

Greenhouse and Nursery Management

Subject Code 010610

Bryan Ellis, Toledo Public Schools

Bryan Smith, Sylvania Schools



Rigorous Assessment Items Aligned to the Four Depth of Knowledge Levels for Ohio CT Courses in

Agricultural and Environmental Systems

Construction Technologies

Human Services

Health Science

Transportation Systems

Sponsored by Northwest Ohio Tech Prep, Northwest Ohio HSTW, The University of Toledo CTE Teacher Prep Program, and Ohio ACTE



Teachers and administrators from five schools throughout Northwest Ohio engaged in a three day workshop focusing on the creation of rigorous assessment items aligned to the four Depth of Knowledge (DOK) Levels as defined by Ohio's Career Field Technical Content Standards for at least one course in their career field. Rigorous assessment items were developed to assist teachers in the creation of student assessments aligned to the state standards, thus ensuring an increase in student performance on the correlating WebXams.

Schools engaged in the initiative:

Penta Career Center, Perrysburg, Ohio

Christina Kerns, Supervisor of Curriculum and Instruction, Workshop Facilitator
Nicole Costello, Small Animal Care Teacher
Eric Eisel, Auto Collision Teacher
Tracy Graf, Hair Design Teacher
Shelley Rogers, Medical Technologies Teacher
David Stacklin, Agriculture Teacher
Phil Stockwell, Supervisor of Agriculture and Transportation
Jason Vida, Construction Carpentry Teacher

Oregon City Schools, Oregon, Ohio

Steve Bialorucki, Director, Career & Technology Education
Jodi Eckman, Cosmetology Teacher
Meredith Wolfe, Agriculture Teacher

Sylvania City Schools, Sylvania, Ohio

Holly Fair, Cosmetology Teacher
Julie Sanford, Secondary/CTE Assistant Director
Bryan Smith, Ag Business Teacher

Toledo Public Schools, Toledo, Ohio

Bryan Ellis, Urban Agriculture Teacher
Steve Oswanski, Small Animal Management Teacher

Washington Local Schools, Toledo, Ohio

Kimberlee Farnham, Cosmetology Teacher
Leslie Fish, Cosmetology Teacher
Phil Kraus, Construction Carpentry Technology Teacher
Deb Heban, Director, Career & Technical Education

Post-Secondary Support:

Kathleen Crates, The University of Findlay
Paul Hubaker, Northwest Ohio Tech Prep
Eric Landversicht, The University of Toledo
Kathy Wilson, Northwest Ohio Tech Prep



Courses Aligned to the Four DOK Levels:

Agricultural and Environmental Systems Career Field

1. **Agriculture, Food and Natural Resources 010105** (A0, A1, A2, A3, A5, and A6 Pathways)
David Stacklin, Penta Career Center, Agriculture Teacher and Meredith Wolfe, Oregon City Schools, Agriculture Teacher
2. **Greenhouse & Nursery Management 010610** (A0 and A5 Pathways)
Bryan Ellis, Toledo Public Schools, Urban Agriculture Teacher and Bryan Smith, Sylvania City Schools, Ag Business Teacher
3. **Zoo and Aquarium 010940** (A2 Pathway)
Nicole Costello, Penta Career Center, Small Animal Care Teacher and Steve Oswanski, Toledo Public Schools, Small Animal Management Teacher

Construction Technologies Career Field

1. **Structural Coverings and Finishes 178004** (Structural Systems DD Pathway)
Phil Kraus, Washington Local Schools, Construction Carpentry Technology Teacher and Jason Vida, Penta Career Center, Construction Carpentry Teacher

Human Services Career Field

1. **Advanced Hair Cutting and Styling 174130** (Cosmetology M1 Pathway)
Tracy Graf, Penta Career Center, Hair Design Teacher, Kimberlee Farnham, Washington Local Schools, Cosmetology Teacher, and Steve Bialorucki, Oregon City Schools, Director, Career & Technology Education
2. **Advanced Chemical Services 174140** (Cosmetology M1 Pathway)
Tracy Graf, Penta Career Center, Hair Design Teacher, Kimberlee Farnham, Washington Local Schools, Cosmetology Teacher, and Steve Bialorucki, Oregon City Schools, Director, Career & Technology Education
3. **Microbiology and Infection Control 174115** (Cosmetology M1 Pathway)
Jodi Eckman, Oregon City Schools, Cosmetology Teacher, Holly Fair, Sylvania City Schools, Cosmetology Teacher and Leslie Fish, Washington Local Schools, Cosmetology Teacher

