sharp hard plastic, and metal, particularly if the garden is in a former vacant lot. Students are reminded that if they do encounter a physical hazard, they are NOT to touch or pick it up. The message students need to understand from the physical hazards section is that if they see any hazardous material in the garden, they need to let you, the instructor, know so it can be removed in a safe manner. It is important to inform students that they should not bring any food or liquid containers into the garden with them because containers can break and result in a physical hazard in the garden.

After watching the video clip on this slide, students should understand that gardening tools can cause physical harm if not used for their specific purpose or stored appropriately when not being used, that physical hazards can be due to manmade or natural items, and that food and beverage containers should be kept out of the garden.

For other potential physical hazards that may be found in the garden, visit the resource listed below.

Physical hazard resource:

- <http://web.uri.edu/foodsafety/food-safety-hazards/>

Upon completion of this section on hazards, students should have a general knowledge of various biological, chemical, and physical hazards they may encounter in the school or community garden. Students must learn these main messages; these are emphasized in the second quiz of the training module, which can be administered at this point in the training.

Below is the answer key for the administered quiz over the different types of hazards that can occur in the garden.

QUIZ 2

Quiz questions for elementary module: QUIZ 2

- 1) What are the three things that we can get sick or hurt from in the garden?
- From people, fruits, and animals.
 - From microbial, chemical, and physical hazards.
 - From water, gloves, and garden tools.
 - None of these can make people ill or hurt.

Answer: The three main ways to get hurt or sick in the garden are from microbial, chemical, and physical hazards. A few ways microbial illness can occur from are contamination and spoilage of produce. Chemical hazards can result from herbicide and pesticide misuse or improper sanitation. Physical hazards can occur in the garden from improper usage of tools or harmful sharp glass or plastic garbage left or thrown into the garden.

- 2) Where, besides on the produce itself, can bacteria be found in the garden?
- In the soil
 - In the water
 - On the tools
 - All of the above

Answer: Bacteria can be found many places around the garden. It can be found in the soil, in water we use, and on our tools if they are not cleaned properly. When working in and around fresh produce, we have to make sure to clean tools appropriately and make sure the water we in our process is microbially safe for humans.

- 3) What tool would we have to use to see harmful microorganisms on our food?
- Our eyes
 - A magnifying glass
 - A microscope
 - There's no way to see them, but we have to act like they are, just in case.

Answer: Microorganisms are very small, and cannot be seen with just our eyes. We have to use microscopes to see what microorganisms are on our food samples.

4) What are the names of some bacteria that could be harmful to people if eaten?

- a. *Listeria monocytogenes* and *Salmonella*
- b. *Streptococcus thermophiles* and *Brevibacterium linens*
- c. *Acetobacter aceti* and *Vibrio fischeri*
- d. All of the above can cause harm to people.

Answer: From the options above, only *Listeria monocytogenes* and *Salmonella* are harmful to people if they are eaten. *Streptococcus thermophiles* is a bacterium that is used in the production of yogurt, and *Brevibacterium linens* is used to ferment different cheese products. *Acetobacter aceti* is used to produce vinegar, and *Vibrio fischeri* will make aquatic microbes glow when activated. Only option A contains microorganisms that can make people sick if eaten.

5) What is the most common and harmful type of virus related to produce?

- a. Influenza virus.
- b. Norovirus.
- c. Tobacco Mosaic Virus.
- d. West Nile Virus.

Answer: The most common type of virus related to produce contamination is Norovirus. It can be transferred from infected people, contaminated water, or from touching contaminated surfaces.

6) Which of the following is an example of a parasite that could be harmful if eaten?

- a. *Toxoplasma gondii*.
- b. *Bacillus cereus*.
- c. *Listeria monocytogenes*.
- d. *Escherichia coli*.

Answer: *Toxoplasma gondii* is the only parasite in the options provided. *Bacillus cereus*, *Listeria monocytogenes*, and *Escherichia coli* are all different types of bacteria that can lead to illness if eaten.

7) What in the human body helps fight off bad microorganisms?

- a. The nervous system.
- b. The immune system.
- c. The pathogen elimination system.
- d. The body can't fight off bad microorganisms.

Answer: The immune system helps the body fight off harmful microorganisms that may be eaten. Some people have stronger immune systems than others. For this reason, produce has to be made safe enough for even people with the weakest immune systems (young, elderly, pregnant, immune-compromised).

8) What can be applied to protect crops from insects or disease-causing organisms, and who should use them?

- a. Pesticides; anyone can use them.
- b. Pesticides; only adults should use them.

- c. Sanitizers; anyone can use them.
- d. Sanitizers; only adults can use them.

Answer: Insecticides should be used to protect produce from insects. Sanitizers should be used on gardening tools and equipment, NOT on the produce itself. These insecticides should only be applied by teachers or approved adults. Students should never apply insecticides.

- 9) What are some physical objects that may be found in the garden and that could hurt you?
- a. Broken glass.
 - b. Sharp sticks and stones.
 - c. Metal fragments.
 - d. All of the above.

Answer: All of the above are possible physical hazards that may be found while gardening. Broken glass, sharp sticks and stones and metal fragments are all physical hazards that can result in cuts or wounds if stepped on or picked up. If students see these hazards in the garden, they should NOT pick them up. Students should tell an adult or instructor so the physical hazard can be removed safely.

- 10) Whose health do we have to worry about when growing produce?
- a. The people eating the produce
 - b. Our own
 - c. Other people who come into contact with the garden or products
 - d. All of the above

Answer: We have to consider the consumer, ourselves, and other individuals that come in contact with fresh produce when growing produce. People have different levels of immune systems, and we have to consider that somebody with a lowered immune system may come in direct contact with the fresh produce. We want to reduce food safety risks when considering everybody that will come in contact with our fresh produce.

Part 2 Activity KEY

Circle the term that does not belong in each group.

1. Practical Biological Chemical Physical

Biological, Chemical, and Physical are 3 types of hazards found in the garden.

2. Bacteria Viruses Chemicals Parasites

Bacteria, Viruses, and Parasites, also known as microorganisms are types of Biological hazards.

3. Pesticides Animals Herbicides Sanitizers

*Pesticides, Herbicides, and Sanitizers are types of Chemical hazards.
Animals are a Physical hazard.*

4. Broken glass Sticks Stones/Rocks Fungi

Broken glass, sticks, and stones/rocks are physical hazards that should be removed from the garden. Fungi would be a biological hazard.

5. Hoe Shovel Trowel Fence

All of these are physical hazards found in the garden. Fence is the "odd man out" because the other three are tools used in the garden.

Section 3

The next section introduces natural hazards and the steps necessary to prevent contamination of garden produce. Each natural hazard will be discussed in greater detail, emphasizing how the hazard can arise, and what students must do to prevent the hazard from affecting the produce.

The first natural hazard that may be present is water contamination. Students will learn about water quality. A take home message is that they shouldn't drink from the garden hose when they are watering the garden plants. Students may not realize it, but if they drink from the hoses when watering the produce, some microorganisms that are in their mouth or on their face could cross contaminate the produce, making it unsafe. Further, the hose itself may be contaminated so the water they are drinking may not be safe. An additional activity in the module will also show students that surface water (pond water) should not be used because of the different types of microorganisms that may be in it.

The only type of water that should be used on your school garden is municipal (city) water. If you are using water from a hose or a sink from the school, the water should be safe for drinking. Do NOT use water that has come from a well unless it has been tested and proven safe; without testing, well water may contain levels of microorganisms that are deemed unsafe to use on your produce items. And under all circumstances, NEVER use standing water from ponds or ditches. Standing water will contain high numbers of microorganisms, increasing the likelihood of pathogen presence in the water.

For additional information on water resources, please follow the links below.

Water contamination resources:

- <https://www.extension.iastate.edu/smallfarms/maintaining-safe-drinking-water-your-private-well>
- <http://www.cdc.gov/healthywater/other/agricultural/contamination.html>
- http://www.chewonki.org/cleanwater/water_pollution.asp

The next natural hazard presented is the soil that is already in the garden. Students will learn about microorganisms naturally found in soil, and action steps needed to ensure students keep themselves and the produce free from potentially harmful microorganisms. The first aspect of soil you should consider when choosing a location for the garden is prior land use. It is important to do background research on the location of the garden to make sure it wasn't previously a site where harmful chemical or biological hazards would reside.

Other chemicals, such as lead from paint, heavy metals, or nitrites in the soil can also be harmful. The take home message for students is to always wash their hands thoroughly after working in the garden because of contact with soil. Proper hand washing is emphasized in the next section of the teaching manual.

Below are links to additional resources on soil contamination.

Soil contamination resources:

- http://www.euro.who.int/_data/assets/pdf_file/0009/119187/E64737.pdf
- http://cwmi.css.cornell.edu/Soil_Contaminants.pdf

The last natural hazard that will be introduced to students in this section of the online learning module is potential contamination from wild animals. Wild and domestic animals can pass harmful microorganisms to the produce from fecal material, from their mouths, fur or skin, or from unclean paws. Fecal material will contain the pathogen, *E. coli* 0157:H7, which can make people very ill. The best way to combat

animal contamination is to have clear policies about no pets allowed and to set up physical barriers, like fences, to keep them out of the garden. A two-foot high chicken wire fence that is buried a couple of inches will keep rabbits from the garden, but a 6 to 8-foot tall fence might be needed if deer are present in your area.

After viewing the training module, students will get an understanding of why all animals need to stay out of the garden, and the potential harm they can cause if allowed in the school or community garden.

Directly below are additional resources for more information on animal contamination.

Animal contamination resources:

- <https://shorestewards.cw.wsu.edu/guidelines/guideline-1/>
- [EPA paper on preventing water contamination by pet and wildlife waste](#)

A common way cross-contamination occurs with produce items is from poor hygienic practices. The next section of the module is dedicated to informing the students about the *importance* of washing their hands, *how* to properly wash their hands, and *when* to wash their hands. Poor hygienic practices are one of the largest causes of cross-contamination to food. Because produce often is not cooked before eating, it is important that cross-contamination of harmful microorganisms be controlled. DO NOT allow students to work in the garden if they show any symptoms of illness.

This section of the module will introduce examples of how cross-contamination can occur between dirty surfaces and clean produce. Students will learn how to properly and thoroughly wash their hands with potable water, soap, and clean paper towels. To put this into practice, make sure adequate hand-washing supplies are available to the students and that there is time scheduled to wash hands before harvesting any produce and after they work in the garden.

The best way to reduce the number of potentially harmful microorganism on hands is through the use of soap and water. Alcohol based sanitizers can help quickly reduce the number of most microorganisms on hands yet sanitizers are not effective in reducing levels of norovirus, one of the viruses commonly associated with produce. Therefore, hand washing is the best practice and teachers should schedule time for hand-washing to occur before and after garden instruction.

Below is a list of different personal hygiene resources for additional information.

Personal Hygiene resources:

- <https://store.extension.iastate.edu/ItemDetail.aspx?ProductID=13687>
- <http://www.health.gov.au/internet/publications/publishing.nsf/Content/ohp-enhealth-manual-atsi-cnt-1~ohp-enhealth-manual-atsi-cnt-1-ch3~ohp-enhealth-manual-atsi-cnt-1-ch3.2>
- <https://www.health.vic.gov.au/food-safety/personal-hygiene-for-food-handlers>
- <http://www.bromley.gov.uk/leaflet/260991/13/756/d>

This slide describes the proper 6-step hand-washing process. To have a successful hand-washing experience, students need to have access to necessary supplies: potable water with soap and disposable towels. In the first step, rinsing hands under hot running water (or clean water if hot is not available) removes the initial presence of microorganisms from their hands. The soap loosens soil from hands with lathering action; the 10 to 15 seconds of lathering is needed to allow the cleaning agents to work effectively, in addition to ensuring that all areas on the hand and wrists have received some of the soap.

Cleaning under fingernails and in between fingers is important because these areas allow places for microbial growth. Rinsing off excess soap and loosened soil results in clean hands. Using disposable paper towels or hot air dryers ensures hands are not re-contaminated from soiled linens. For further information on hand washing, please view the below resources.

Hand-washing resources:

- <https://www.extension.iastate.edu/foodsafety/handwashing>
- <http://www.cdc.gov/features/handwashing/>
- <http://www.bidmc.org/YourHealth/Holistic-Health/How-to-Wash-Your-Hands-Properly.aspx>
- <http://sarasota.floridahealth.gov/programs-and-services/wellness-programs/clean-hands-campaign.html>

After completing the section on personal hygiene, students will have the opportunity to engage in some interactive exercises to reinforce these concepts. Two engagement activities are included in this portion of the module. Students will apply a fluorescent lotion product to their hand (one brand is called Glo Germ™ or you can make this in house with fluorescent paint) and rub it into their skin. To successfully perform this activity, you will need the fluorescent lotion, a black light, antibacterial soap, and a potable water source.

When placed under a black light, the fluorescent lotion will show simulated germs or microorganisms on the student's hands. After students follow the 6-step hand-washing method in the module and place their hands under the black light again, there should be no presence of any lotion on their hands. This activity specifically helps students learn the correct way to wash their hands effectively.

Many times, people forget to wash their hands after simple tasks. The second activity in this portion of the module will show students the importance of *when* to wash their hands and *why* frequent hand washing is important. To successfully perform this activity, students will need printed sheets from the "Activities" tab on the right side of the module menu. Students will also need a pencil or pen. You can choose to either make this a small group activity or an individual activity based on your preference or the age group of the students.

There are plenty of objects that can be found in the garden that can potentially cut or scratch students. As the teacher, it is important for you to make sure to reinforce that students do not touch any of them. It is your duty to safely remove any potentially harmful objects from the garden to reduce the chances of potential injury. These objects should be removed with gloves, and placed in a proper waste bag or receptacle, and disposed of in the appropriate location.

It is important to emphasize to students that horseplay will not be tolerated in the garden and to stay away from any fences. Fences are meant to protect the produce from any wildlife or domestic animal, as well as to reduce the chance of vandalism; they are not intended as a recreational item.

Fences are not as sturdy as they might appear. They may topple over or could scratch or cut a student if they are playing on them.

Students must also wear protective clothing when gardening. The biggest physical concern when working in the garden is of students wearing sandals. Students should put closed toed shoes on before entering the garden. Shoes are the best option because they can protect the student from physical

hazards, such as rocks, thorns, or sharp branches. By wearing adequate amount of protective gear, they will reduce the chances of an accident.

QUIZ 3

The third quiz consists of questions over specific biological, chemical, and physical hazards and how to minimize risks from these hazards. There will also be a few questions covering poor personal hygiene including some related to the two activities about cross-contamination because this is a big concern when handling fresh produce. Please make sure to pause the module at this time until students have completed the quiz. The answers to the third quiz are given below.

- 1) How can drinking from hoses make people sick from fruits and vegetables?
- a. Microorganisms will form more quickly in hoses than in other places.
 - b. Microorganisms from our mouth can transfer to the fruits and vegetables and contaminate them.
 - c. Drinking from hoses can't make people sick.
 - d. None of the above.