Health Science Career Field

1. **Patient Centered Care 072050** (Allied Health and Nursing JM Pathway)
Deb Heban, Washington Local Schools, Director, Career & Technical Education and Shelley Rogers, Penta Career Center, Medical Technologies Teacher

Transportation Systems Career Field

1. **Collision Painting & Refinishing 177012** (Ground Transportation T9 Pathway)
Eric Eisel, Penta Career Center, Auto Collision Teacher and Phil Stockwell, Penta Career Center, Supervisor of Agriculture and Transportation

**Course Specific Descriptors for Each DOK Level
Agricultural and Environmental Systems Career Field
Greenhouse and Nursery Management**

COURSE DESCRIPTION

Students will learn the operational practices needed for the successful growth of nursery stock and/or greenhouse plants. They will learn essential greenhouse practices including water and fertilizer distribution, lighting, ventilation and temperature control. Students will learn pest and disease identification and control along with bio-security practices. Students will demonstrate knowledge of propagation methods, plant health, nutrition, and growth stimulation. Throughout this course, business and employability skills will be emphasized.

DOK LEVEL 1

At this level, students will: identify pests, weeds, diseases, and nutrient deficiencies; identify the proper growing media, soil conditions, water and all cultural requirements for given plants; identify ripe fruit, vegetables, and flowers ready for harvest, storage, or sale; and have knowledge of industry credentials, vocabulary, and necessary safety measures.

DOK LEVEL 2

At this level, students will: classify and categorize pests, weeds, diseases, nutrient deficiencies and implement the appropriate corrective action; analyze soil, growing media, and water and manipulate the conditions to create optimal plant health; identify and properly harvest ripe fruit, vegetables, and flowers to store, sale, or ship; recognize potential biosecurity issues and make corrections as needed; and have knowledge of industry credentials, vocabulary, and can demonstrate proper safety measures at all phases of crop production.

DOK LEVEL 3

Students at this level of learning will: analyze soil and growing media data to create a crop plan for optimum yield; determine best management practices that lessen the environmental impact from various crop production operations; evaluate and create techniques for grading, handling, packaging, of plants and plant products for distribution with maximum biosecurity measures; make proper plant selection and planting/seeding practices for optimal plant health and yield in a given environment based on pre-evaluations; survey plants and provide a detailed IPM (Integrated Pest Management) plan to eliminate or minimize pests for an array of growing scenarios; create SOP's for safe herbicide and pesticide storage and application including all necessary PPE; and explain and rationalize all prescribed growing or safety practices and techniques they have provided for any given growing situation.

DOK LEVEL 4

Students at the deepest level of learning will: predict and mitigate any plant stress factors and employ evasive and preventative measures to ensure optimal plant health; analyze soils in a given environment and enact their plan to optimize yield for maximum economic potential; and implement a safety plan and ensure biosecurity during all aspects of harvest, post-harvest, distribution, and storage of plant products. Students performing at Level 4 will pursue and acquire all applicable greenhouse industry credentials and licensure.

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Competencies: 6.1.1-6.1.4	
6.1.1. Identify soil forming factors and explain how they produce variability in soils. LEVEL 1	
6.1.2. Describe the relationship among physical properties of soils. LEVEL 1	
6.1.3. Collect, test, and analyze soil samples for physical and chemical properties. LEVEL 2	
6.1.4. Identify factors (e.g., climate, vegetation, soil texture, drainage, management practices, landscape) effecting organic matter and its function in soil quality. LEVEL 1	
DOK LEVEL 1 What are the three types of soil?	DOK LEVEL 2 Compare and contrast sand, silt, and clay.
DOK LEVEL 3 Analyze soil and soil forming properties to identify soil types. Chart your findings on the Soil Triangle.	

Competencies: 6.2.4-6.2.5	
6.2.4. Explain the hydrological cycle (e.g., condensation, evaporation, transpiration) and how human and animal activity impacts the cycle. LEVEL 2	
6.2.5. Explain the biotic and abiotic factors effecting water quality. LEVEL 2	
DOK LEVEL 1 List at least four components of the Hydrological Cycle.	DOK LEVEL 2 Create a presentation on animal or human impact on the Hydrological Cycle.
DOK LEVEL 3 Create a presentation describing mitigating factors on human or animal impact of the Hydrological Cycle. Provide supporting evidence.	DOK LEVEL 4 In your group, investigate repeatable methods to minimize effects from farms, animals, and humans. Create a pamphlet that can be distributed. Construct a functional demonstration model.
Resources: Mason jars with lids for soil samples.	