Answer: Drinking from hoses can make people sick because harmful microorganisms in our mouth can transfer to the produce. Unintentionally, water can help transfer microorganisms from our mouth to the surrounding soil, or even directly onto the produce. Nobody should ever drink from the hoses that are used on the garden produce.

- 2) Why should fruits and vegetables not be set in soil after taken off the vine?
- a. Contaminated soil can affect fruits and vegetables that were originally safe.
 - b. Dirt and debris with harmful microorganisms can get on the surface of the fruit or vegetable, making us sick.
 - c. Other physical hazards could come in contact with the safe produce.
 - d. All of the above.

Answer: All of the above are reasons why produce should not be placed in soil after being picked. The soil may have already been contaminated. By placing the produce on the soil, it is exposed to potential physical, chemical, and biological hazards.

- 3) Are all microorganisms harmful?
- a. Yes, all microorganisms are harmful.
 - b. No, there are no harmful microorganisms.
 - c. There are some harmful microorganisms, but most will not make us sick.
 - d. There are more microbes than harmful ones.

Answer: Not all microorganisms will cause harm if we eat them. Some microorganisms are used to help make food products, such as cheese and yogurt. There are some harmful microorganisms, but a majority of them will not cause harm or illness if eaten.

- 4) Which of the following is NOT a risk associated with animals in the garden?
- a. Animal's poop.
 - b. Spread of microorganisms from paws to fruits and vegetables.

c. Contamination of soil in the garden.

d. All of the above are risks associated with animals.

Answer: All of the above are risks with having animals in the garden. Animal poop contains many microorganisms. If the animals poop in the garden, it will contaminate the garden soil, which can result in harmful microorganisms on the produce. The paws on animals are also not regularly washed like our hands are. Paws may have harmful bacteria, viruses, or parasites on them and then transferred to the soil when the animals steps into the garden.

5) Where should fruits and vegetables be placed after picked from the vine?

a. On the ground, outside of the garden.

b. On the ground, inside of the garden.

c. In a separated bin away from rotten or ruined produce.

d. Any of the above are ok locations to place picked fruits and vegetables.

Answer: After picked, produce should never be placed back onto the ground. Placing produce on the ground can result in contamination by physical, chemical, or biological hazards. Storing produce in a clean, separated bin away from rotting or bad produce will reduce the chances of contamination from occurring.

6) Why should most produce be rinsed after it has been collected?

a. Because of potentially harmful microorganisms from the garden.

b. Because of potentially harmful microorganisms on your hand.

c. Because of potentially harmful microorganisms from gardening tools.

d. All of the above.

Answer: Produce should be thoroughly rinsed after collection for all of the above reasons. Harmful microorganisms can be present in the garden (some of them are found naturally).

People touch many objects throughout the day. If proper hygienic practices are not followed, students could transfer harmful microorganisms from their hands onto the freshly picked produce. When gardening tools are not properly sanitized after use, they could have come in contact with chemicals or harmful microorganisms that are in the garden soil.

The chances of physical, chemical, and biological hazards are significantly reduced if produce is rinsed after it has been picked.

7) Sam used warm water and soap to wash his hands. He made sure that he rubbed soap on the front and back of his hands and between his fingers for 10-15 seconds; then he rinsed them and dried them with a paper towel. What did Sam do wrong?

a. He did nothing wrong.

b. He should have scrubbed his wrists and arms too.

c. He should have let them air dry.

d. He forgot to scrub under his fingernails.

Answer: When washing our hands, we have to make sure to clean hard to reach places, including under our fingernails. When handling fresh produce, we may have harmful microbes under our fingernails without even knowing. By scrubbing under fingernails, we can reduce the risk of cross-contaminating the fresh produce we handle.

8) What is the length of time needed for hands to be lathered once soap has been applied?

a. 3-5 seconds, or about the length of "Hello. My name is _____."

b. 10-15 seconds, or about the length of the, "Happy Birthday" song.

c. 1 minute.

d. Place hands under water for as long as you want.

Answer: To properly use soap, it should be lathered for 10-15 seconds. Lathering will allow the antimicrobial properties to get to the hard to reach spots on the hand. Singing, "Happy Birthday" to yourself is an easy way to make sure enough time is spent lathering.

9) Fences are a helpful tool for keeping animals out of the garden. What do we have to remember when working around fences?

a. Wear protective clothing

b. Fences are not jungle gyms

c. Fences could have sharp objects so we shouldn't touch them.

d. All of the above.

Answer: As beneficial as fences can be, they can also be a physical hazard if we are not careful around them. To avoid physical injury, we should wear protective clothing when around them. Additionally, fences are not a toy; to avoid sharp edges, we should not play or touch them while working in the garden.

10) How should gardening tools be stored when not in use?

a. They can be left anywhere.

b. Placed in a designated location to avoid physical hazards.

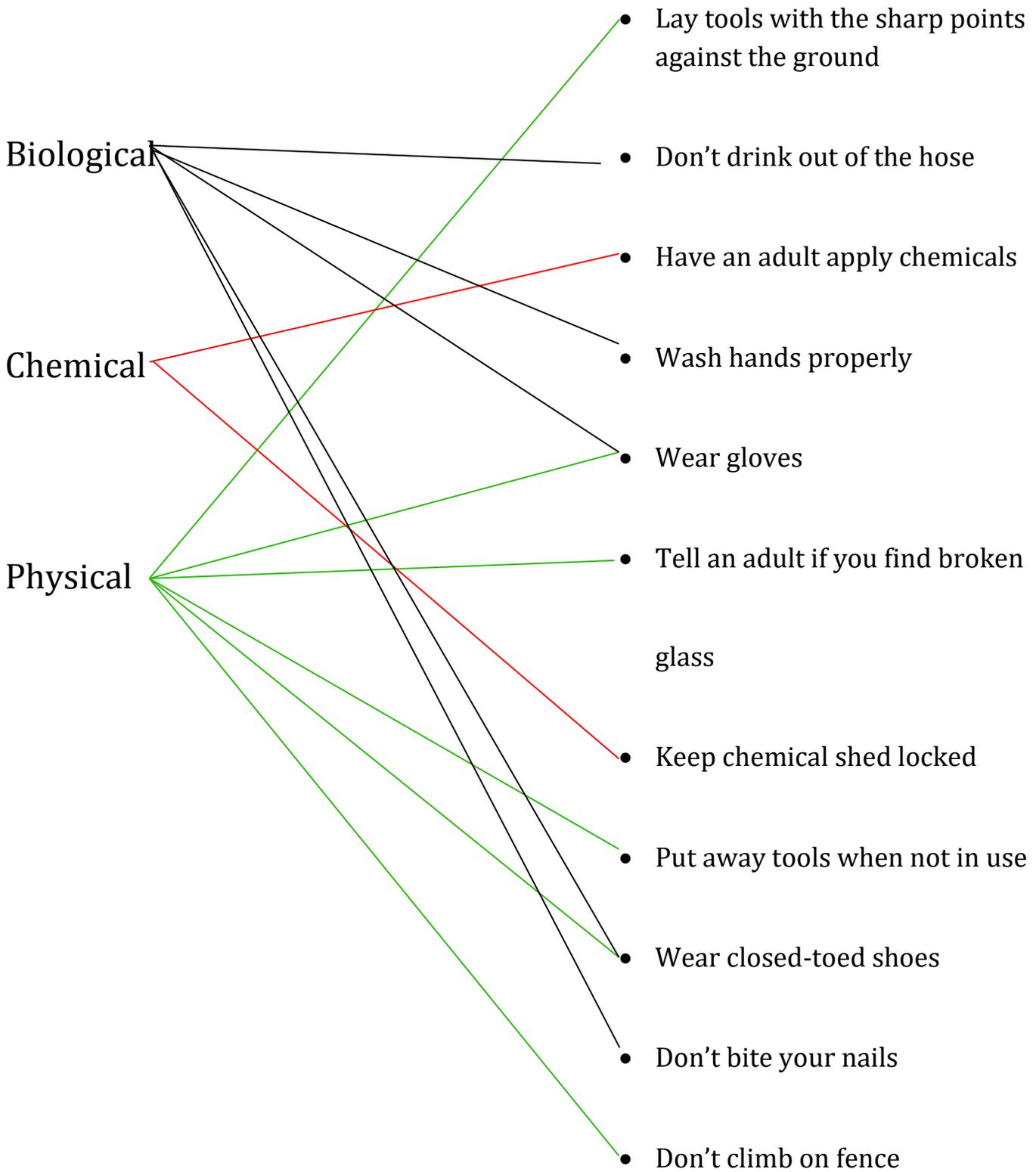
c. Leave them the last place they were used to pick fruits or vegetables.

d. All of the above.