Competencies: 6.2.6-6.2.7	
6.2.6. Monitor and analyze water quality and quantity. LEVEL 3	
6.2.7. Implement procedures and management practices that maintain or improve water quality. LEVEL 4	
DOK LEVEL 1 Collect water samples from a pond, lake, river, or stream.	DOK LEVEL 2 Using collected water samples, conduct the four water quality tests: Ammonia, Nitrite, Nitrate, and pH. Chart your findings.
DOK LEVEL 3 Collect water samples from two separate sources and determine what factors have affected the results from each location. Cite evidence to support your conclusions.	DOK LEVEL 4 Gather, analyze, organize, and interpret water samples for quality and quantity. Investigate and implement procedures to improve water quality in a given body of water.
Resources: Waders, cylinders, water testing lab equipment	

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Competencies: 6.7.2-6.7.4	
6.7.2. Distinguish the risks associated with solid waste accumulation, utilization, and disposal. LEVEL 1	
6.7.3. Determine an acceptable site for solid waste disposal. LEVEL 2	
6.7.4. Compare the processes of aerobic and anaerobic waste decomposition. LEVEL 1	
DOK LEVEL 1 List five risks associated with solid waste accumulation.	DOK LEVEL 2 List and explain aerobic and anaerobic decomposition factors.
DOK LEVEL 3 Describe best management practices for site waste management for a fish farm and an organic vegetable farm. What is the recurring theme and provide supporting evidence.	

Competencies: 6.7.1, 6.7.5-6.7.6	
6.7.1. Collect, analyze and treat solid waste materials (e.g., mortalities, manure, garbage). LEVEL 3	
6.7.5. Describe and monitor solid waste disposal procedures (e.g., landfill, compost). LEVEL 3	
6.7.6. Describe and implement solid waste management methods (e.g., composting, incineration, recycling, burial). LEVEL 3	
DOK LEVEL 1 What is vermicompost?	DOK LEVEL 2 List and describe three different solid waste disposal procedures. Explain how each can be monitored?
DOK LEVEL 3 Create both a vermicompost bin and a compost tumbler. Predict which is more effective. After one week of monitoring, describe which method of composting appeared to be more effective and explain why. Provide supporting evidence.	DOK LEVEL 4 Create both a vermicompost bin and a compost tumbler. Predict which is more effective. After two weeks monitoring, prescribe any actions to be taken to maximize the decomposition of each compost variety. After adjustments are made, draw conclusions on which is most effective with the least amount of environmental impact.

Competencies: 6.7.7-6.7.10	
6.7.7. Explain the control processes and potential uses for solid waste byproducts (e.g., leachate, ash, landfill gas, sludge, methane, manure). LEVEL 2	
6.7.8. Describe standard operating procedures and identify design requirements for specific purposes (e.g., landfill, lagoon, leachate treatment). LEVEL 3	
6.7.9. Evaluate site closure methods and post-closure monitoring. LEVEL 3	
6.7.10. Determine type and volume of solid waste generated by an operation or facility. LEVEL 2	
DOK LEVEL 1 List five solid waste byproducts.	DOK LEVEL 2 Compare and contrast landfill gas and methane.
DOK LEVEL 3 Evaluate and create a solid waste byproduct management plan for a small livestock farm by determining the generated volume. Supply evidence of how it will be affected.	

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Competencies: 7.7.1-7.7.3	
7.7.1. Investigate sources and origins of agents that can contaminate processed and unprocessed food products. LEVEL 2	
7.7.2. Identify activities and biological agents that contribute to the risk of acquiring or preventing a specific disease. LEVEL 1	
7.7.3. Identify sources of biological and chemical tampering points. LEVEL 1	
DOK LEVEL 1 Match the given contaminants to either biotic or abiotic.	DOK LEVEL 2 Students will can a jar of pickles. Then they will identify sources and origins of potential contaminants for the unprocessed and finished product.
DOK LEVEL 3 During the pickle canning lesson, list and evaluate potential points of contamination. Make predictions of possible outcomes. Provide a standard operating procedure to mitigate contamination opportunities. Demonstrate the operating procedure.	

Competencies: 7.7.4	
7.7.4. Assess a facility's biosecurity, classify the level of risk and recommend improvements. LEVEL 3	
DOK LEVEL 1 What are some examples of biosecurity risks?	DOK LEVEL 2 After a visit to a processing facility, create a list of five biosecurity risks. What actions could be taken to address each risk?
DOK LEVEL 3 What biosecurity procedures were already in place at the processing facility? Make recommendations on how to improve the biosecurity procedures. Give evidence to support your findings.	DOK LEVEL 4 Create a Standard Operating Procedure (SOP) for a duty performed at the processing facility. Include all necessary PPE and associated costs to implement the new SOP. Describe and provide evidence of how the new procedure improves the existing biosecurity procedure. Arrange a time to present the SOP to the facility's site manager.