Answer: Gardening tools must be placed in a designated location when not in use. Fewer physical hazards will occur because students and teachers will be aware of dangerous tools in the area. It is important not to leave tools in the garden, because they will be hard to see and people may step on them. Also, NEVER leave sharp side upward.

Part 3 Activity KEY

Match the hazard to the solution that would eliminate or reduce the risk.



Section 4

This section of the learning module describes practices after the produce has been harvested. The first portion of this section will teach students about the importance of distinguishing between good quality and poor quality produce items. This knowledge can reduce chances of contamination. In addition, students can add poor quality produce items to the compost pile to improve the garden soil. The good produce will be gathered for further cleaning later. These fruits and vegetables are fully mature and ripe, with minimal insect damage or bruising. It is important for students to be able to recognize inferior fruits and vegetables for more than just the quality aspect. These items need to be kept away from good produce items so cross-contamination cannot result.

Students can complete a third interactive exercise that allows them to visualize different produce items and see if they can properly evaluate whether these are acceptable products or poor quality produce items. To successfully complete this activity, a printer will be needed to copy activity sheets from the, “Activity” tab on the right side of the module. This can also be done via computer as a large group or class activity if everyone can view the pictures. If done individually, students will either need a pen or pencil, or a personal computer if the activity is done in a computer lab. Please pause the module at this time until the activity has been completed and discussed.

The purpose of this slide is to allow students to see examples of produce items and determine why they are “good,” or, “bad.” The narrator will speak (as written in the script) and hold up the produce items in the order they are listed in the interactive exercise.

The last topic that will be covered in this module is how fruits and vegetables should be stored after they have been harvested. It is important to practice, “first in, first out,” inventory management with students to help them understand produce items will only maintain an acceptable quality for a certain amount of time. The, “first in, first out,” procedure means produce items initially placed in the storage location must be the first ones removed. If this practice is followed, less produce will be wasted because it will be used before it spoils. As the instructor, it is important to check the storage location frequently and make sure this practice is followed as well as check that appropriate cleaning practices are followed to avoid cross-contamination from unclean surfaces. The instructor should also check proper storage temperatures are maintained.

To learn more about produce storage, follow the links to the resources listed below.

Produce storage resources:

- http://msue.anr.msu.edu/news/proper_produce_storage

Fresh Produce Safety – CDC and FDA sites:

- <https://www.cdc.gov/foodsafety/index.html>
- <http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm114299>

The students will learn why produce should always be rinsed before consumed to reduce the chances of becoming ill from any of the potential hazards. They will learn how to properly store and rinse and store garden produce.

The kitchen or wash area needs to be completely cleaned before bringing produce in. Cleaning surfaces and applying sanitizers where produce will be placed further reduces chances of cross-contamination from harmful microorganisms or chemical agents. It is also important to thoroughly wash all surfaces after produce have been placed in appropriate storage. This will reduce potential microbial growth and cross-contamination on future produce items and reduce chances of infecting students' hands. For additional information on kitchen sanitation, please refer to the resources listed below.

Kitchen sanitation resources:

- http://www.ohio.edu/riskandsafety/docs/food_forms/studentkitchensanitationguidelines0207.pdf
- <https://www.extension.iastate.edu/foodsafety/ten-steps-safe-kitchen>

NOTE: For additional information on proper storage temperatures and handling, please visit: <https://www.fns.usda.gov/ofs/storage-temperatures>

The final quiz of this training module covers strategies to determine if produce items are good for consumption or if they should be discarded in the compost pile. Students will be quizzed over good storage practices, such as, "first in, first out," and what the storage area should look like before placing product in its designated location. Print the quizzes for students and pause the module until all students have finished with the quiz. Below are the answers for the final quiz.

Quiz 4

Quiz questions for elementary module: QUIZ 4

- 1) What should we do if rotting or damaged fruits and vegetables are found?
 - a. Save them and eat them anyway.
 - b. Feed them to pets or animals that are around the garden.
 - c. Separate them from good produce and add them to a compost pile.
 - d. None of the above.

Answer: If rotten produce is found, it should be set aside and added to a compost for later use. Damaged produce should NOT be saved for eating because it could have harmful microorganisms, in addition to undesired tastes. Rotting fruits and vegetables should not be fed to pets or animals around the garden because the animals could get contaminated and transfer those hazards to the garden soil or produce if exposed to it at a later time.

- 2) What should NOT be done with most fruits and vegetables before storing them?
 - a. Let them sit out for a few hours before storing them.
 - b. Place by rotting fruits and vegetables so everything is close together.
 - c. Put them in storage before cleaning.
 - d. All of the above.

Answer: All of the above are measures that should not be taken when storing produce items. If produce is allowed to sit out for hours before storage, contamination is more likely to occur. Cross-contamination is more likely to occur if rotting produce is placed next to the good fruits and vegetables.

It is important to clean the produce before it is stored to remove any surface microorganisms or chemicals that may have been present from the garden.

- 3) What other surfaces need to be kept clean to keep fruits and vegetables safe?
- a. Counter tops.
 - b. Cutting Boards.
 - c. Refrigerator shelves for refrigerated fruits and vegetables.
 - d. All of the above.

Answer: All of the above surfaces need to be kept clean to maintain the safety of fruits and vegetables. Counter tops and cutting boards should be washed prior to and after rinsing produce to reduce the chances of cross contamination from fomites or other possible contaminants.

- 4) After washing fruits and vegetables after storage, how should they be dried?
- a. Rub them with a reusable cloth towel.
 - b. Air-dry or blot the produce with paper towels.
 - c. Sun dry the produce items and wipe with a cloth towel.
 - d. Any of the above drying methods are preferred.

Answer: Both air-drying and blotting methods are acceptable after washing produce. They should not be rubbed with a reusable cloth towel. After numerous uses, reusable towels can pick up harmful microorganisms and become contaminated. It is important to use one-use paper towels if possible.

- 5) Throughout this video we have talked about several things that help us stay safe while working in the garden. Which of the following is not a way to stay safe?
- a. Wearing gloves
 - b. Washing our hands, the produce, and anything that comes in contact with them
 - c. Not using garden tools as toys.
 - d. Wearing sandals.

Answer: The goal of this training is to make sure we are aware of the different safety hazards associated with fresh produce production and distribution. All of the above examples show ways to minimize food safety risks, except for wearing sandals. Sandals can increase physical and biological risks. We could encounter sharp objects in the garden, which could cause physical pain if we touch them with our bare feet. Also, our feet may contain harmful pathogens, which could cross-contaminate the soil or fresh produce when we come in direct contact with it.