Competencies: 7.7.6-7.7.7	
7.7.6. Screen and test animals and plant products for infectious agents or contamination. LEVEL 3	
7.7.7. Select bio-containment practices (e.g., quarantine, eradicate, showering into facilities) to manage pests and diseases. LEVEL 3	
DOK LEVEL 1	DOK LEVEL 2 Identify ways of screening and testing animal and plant products for infectious agents or contamination.
DOK LEVEL 3 Evaluate and determine the best bio-containment practices for egg producing chickens on a small farm. How would you adapt your findings to a large scale commercial facility? Provide supporting evidence to confirm your findings.	DOK LEVEL 4

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Competencies: 8.1.1-8.1.4	
8.1.1. Compare and contrast organic and inorganic sources of macronutrients and micronutrients. LEVEL 2	
8.1.2. Describe the functions of macronutrients and micronutrients in plants and the role that microorganisms play in plant nutrition. LEVEL 1	
8.1.3. Determine the nutrient requirements of plants. LEVEL 2	
8.1.4. Identify symptoms and causes of plant nutrient deficiencies and toxicities. LEVEL 1	
DOK LEVEL 1 List three macronutrients and five micronutrients.	DOK LEVEL 2 Pick one macronutrient or micronutrient and explain the affect the deficiency will have on the reproductive anatomy.
DOK LEVEL 3 Create a side-by-side study of three plants. Determine and provide the plants perfect cultural requirements. Next remove one macronutrient from two of the plants and analyze the plants ability to perform all physiological functions. Provide weekly evidence to support your predictions.	

Competencies: 8.1.5-8.1.6	
8.1.5. Collect soil and plant tissue for testing and analysis. LEVEL 2	
8.1.6. Analyze and draw conclusions from soil and plant tissue test data. LEVEL 3	
DOK LEVEL 1 Demonstrate the proper way to collect both a soil sample and a tissue sample.	DOK LEVEL 2 Collect soil and plant tissue samples for analysis. Collect data and interpret your findings.
DOK LEVEL 3 Evaluate and predict the yield potential of a given soil.	
Resources: Pre-tested soil with data sheets.	

Competencies: 8.1.7	
8.1.7. Distinguish between biotic and abiotic factors (e.g., minerals, pH, microorganisms) that influence and optimize the availability of nutrients for plants. LEVEL 2	
DOK LEVEL 1 Provide one example for both abiotic and biotic factors that affect plant nutrition.	DOK LEVEL 2 Explain the affects of both biotic and abiotic factors on plant health.

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Competencies: 8.1.8-8.1.10	
8.1.8. Calculate nutrient requirements and select nutrient sources and additives for optimum economic return. LEVEL 2	
8.1.9. Determine the nutrient content of organic and inorganic fertilizers. LEVEL 1	
8.1.10. Select the methods and time of nutrient application and apply nutrients. LEVEL 3	
DOK LEVEL 1 What is the difference between organic and inorganic fertilizer?	DOK LEVEL 2 When would you use inorganic fertilizer instead of organic fertilizer? Explain why.
DOK LEVEL 3 Select and apply nutrients with appropriate method and times for a given crop to produce optimum economic return. Supply that supports your selection and application methods.	

Competencies: 8.2.1-8.2.3	
8.2.1. Identify the reproductive anatomy of plants and describe their physiological functions. LEVEL 1	
8.2.2. Describe how biotic and abiotic factors (e.g., insects, light, temperature, microorganisms, moisture, location) influence and optimize plant reproduction. LEVEL 1	
8.2.3. Compare and contrast variations of plant reproductive systems among plant species. LEVEL 2	
DOK LEVEL 1 Fill in the blanks on the diagram with the given plant reproductive terms. (Teacher will provide a diagram to the students)	DOK LEVEL 2 Describe the physiological functions of each of the reproductive parts of a plant. Explain how biotic and abiotic factors influence plant reproduction.
DOK LEVEL 3 Use both biotic and abiotic measures to influence optimum plant reproduction. Show supporting evidence to rationalize selected practices.	