- 6) What will fruits and vegetables look like that are good for eating?
- a. Ripe and free from blemishes.
 - b. Rotting.
 - c. Spotted and cracked.
 - d. None of the above.

Answer: Fruits and vegetables that are good for eating will be fully ripe and have minimal to no blemishes. Bad produce that should not be eaten will be rotting, have spots over the surface, and could have cracks in the skin layer.

7) Why do we have to remove bad produce from the garden?

- a. To make sure we are providing a healthy product
- b. To hide our failures
- c. To keep the other produce from spoiling
- d. Both A and C

Answer: We have to make sure to provide healthy products, as well as make sure to prevent additional spoilage from the produce that is currently growing in the garden.

8) What parts of the produce could show damage?

- a. The skin
- b. The inside
- c. The leaves
- d. All of the above

Answer: When evaluating our fresh produce, we are only able to see the surface. We cannot see the inside of the produce item. Similarly, we will be able to see if there is damage to the leaves, but this is not part of our product we are providing for consumption. By evaluating the skin, we can confirm if there is damage to the produce prior to post-harvest practices.

9) Why are fruits and vegetables washed before eating them?

- a. To remove any additional dirt or debris that may be present on the fruit or vegetable after picking.
- b. To remove chemicals that may still be present on the fruits or vegetables.
- c. To remove potentially harmful microorganisms that could still be present on the fruits and vegetables.
- d. All of the above.

Answer: All of the above are reasons that produce is washed before being eaten. By rinsing after storage, any additional dirt or debris will be removed.

Washing produce before storage will also reduce chemical and microbial hazards. If the produce was sprayed with any pesticides or herbicides before being picked, they could still be on the surface of the fruit or vegetable. Rinsing will reduce the likelihood of any potential chemicals that are on the surface of the produce. It will also remove any harmful microorganisms that were still on the surface after storage.

10) How will you know where fruits and vegetables should be stored?

- a. Guess.
- b. Ask your friend.
- c. Ask your teacher.
- d. Don't bother, just leave fruits and vegetables in storage bins next to the garden.

Answer: It is important to ask your teacher where to store produce. Do NOT guess where to put it. Some produce requires refrigeration temperatures for storage, while other fruits and vegetables require room temperature conditions. Your teacher will have information on where to put the produce to make sure it stays as safe as possible until eaten at a later time.

Part 4 Activity KEY

Yellow Solutions are questions 1-7. Blue Solutions are questions 8-14.

S	H	H	W	E	G	E	E	M	Z	A	C	B	Y	B
M	J	K	A	P	D	C	E	N	T	H	A	A	I	I
S	X	S	D	N	U	W	O	T	E	D	D	G	G	O
I	W	Y	O	D	D	X	A	M	A	H	G	K	A	L
N	U	Z	O	I	F	W	I	W	T	L	B	I	U	O
A	P	R	P	W	Z	C	A	R	U	F	P	W	S	G
G	P	P	W	V	A	S	I	S	U	X	F	Y	S	I
R	L	A	A	L	A	B	A	L	H	O	Z	Q	M	C
O	L	F	S	P	Y	K	P	H	X	I	T	O	T	A
O	Q	J	H	P	E	E	I	M	M	U	N	E	S	L
R	D	P	P	T	L	R	A	V	R	E	R	G	O	T
C	J	A	Y	D	E	B	H	A	X	V	J	A	P	W
I	H	M	B	G	J	S	P	H	N	P	Z	D	M	D
M	R	E	F	R	I	G	E	R	A	T	O	R	O	J
L	A	C	I	S	Y	H	P	Z	P	S	F	F	C	U

1. Small living things that could make produce unsafe are called **MICROORGANISMS**.
2. Some foods should be kept at room temperature while others should be stored in a **REFRIGERATOR**.
3. Bad produce should be placed in the garbage or on a **COMPOST** pile.
4. Proper **HANDWASHING** can stop the spread of many microorganisms.
5. We must **WASH** produce after harvesting it and before eating it.
6. **BAD** produce will show spots, cracks, or discolored areas.
7. The **MYPLATE** Diagram tells us that half of our diet should be made up of fruits and vegetables.
8. Bacteria, Viruses, and Parasites are **BIOLOGICAL** hazards that could affect the produce.
9. We need to be aware of Biological, **CHEMICAL**, and Physical hazards in the garden.
10. Singing "**HAPPY BIRTHDAY**" is a good way to know that you've washed your hands long enough.
11. We need to follow food safety guidelines because people with weak **IMMUNE** systems could get sick easily from unsafe produce.
12. When washing your hands, you should use warm water, soap, and **PAPER** towels.
13. Glass, gardening tools, and jewelry could all be **PHYSICAL** hazards.
14. In the garden we grow fruits and vegetables, which could also be called **PRODUCE**.

Script of Online Module:

Below is the script for the video. It will enable you to follow along and determine when to stop the video if you feel extra emphasis is needed at any point in the presentation. If students have questions throughout the presentation, the script will also help prepare you for any potential concerns or misunderstandings. By reading the script prior to showing the module to the students, you will be able to deliver this module however you feel necessary.

Introduction (2:34 minutes)

Welcome students! Do you like to eat fruits and vegetables? Fruits and vegetables, or garden produce, make us healthy and strong! Today, we are going to talk about how we can safely grow produce in our garden. There are some things that can affect produce and make us sick after we eat it. Today we are going to talk about what we can do to make sure our fruits and vegetables are clean and safe. We will be doing a few activities and also taking a few short quizzes to make sure we understand the important things we can do to help ourselves and keep others safe.

Girl Speaking: “Even if we don’t always feel like eating fruits and vegetables, we need to remember they are important for our nutrition. They make us strong and keep us healthy. Apples, bananas, strawberries, broccoli, carrots and tomatoes are just some of the fruits and vegetables that we can grow right in our own garden that will make us stronger. By eating more fruits and vegetables and eating less candy or fatty foods, we can lower the chances of getting different types of diseases when we get older. We need to start eating these now to keep us healthy for many years”.

So how important are fruits and vegetables? This diagram is called the My Plate. It shows us how many fruits and vegetables we should eat at every meal. The red and green sections of the plate are for produce. You can see they make up half of the total plate! The amount of fruits and vegetables we are supposed to eat depend on your age, your physical activity, and if you are a boy or a girl. The older you are, the more of these you should eat. The more physically active you are, the more energy you need every day.

Even though they are good for us, fruits and vegetables can make us sick if we don’t grow and handle them properly. People get sick when produce isn’t cleaned the right way. People also get sick when they eat fruits and vegetables that have harmful things on them. Before eating fruits and vegetables, we have to make sure to clean them well and remove anything that is on the outside of the produce.

We are going to take a short 10-question quiz now. It will cover why fruits and vegetables are important for us, what foods we should eat more of and, which ones we should stay away from. It will also ask why we are learning about garden safety. There is also an activity titled “Part 1 Activity: MyPlate” that will help you draw and identify the correct make up of a meal.

Potential Hazards (4:33 Minutes)

There are different ways we can get sick or hurt if we don't work with food the right way. There may be bugs on the fruits and vegetables. These bugs are very small. We can't even see them with our bare eyes! To see these bugs, we would need a strong microscope. Even though we can't see them on the produce, it doesn't mean that they aren't there. We call these bugs "microorganisms." We use the word "micro"- because that means very small. And we use the word "organism" because that word means living. So, microorganism is just a fancy way to describe them as small living things. Most microorganisms are actually good for us, but there are three main types that are harmful.