Competencies: 8.2.4-8.2.6	
8.2.4. Select seeds and seed stock for desired traits. LEVEL 2	
8.2.5. Select and apply methods that create desired traits in seeds. LEVEL 3	
8.2.6. Select and apply all methods of asexual plant propagation for desired traits (e.g., grafting, layering, cutting, cloning). LEVEL 3	
DOK LEVEL 1 List four desirable traits in greenhouse grown crops.	DOK LEVEL 2 List four methods of asexual plant propagation and describe each of them.
DOK LEVEL 3 Select seed stock with desired traits. Provide cultural conditions to produce a seed variety with desired traits. Predict the outcome and provide evidence to rationalize your choices.	

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Competencies: 8.3.1	
8.3.1. Identify and classify insect, weed, disease and animal pests. LEVEL 1	
DOK LEVEL 1 List five insects, weeds, and diseases that require control measures.	DOK LEVEL 2 Pick five common greenhouse insects or diseases and provide the proper IPM steps or organic management tool to mitigate the effects of the chosen pests and diseases.

Competencies: 8.3.2-8.3.3	
8.3.2. Examine the interrelationships among plants, pests, humans, and the environment. LEVEL 1	
8.3.3. Analyze and calculate the economic threshold of pest damage. LEVEL 2	
DOK LEVEL 1 Describe the interrelationship between plants, pests, humans, and the environment.	DOK LEVEL 2 Analyze and calculate the economic threshold of pest damage.
DOK LEVEL 3 Explain some factors that can limit pest damage to an acceptable level while ensuring maximum economic potential. Provide evidence to support your claims.	

Competencies: 8.3.4-8.3.5, 8.3.7-8.3.8	
8.3.4. Determine and implement pest management safety practices (e.g., safety data sheets [SDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA], personal protective equipment [PPE], worker protection standards [WPS], refuge management strategy). LEVEL 3	
8.3.5. Evaluate the effectiveness of a pest management plan. LEVEL 3	
8.3.7. Describe the types and functions of biological and mechanical control methods. LEVEL 1	
8.3.8. Describe the types and functions of chemical pesticide control measures. LEVEL 1	
DOK LEVEL 1 Describe two instances of genetic adaption and modification that have led to fungal, bacterial, and insect resistance in plants.	DOK LEVEL 2 Describe the similarities and difference between biological, mechanical, and chemical control methods. Organize your information in a chart.
DOK LEVEL 3 After studying and discussing pest management safety practices, have students select a pest management system from the internet. Next, have the students evaluate the effectiveness of a pest management system. Students should provide evidence as to why the pest management system is effective or not. Finally, students will present the findings to the class.	

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Competencies: 8.3.9-8.3.11	
8.3.9. Develop an IPM plan, based on pest life cycles, available treatments, application methods and the impact on the environment. LEVEL 3	
8.3.10. Select application methods and implement an IPM plan. LEVEL 3	
8.3.11. Evaluate IPM plans and applications for their impact on the environment and their effectiveness. LEVEL 3	
DOK LEVEL 1 Define IPM.	DOK LEVEL 2 Give an example of an IPM plan for an organic, indoor lettuce producing facility.
DOK LEVEL 3 Determine what IPM plans will have the minimum environmental impact on a tomato field next to a small stream. Explain the effectiveness.	DOK LEVEL 4 Determine what IPM plan will have the minimum environmental impact on a tomato field next to a small stream. Apply your IPM plan and measure the effectiveness while monitoring the environmental impact on the local fauna. Rationalize your action plan and share your findings. Or Contact a local vegetable producing facility. Inquire as to what IPM plan is utilized and request a copy of the plan. Evaluate the plan and determine the plan's effectiveness and also determine what the impact is on the local environment. Share your findings with the vegetable producing facility.

Competencies: 8.4.1-8.4.3	
8.4.1. Identify and classify plants using taxonomy. LEVEL 1	
8.4.2. Identify plant anatomical structures and tissues. LEVEL 1	
8.4.3. Identify and classify seeds and plants at all stages of growth. LEVEL 1	
DOK LEVEL 1 Using taxonomy, identify and classify the given plants.	DOK LEVEL 2 Label and classify all given plants based on anatomical structure, seeds, and tissue at all stages of growth. Organize your data in a chart.

Competencies: 8.4.4-8.4.5, 8.4.16	
8.4.4. Explain requirements necessary for photosynthesis to occur and identify the products and byproducts of photosynthesis. LEVEL 2	
8.4.5. Understand aerobic respiration and its relationship to plant growth and management. LEVEL 2	
8.4.16. Explain the process and importance of transpiration in plant growth and development. LEVEL 2	
DOK LEVEL 1 Define photosynthesis. How does photosynthesis affect our daily lives?	DOK LEVEL 2 How does photosynthesis affect plant growth and development? Please explain your answer in detail and provide examples.
DOK LEVEL 3 Create a poster that illustrates all concepts of photosynthesis. Label all components. Provide supporting evidence to justify your reasoning.	