The first type is called bacteria. Bacteria are very small living creatures that can live just about anywhere. In the garden, they can be in the soil, on the skins of fruits and vegetables, in the water, or even on the tools we use. We have to make sure to clean the fruits well so the bad bugs aren't on our fruits and vegetables. A few examples of bad bacteria that we might find in the garden are: *E. coli*, *Listeria monocytogenes*, and *Salmonella*. All of these bacteria can make us sick and affect us in different ways.

Another type of microorganism we have to watch out for is called a virus. Viruses are similar to bacteria, but they are even smaller. An example of a common type of virus is called Norovirus. Norovirus can be spread throughout the garden by not washing our hands.

The last type of microorganism is called a parasite. Parasites are larger than bacteria and viruses, but we still can't see them with our eyes. When working in the garden, parasites can be in the soil. One type of parasite that can make us sick is called *Toxoplasma gondii*. This parasite is also associated with cat litter.

We need to remember that all three of these types of bad bugs can be found naturally in our garden, so we have to be sure to take safety measures so we don't eat them and get sick.

Boy Speaking: Many people might eat the food from our garden. When working around food we have to think about our immune systems. Our immune system is the part of our body that helps us fight off bad microorganisms. However, some people have stronger immune systems than others. Someone with a weak immune system might not be able to fight off the bad microorganisms as well as those with a very strong immune system. It is VERY important that we make sure our fruits and vegetables are clean and safe for everybody who eats them.

When we work in the garden, we also have to think about chemicals that may be applied on the crops to protect them from insects, weeds, and disease-causing organisms. Chemicals can be a very helpful tool in the garden. However, if we don't use them correctly, they can make us sick. While chemicals are a helpful tool, they are not required to produce a healthy crop. If chemicals are used, they must be applied according to the label on the container, and should always be applied by an adult. Chemicals should be stored in a locked storage area, and we need to make sure to use caution when around them.

The final thing we should be aware of and avoid are sharp objects that might be in the garden such as broken glass, sharp sticks, stones, rocks, and metal pieces. It's important to protect ourselves from these items by wearing gloves while working in the garden. If you see sharp objects, make sure to contact a teacher or an adult so they can get rid of them. DO NOT try to remove these items from the garden by yourself. Also, remember garden tools are not toys and some can be sharp and dangerous if not handled correctly. The only time you should use these tools is while gardening.

Now we are now going to take a quick quiz about the different things we learned that could make us sick or hurt while we are in the garden. This quiz will have ten questions. See if you can remember all of the important steps you need to know when identifying dangers in the garden. There is also an Activity available for this module titled "Part 2 Activity: "Odd Man Out" Hazards where you must find the word that does not fit with the other words. There is another activity titled " Identify the Garden Hazards" that is available as a class assignment. Good luck!

Hazard Prevention (6:52 Minutes)

Welcome back! We just finished talking about things that might hurt us or make us sick in the garden. Now we are going to talk about what we can do to prevent this from happening. There are many ways to make sure our fruits and vegetables are safe to eat, like preventing microorganisms from contaminating our garden crops.

Girl Speaking: We need to make sure microorganisms aren't on our fruits and vegetables when we harvest them from the garden. To grow fruits and vegetables we have to water the plants. Water helps the plants grow and produce the crop. If we are watering the garden with a hose, we have to make sure NOT to drink out of the hose. We can have bugs that make people sick in our mouth. Some of the might come out of our mouth with the water, and spread the bugs to the fruits and vegetables, which can make other people very sick.

Another Girl Speaking: Microorganisms can also get on fruits and vegetables from animals. We have to make sure to keep all animals out of the garden as much as possible because they might poop in the garden. Many microorganisms from animals' poop can get on the fruits and vegetables and make them unsafe. We also have to remember that many animals can pick up diseases from other places too. If an animal with a disease gets into the garden, it can spread some of the disease to a fruit or vegetable that a person could eat later.

We can also contaminate fruits and vegetables by forgetting to wash our hands. Our hands often have microorganisms on them from other things that we touch. This can make people sick.

We need to wash our hands after going to the bathroom to keep the food and ourselves clean and healthy. We also need to wash our hands at other times when they are dirty. This could be after playing outside or after touching animals. It is also very important to wash our hands when we are done touching the fruits and

vegetables. If the produce has microorganisms on it, we could accidentally eat them if we put our hands in our mouth, like biting our nails. This could make us sick.

When we wash our hands, we need to make sure to do it the right way. To wash our hands correctly, first, get your hands wet with warm or hot water. Then, put some soap on your hands. Make sure to rub your hands together for at least 10-15 seconds, which is about the time it will take us to sing, "happy birthday." Then, you need to clean in between your fingers and scrub under your fingernails, which is a great place for microorganisms to hide. After you have cleaned your hands and wrists, rinse them one more time under warm running water. This will get all of the extra soap off of your hands. The last thing to do is to dry them with a paper towel. By following this six step process, you will have very clean hands, and will get rid of the microorganisms that could be on them.

Now we are going to do a fun activity where we practice washing our hands the right way! We are going to put glowing liquid on our hands that we will be able to see under a special light. Look at the way the liquid glows when our hands are placed underneath these lights. Then, go to a sink and practice washing your hands with the six-step process to see if you washed your hands well enough. After drying your hands on the paper towel, put your hands back under the special light to see if you removed everything, so they no longer glow. Good luck!

Great job with washing your hands! It looks like we are doing all of the right things to prevent us from spreading microorganisms when we handle garden produce. It's now time for another activity. We are going to look at a few different pictures and see if we need to wash our hands after that specific daily activity. Please stop or pause this training video until the activity has been completed.

It's important to remember to wash our hands after all of these activities. We need to wash our hands before handling fruits and vegetables regardless of what we are doing so that we don't get bad microorganisms on the produce from other things we touch during the day.

When we work in the garden, we use many different types of chemicals. Some keep insects and animals away; we call these pesticides. We also use chemicals to kill weeds, and we call these herbicides. We also use chemicals to keep gardening tools and other objects clean, which we call sanitizers. All of these chemicals are very helpful to us. However, some of these chemicals can make us sick if we don't use them the right way. Chemicals need to be kept away from fruits and vegetables. If we see chemical containers in the garden, we have to make sure to tell the teacher or adult about them, and not try and pick them up by ourselves.

Girl speaking: We are now going to talk about sharp or dangerous objects that we might see in the garden that can hurt us when we were in the garden, or that could be in or on the fruits and vegetables when we pick them out of the garden. Gardening tools are useful, but can be dangerous. When using gardening tools, we

have to make sure to only use them the way they are supposed to be used. Set the tools down with the sharp parts down, against the ground so people don't get hurt or fall on them. Another thing we can do is give the gardening tools to the teacher to put in a safe place.

When gardening, there are many sharp or dangerous objects that can hurt us while we work. The objects can also be on the fruits and vegetables when we pick them. We may pick up a fruit or vegetable that has broken glass or a sharp stick in it that can hurt us if we touch it in the wrong place. Gardening tools in particular can be dangerous. Be sure to only use the tools the way they were meant to be used. When you are finished using the tools, give them to a teacher or adult to put away, or be sure to set them with the sharp parts pointed toward the ground, so others don't fall or trip over them.

Fences surrounding the garden are another physical objects that should be treated with care. Fences are not meant to be a jungle gym or a toy, so we shouldn't touch or climb on them. We should also wear clothes that protect us while we work in the garden. An example of this would be to wear close-toed or tennis shoes to protect our feet, instead of sandals or going barefoot.

Now let's take another quiz. This quiz will cover the different types of things we can do to ensure we don't get sick or hurt when working in the garden. It will cover bad microorganisms, chemicals used on fruits and vegetables, and physical objects that can hurt us when working in the garden. There is also an activity titled "Part 3 Activity: Matching Hazards to Solutions" that is available to complete. There is also two activities titled "What would you do? Brian" and "What would you do? Jada" which will allow you to utilize your new knowledge about Hazard Prevention. Good Luck!