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Competencies: 8.4.6 8.4.6. Identify the principles of primary and secondary plant growth. LEVEL 1	
DOK LEVEL 1 What is primary growth? What is secondary growth?	DOK LEVEL 2 Contrast and compare primary and secondary plant growth. Organize your information in the provided graphic organizer.
DOK LEVEL 3 Demonstrate how you could dissect primary and secondary growth from a mature woody tree. Provide justification for your reasoning.	

Competencies: 8.4.7-8.4.8, 8.4.14 8.4.7. Identify the plant responses to plant growth regulators and different forms of tropism. LEVEL 1 8.4.8. Understand the influence of environmental factors on plant growth, development, and maintenance. LEVEL 2 8.4.14. Control plant growth through mechanical and chemical means. LEVEL 2	
DOK LEVEL 1 What is a plant growth regulator (PGR)? What does this process do to plant life?	DOK LEVEL 2 Identify the causes and effects of PGRs and environmental factors on plant growth, development, and maintenance control growth through chemical and mechanical means. Organize your information in the graphic organizer provided. What one question do you still have regarding this activity?
DOK LEVEL 3 Set up an experiment that manipulates plant growth, germination, and development. Analyze your findings, draw a conclusion, and provide supporting evidence. Present your findings to the class. Apply three forms of tropism to an assigned plant and determine which is most effective to create the desired characteristics. Verify the reasonableness of your responses.	

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Competencies: 8.4.9-8.4.13	
8.4.9. Manipulate natural and artificial factors to influence plant germination, growth, and development. LEVEL 3	
8.4.10. Select, evaluate, and prepare soil or media for planting. LEVEL 2	
8.4.11. Understand and evaluate the process by which plants are selected. LEVEL 3	
8.4.12. Evaluate and implement planting practices (e.g., population rate, germination, seed vigor, inoculation, seed and plant treatments, type of planter, cuttings, pot in pot). LEVEL 3	
8.4.13. Evaluate and implement transplanting practices. LEVEL 3	
DOK LEVEL 1 Describe ways of planting that involves various soil media. Name five different growing medias. Next list the origin and makeup of each.	DOK LEVEL 2 Identify types of soil that would be used for given plants. Compare and contrast what these soils would increase and decrease in plant health. Select and evaluate the soil and growing media for a given plant.
DOK LEVEL 3 Based on the pre-selected soils and media, select and evaluate the proper plant for each cultural condition to be transplanted. Organize your information in a chart with supporting evidence. Present your findings to the class.	

Competencies: 8.4.15	
8.4.15. Analyze plant water requirements and provide water through artificial or natural means. LEVEL 2	
DOK LEVEL 1 Explain the difference between artificial and natural means. Describe three different irrigation/watering methods for each growing method.	DOK LEVEL 2 While using multiple watering techniques, explain how water affects plant health and plant growth. While using multiple watering techniques, explain the function of water in plants.
DOK LEVEL 3 Using an experiment to evaluate water depth, analyze and draw conclusion regarding how plants adapt to dry, moist, and wet soils. Construct an excel spreadsheet to detail your findings. Design and install a watering system that maximizes economic return and plant productivity. Provide supporting data.	

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Competencies: 8.4.17 8.4.17. Recognize plant disease symptoms, prevention, avoidance, and treatments. LEVEL 1	
DOK LEVEL 1 On the diagram provided, match the plant symptom with the disease. What is a symptom? What is a disease?	DOK LEVEL 2 Utilize the proper voidance and preventative treatment techniques for the "x" disease. Students should select three diseases for this activity.
DOK LEVEL 3 Select three diseases. Describe, compare, and contrast proper cultural or chemical applications to prevent or cure symptoms and diseases. Locate three plants that appear to have a plant disease. ID the plant disease on each plant and determine the best action to take. Perform the action for each plant.	

Competencies: 8.5.1 8.5.1. Identify characteristics of grains, seeds, vegetables, fruits and ornamental plants that indicate crop maturity. LEVEL 1	
DOK LEVEL 1 Provide one characteristic of maturity for each of the following: grains, seeds, vegetables, fruits, and ornamental crops.	DOK LEVEL 2 Enter the greenhouse and tag two of each of the following: lettuces for harvest and cut flowers.
Notes: This is an ongoing standard that is learned year round or in separate pieces.	