Post-Harvest Safety (3:35 Minutes)

Welcome back everyone! We have talked about the bad things that can happen in the garden, and what we can do to prevent them. Now, lets talk about what to look for when picking fruits and vegetables. After that, we will talk about how to keep the produce safe and tasty so everyone can enjoy.

When picking fruits and vegetables, look for produce that looks great to eat and also for produce that looks bad. Good produce will be full sized and ripe in color. They will not have any soft spots or bug bites on them. Bad produce will have spots, cracks, and discolored areas. Bad produce won't look good to eat. Even though we won't use the bad fruits and vegetables, we need to remove them from the garden and place them in a compost pile or in the garbage. Bad produce spoils quickly and may cause other fruits and vegetables from the garden to spoil as well. Your teacher will be able to help you tell the difference between good and bad produce.

Boy Speaking: To pick out the differences between good and bad fruits and vegetables in the garden, we will have to be detectives! We need to look closely and

see if anything on the surface of the fruit or vegetable that doesn't look normal or right. Do you think you can be a good detective?

Let's test your detective abilities. We are going to look at some pictures of different fruits and vegetable. We need your help to tell the difference between good produce and bad produce we should send to the compost pile or to the garbage. Good luck detectives! Please stop or pause this training video until the activity has been completed.

Good job everyone! As you can see, only the cucumber was a good piece of produce. All the other produce in the pictures are bad produce. The apple shows a different color on the backside that might be mold; the corn is rotten and should not be eaten. The avocado and tomato both have weird colors and also show that they are rotten. Since all of these fruits and vegetables have holes in the skin, it is possible bad microorganisms can enter the produce and make us sick if we eat them.

Now that we know what fruits and vegetables are safe for us to eat, we need to know how to store them so they stay safe and still taste good. We must always wash and rinse our fruits and vegetables before serving or eating them. Some fruits and vegetables are best stored in the refrigerator, while others need to be stored at room temperature. As you know, we need to make sure that we clean the fruits and vegetables we pick and also clean the areas where food will be stored. By cleaning the food and storage areas, we can reduce the chances of having unsafe fruits and vegetables. Even though we washed the fruits and vegetables before we stored them, we should wash them again before we eat them to ensure they are safe.

Now let's take the final quiz over what we should look for when picking fruits and vegetables, how to tell good fruits and vegetables from bad, and what we should do make sure fruits and vegetables are cleaned and stored the right way. There is a last activity titled "Part 4 Activity: Food Safety Word Find" that can provide you an opportunity to find all the food safety words learned.

Risk Management:

As illustrated throughout the teaching manual and learning module itself, there are many different hazards that may be present when working in school or community gardens. Before beginning our garden program, make sure you have a fully stocked first aid kit readily available. The first aid kit should include a minimum of: Bandages, adhesive cloth tape, antibiotic ointment packs, aspirin, 2 pairs of latex gloves, scissors, sterile gauze pads, and tweezers. If any of these materials are used, be sure to restock the first aid kit for future use. In addition to having a first kit, it is important to keep medical phone numbers on hand if needed. Have your local hospital number on hand and ready if needed. Make sure to also have the poison control center phone number ready in case of any chemical ingestion. Lastly, have phone numbers for each student's parent or guardian readily available, or alert the school office. This will allow for parents or guardians to be quickly contacted should there be an incident.

Additional exercises:

In addition to the exercises included in the module, there are a few other hands-on activities you can choose have the students learn. These exercises can be accessed from the “Activities” tab on the right side of the module.

Additional Activity #1: Cleaning our Produce

Educational requirements for Activity #1:

Students should have knowledge of:

- General biology concepts.
- Proper sink or hose usage.
- The proper storage location for fresh produce.

Activity #1 tools needed:

- Potable water source – running water from a sink or hose.
- Disposable paper towels.
- Produce item that is to be cleaned.
- Appropriate/clean produce storage location.

In this activity, we will focus on produce that has already been harvested. Once harvested, the produce must be rinsed appropriately, and stored in a clean, storage location with appropriate temperature for that produce item.

For this activity, have students standing at a sink or hose that has clean water (If not available, present the material to the students so they can see and understand hoe produce must be properly rinsed). Have the students take the produce item, and rinse it under the running water, washing the surface of the produce item clean. Once rinsed, have students turn off the water, drain excess water, and blot the produce with a disposable paper towel. When the produce is dried, have students place the produce in the appropriate storage area (refrigerated produce should be placed in a clean container or on a clear surface in a clean refrigerator while room temperature produce should be placed in a designated area that is secure).

Additional Activity #2: Find the Hazards in the garden

Educational requirements for Activity #2:

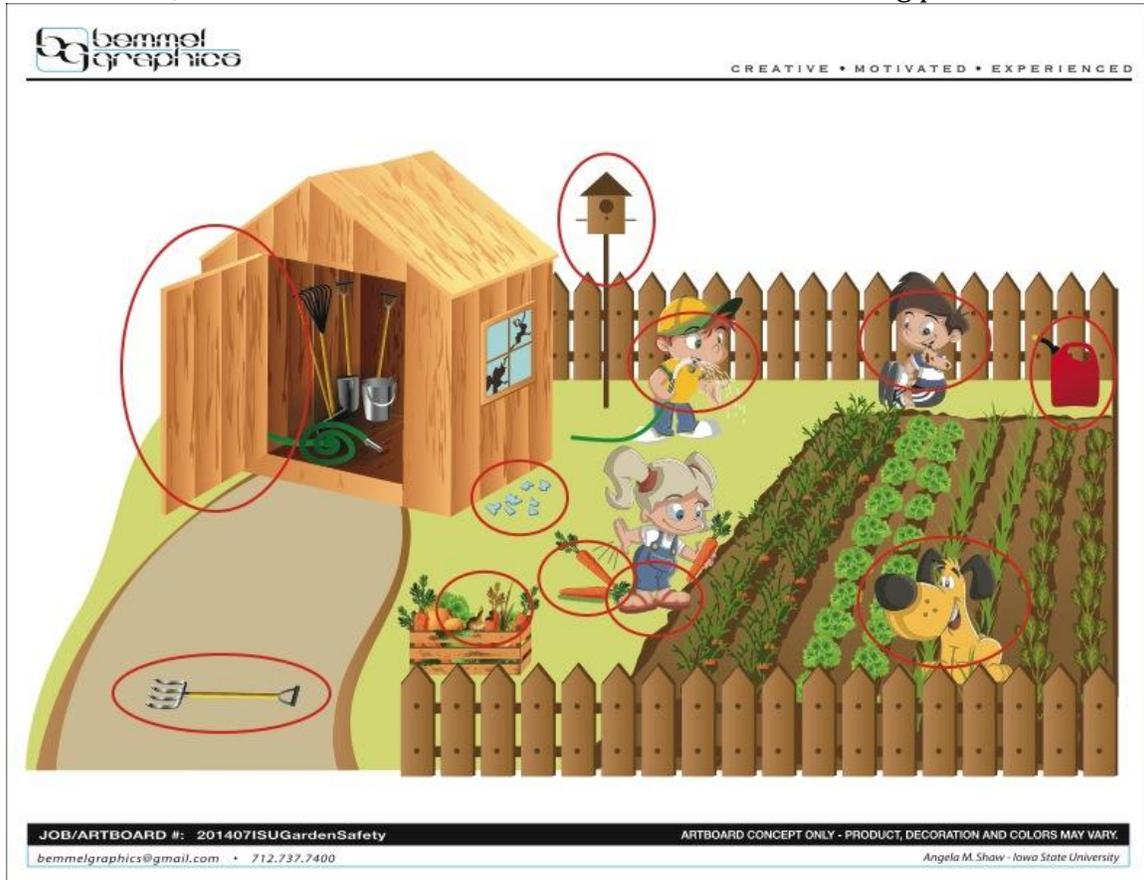
Students should have knowledge of:

- General biology concepts.
- Basic chemical application.
- Common physical hazards.
- Location and familiarity with garden.
- Common gardening tools/chemicals.

Activity #2 tools needed:

- Printer to print off and copy the worksheets.
- Pen or pencil for each student.

In this activity, students will have to evaluate biological, chemical, and physical hazards that are likely to be present in a garden setting. This activity will be a printout that is located in the “Activities” tab to the right of the module. Below is the answer key to all of the hazards that are present, with an explanation of why they are a hazard, in addition to how to eliminate the hazard from being present.



Hazards in the garden:

- Shed door left open.
- Garden tool placed in an inappropriate location.
- Broken glass from tool shed dispersed on the ground in the garden.
- Dog allowed to walk around the garden.
- Chemical container left in the back corner of the garden.
- Rotten produce picked and placed in the harvest bin with good produce.
- Child holding hose and drinking from it.
- Child in the soil putting soiled hands in mouth.
- Fresh Produce bin placed on ground.
- Having a birdhouse in the garden.

Additional Activity #3: What Would You Do?

Educational requirements for Activity #3:

Students should have knowledge of:

- General biology concepts.
- Basic chemical concepts.
- Common physical contamination.
- Situational critical thinking.

Activity #3 tools needed:

- A printer to print off case studies.
- Pen or pencil for each student.

This exercise will be available in the “Activities” tab to the right side of the module. In this activity, students will receive three short case studies of people working in the garden. Each study will emphasize different areas of improper garden practices. After reading each study, students will be expected to identify all of the hazards in each case study, explain why it is a hazard, and what the person in the case study should have done to eliminate the hazard from arising. Upon completion of the third case study, a majority of the most common hazards will have been addressed, and students will have safety concepts reinforced before entering the school or community garden.

Below is the answer key for all of the hazards in each of the case studies provided.

ANSWER KEY: WHAT WOULD YOU DO? Case Study #1:

Brian washed his hands with soap and water before going out to pick fruits and vegetables. He tied his shoelaces tightly, and went into the garden to pick the produce.

Brian saw some gardening tools outside of the garden, so he decided to use them on some of the produce items as he went around collecting fruits and vegetables. When finished with the tools, Brian set them down in the garden and went back to picking.

After picking produce for some time, Brian heard the class puppy, Scrappy, barking at the gate of the garden. Feeling bad for Scrappy, Brian opened the gate to the garden to let Scrappy walk around the garden while he picked the fruits and vegetables.

When Brian finished picking the fruits and vegetables, he left the basket by the entrance to the garden and went inside to wash his hands with soap and water.

1. What did Brian do wrong?

--- Brian left the gardening tools in the garden. If not removed after using, these can become physical hazards because other people could step on them.

---Brian let the class puppy, Scrappy, into the garden. Do not let animals into the garden, because they can poop on the produce or spread disease to it. Animals also carry harmful bacteria that can make the produce unsafe to eat.

---Brian left the basket of fruits and vegetables by the entrance to the garden. These were not given to the teacher to properly store.

2. What can YOU do to avoid these problems?

--- When using gardening tools, always make sure to place them in a designated storage location to reduce the chances of injury to others. These tools should be properly cleaned before placed in their designated storage location to reduce the hazards of later use.

--- Keep wild animals and pets out of the garden as much as possible to reduce the chances of contaminating the produce, plants, or soil.

--- Make sure to give the produce to the teacher so it can be properly stored. If inappropriately stored, the produce will be more likely to rot or be unacceptable.

ANSWER KEY: WHAT WOULD YOU DO? Case Study #2:

Little Jada rinsed her hands thoroughly with soap and water before going out to the garden to pick fruits and vegetables. Jada entered the garden wearing her sandals and her basket and began picking produce that was ready. As she was harvesting, Jada saw a broken glass bottle in the garden. She safely stepped over it and continued picking the produce.

After awhile of picking produce, Jada was feeling very thirsty. She looked around the garden and saw the garden hose. She went over to it, turned it on, and took a quick drink from the hose.

When Jada finished in the garden, she gave the produce to her teacher to put in a safe place. She then washed her hands under the sink for two seconds before going back to class.

1. What did Jada do wrong?

---Jada entered the garden wearing sandals. Sandals should not be worn because of physical hazards that could be present in the garden.

---Jada only stepped over the broken glass that was in the garden. Jada should not pick it up because of potential harm, but she should also not completely ignore it.

---Jada drank out of the garden hose. NEVER drink from the garden hose. Jada could have potentially harmful microorganisms in her mouth, and they could travel from her mouth to the soil or produce through the stream of water and make the produce unsafe.

---Jada only washed her hands for 2 seconds under the sink. It is important to wash hands thoroughly with soap to clean the hard-to-reach areas on her hands

and remove any potentially harmful microorganisms that got on her from picking produce.

2. What can YOU do to avoid these problems?

--- Bring a pair of close-toed shoes to school if you are wearing sandals. Before entering the garden, change into the shoes to avoid any sharp objects (broken glass, sharp plastic or stones). Shoes should be kept on until leaving the garden area.

--- Inform the teacher or adult of the broken glass when it is seen. The teacher or adult will be able to remove the broken glass safely so people who go into the garden later are not cut by the broken glass.

--- Do NOT drink from the hose. Bring a water bottle out to the garden with you and set it by the garden entrance or go visit a nearby drinking fountain. When thirsty, leave the garden, take a quick drink, and then go back to picking produce.

--- When washing hands, make sure to lather them with soap for at least 10-15 seconds, or how long it takes to sing, "Happy Birthday." After lathering, rinse the rest of the soap off and wash hands with a single-use, disposable paper towel.

REFERENCES:

For further information on any of the general information mentioned in the teaching manual or in the module itself, click the online links listed below. These links provide additional information on potential biological, chemical, and physical hazards that may arise when working in the garden, and what additional measures you can take to prevent all of these hazards from arising in your community or school garden.

General comprehensive resources for garden food safety:

- <http://www.extension.iastate.edu/hrim/localfoods>
- <https://extension.psu.edu/food-safety-and-quality/farm-food-safety>
- http://www.schoolnutrition.org/uploadedFiles/School_Nutrition/104_CareerEducation/ContinuingEducation/Webinar_Wednesdays/GAPs%20School%20Gardens-11.3.11%20FINAL%20UPDATED.pdf?n=8068
- http://www.schoolnutrition.org/uploadedFiles/School_Nutrition/104_CareerEducation/ProfessionalDevelopment/Certification/Cerification_Documents/Food%20Safety%20Tips%20for%20School%20Gardens.pdf?n=7984
- http://www.wafarmtoschool.org/Content/Documents/School_Gardens_Food_Safety_Tips_-_Maryland_Extension.pdf
- http://www.wafarmtoschool.org/Content/Documents/Serving_Foods_Grown_in_School_Gardens.pdf
- <http://www.sde.ct.gov/sde/LIB/sde/pdf/DEPS/Nutrition/OPmemos/10/5stepsOM1010.pdf>
- <http://ucfoodsafety.ucdavis.edu/files/157441.pdf>
- <http://wwwnc.cdc.gov/eid/article/19/3/pdfs/11-1866.pdf>
- <http://agriflifefoodsafety.tamu.edu/files/2011/03/Pre-Harvest-and-Harvest-Food-Safety.pdf>