Competencies: 8.5.2 8.5.2. Describe safety precautions to take when harvesting. LEVEL 1	
DOK LEVEL 1 What are four ways of harvesting crops? What PPEs would you use with each of the four ways listed above?	DOK LEVEL 2 Demonstrate safety precautions you would take for specific harvesting methods. Apply actual harvesting techniques in the field in a safe way using all PPE requirements.
DOK LEVEL 3 After applying the actual harvesting techniques in the field using all PPE requirements, verify the reasonableness of the process you implemented versus the other ways to harvest crops. Present your findings to the class.	

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<p>Competencies: 8.5.7, 8.5.10</p> <p>8.5.7. Identify harvesting methods and harvesting equipment. LEVEL 1</p> <p>8.5.10. Implement non-mechanized harvesting techniques. LEVEL 2</p>	
<p>DOK LEVEL 1</p> <p>Match the method of harvesting with the equipment used to successfully harvest a land filled with crops.</p>	<p>DOK LEVEL 2</p> <p>Specify and explain the purpose of pre and post checks on harvesting machinery techniques.</p> <p>Determine the best practice for harvesting the given crops with non-mechanized techniques.</p>
<p>DOK LEVEL 3</p> <p>Operate heavy machinery in a cautious way while implementing harvesting techniques.</p> <p>Harvest crops via non-mechanized means. Afterwards, determine the advantages to crop health, soil health, and overall cost. Provide evidence to support your claims.</p>	

<p>Competencies: 8.5.1, 8.5.8</p> <p>8.5.1. Identify characteristics of grains, seeds, vegetables, fruits and ornamental plants that indicate crop maturity. LEVEL 1</p> <p>8.5.8. Assess the stage of growth to determine the maturity and salability of grains, seeds, vegetables, fruits, and ornamental plants. LEVEL 2</p>	
<p>DOK LEVEL 1</p> <p>Label each vegetable seed as it sits.</p> <p>What will these seeds look like after they mature?</p>	<p>DOK LEVEL 2</p> <p>At each station, identify and determine the stage of maturity of the given crop.</p>
<p>DOK LEVEL 3</p> <p>Part One: Select three different types of seeds. Complete a cycle project on each one that begins with the seed and ends with maturity. Label all aspects of the cycle and explain the changes in each stage of the cycle.</p> <p>Part Two: Complete an analysis comparing the different stages of the cycle with all three types of seeds. Chart your findings. Present your findings to the class.</p>	

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Greenhouse and Nursery Management 010610
Bryan Ellis, Toledo Public Schools and Bryan Smith, Sylvania Schools**

<p>Competencies: 8.5.3, 8.5.6, 8.5.11, 8.6.4</p> <p>8.5.3. Adjust to environmental conditions to enhance the harvesting of plant products. LEVEL 2</p> <p>8.5.6. Evaluate the impact of harvest techniques on the quality of plants and plant products. LEVEL 3</p> <p>8.5.11. Evaluate crop yield and loss data. LEVEL 3</p> <p>8.6.4. Calculate potential yield and loss due to processing and storage. LEVEL 2</p>	
<p>DOK LEVEL 1 Define the term “environmental conditions.”</p> <p>What is a yield?</p> <p>What is loss potential?</p> <p>Describe perfect harvesting conditions for the following crops: (teacher choice).</p>	<p>DOK LEVEL 2 If a crop experiences a 40% loss through the year, what is your growing yield?</p> <p>Predict cost savings by taking evasive actions to protect a crop.</p>
<p>DOK LEVEL 3 Part One: In a given plot, calculate yield and loss potential based on the given environmental conditions. Next, evaluate loss potential versus gains. Afterwards, verify the reasonableness of your results. Part Two: Compare your calculation with that of a classmate’s calculation. The two of you should determine whose calculation is the most accurate based on the verification that you each provided.</p>	

<p>Competencies: 8.5.4-8.5.5, 8.5.12</p> <p>8.5.4. Evaluate techniques to maximize yield through mechanical or hand harvesting methods. LEVEL 3</p> <p>8.5.5. Calculate potential yield and loss due to harvesting. LEVEL 2</p> <p>8.5.12. Implement management practices to reduce loss. LEVEL 3</p>	
<p>DOK LEVEL 1 What are the most popular mechanical harvesting methods?</p>	<p>DOK LEVEL 2 Compare and contrast mechanical versus hand harvesting techniques that maximize yield for three different crops.</p>
<p>DOK LEVEL 3 Select a given crop. Explain which management practices will ensure highest yield/minimum loss. Determine whether mechanical or hand harvesting practices will maximize yield and minimize loss. Support your rationale.</p>	<p>DOK LEVEL 4 Select two of the given crops. Explain which management practices will ensure highest yield/minimum loss. Organize your findings in a chart and create an implementation plan specific to these two crops. Invite local farmers to the school and share your plan with the farmers. Collect feedback from the farmers regarding your plan. Ask them what changes should be made from their perspective. Reflect on the changes, and revise your plan as needed.</p>

**Agricultural and Environmental Systems
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Competencies: 8.6.1, 8.6.3	
8.6.1. Describe safety precautions in handling and storage practices. LEVEL 1	
8.6.2. Adjust to environmental conditions to enhance the handling and storage of plant products. LEVEL 3	
8.6.3. Apply harvesting, handling, and storage techniques to minimize loss and maximize economic return. LEVEL 2	
DOK LEVEL 1 Give an example of a safety precautions while handling and storing plants.	DOK LEVEL 2 While demonstrating safety precautions, apply harvesting, handling, and storage techniques to minimize loss.
DOK LEVEL 3 Given four plant products and several environmental condition scenarios, explain how you would adjust to each of the environmental conditions to enhance the handling and storage of plant products. Organize your work in a chart with the following descriptors: <ul style="list-style-type: none"> • Environmental Condition Scenario • Adjustments needed for enhancement • Type of plant products handled and stored • Supporting evidence 	DOK LEVEL 4

Competencies: 8.6.5, 8.6.8	
8.6.5. Explain the proper conditions to maintain the quality of plants and plant products held in storage. LEVEL 2	
8.6.8. Identify storage methods for plants and plant products. LEVEL 1	
DOK LEVEL 1 List five storage methods used for plant storage.	DOK LEVEL 2 Contrast and compare proper plant storage conditions that help maintains resale quality. Use the graphic organizer provided to organize your responses.
DOK LEVEL 3 Part One: Organize areas that hold plants to minimize loss and contribute profitable return to the organization. Part Two: Develop a plan to share with an organization for the storage methods of the plants to maintain plant quality to minimize loss and contribute profitable return. Part Three: Organize your plan in a brochure.	

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Competencies: 8.6.6	
8.6.6. Maintain and enhance the quality of plant products through the manipulation of handling and storage techniques (e.g., temperature, humidity, retardants, light, chemicals, contamination). LEVEL 3	
DOK LEVEL 1 List some plant handling techniques. List some plant storage techniques.	DOK LEVEL 2 What steps are needed to enhance plant product quality through manipulation of handling and storage techniques?
DOK LEVEL 3 What manipulative practices should be used to maintain the quality of fresh cut flowers? Develop a plan that also is suitable for mixed, organic, leafy greens to minimize labor and time. Provide evidence.	DOK LEVEL 4 Using one walk-in cooler, determine temperature, humidity, light, and what chemicals are best suited to maintain and enhance the marketability of one tree, flower, and edible variety. Document your predictions, then create the environment. Present your findings to the class via a multi-media presentation.

Competencies: 8.6.7, 8.6.9, 8.6.10	
8.6.7. Prepare products for sale, transportation, and storage. LEVEL 2	
8.6.9. Monitor environmental conditions in storage facilities for plants and plant products. LEVEL 2	
8.6.10. Explain the reasons for preparing plants and plant products for distribution. LEVEL 1	
DOK LEVEL 1 How do you prepare plants for transportation?	DOK LEVEL 2 Determine what the 50% mark up will be on all plant materials given the sale price.
DOK LEVEL 3 Using cost analysis techniques, prepare three different plant products for sale, transportation, and storage. Verify the reasonableness of your results.	

Competencies: 8.6.11	
8.6.11. Implement and evaluate techniques for grading, handling, packaging and loading plants and plant products for distribution or transportation. LEVEL 3	
DOK LEVEL 1	DOK LEVEL 2 List and describe techniques for grading, handling, packaging, and loading plant products for distribution.
DOK LEVEL 3 Design a multipurpose package for distributing ripe, unripe, large and small fruit. Explain how the packaging will work for multiple grades of product.	DOK LEVEL 4 Design a multipurpose package for distributing ripe, unripe, large and small fruit. Explain how the packaging will work for multiple grades of products. Then, build a prototype of your multipurpose package and ship produce to yourself in you the multipurpose package that you created. Explain similarities in your prototype to available industry products. Determine the benefits and disadvantages of your prototype once your package returns.