

Plant Growing Methods Curriculum



Every effort has been made to trace the ownership of copyrighted material and to make full acknowledgement of its use. If errors or omissions have occurred, they will be corrected in subsequent editions, provided that notification is submitted in writing to the publisher.



© 2025 Realityworks, Inc. All rights reserved.

2709 Mondovi Road
Eau Claire, WI 54701 USA
800.830.1416
+1.715.830.2040
www.realityworks.com

1072405-01

Table of Contents

Table of Contents	3
Author	4
Curriculum Structure	4
Lesson Structure	5
Lesson One – Seed Germination	6
FOCUS: Introduction to Seed Germination	7
LEARN: Seed Germination Observation	13
REVIEW: Seed Germination Analysis	14
Sources	19
Lesson Two – Container Gardening	20
FOCUS: Introduction to Container Gardening	21
LEARN: Hands-On Container Gardening	22
REVIEW: Reflecting on Container Gardening	24
Sources	25
Lesson Three – Vertical Gardening	26
FOCUS: Introduction to Vertical Gardening	27
LEARN: Designing a Vertical Garden	28
REVIEW: Reflecting on Vertical Gardening	30
Sources	31
Lesson Four – Raised Bed Gardening	32
FOCUS: Introduction to Raised Bed Gardening	34
LEARN: Designing and Building a Raised Garden Bed	35
REVIEW: Reflecting on Raised Bed Gardening	37
Sources	39
Lesson Five – Career Exploration	40
FOCUS: Introduction to Horticulture Careers	41
LEARN: Career Exploration and Research	43
REVIEW: Reflection and Career Discussion	44
Sources	45
Summative Assessment	46
Summative Assessment – Answer Key	50

The purpose of the Plant Growing Methods Lab Kit and its accompanying curriculum is to provide students with an engaging, hands-on approach to learning about seed germination as well as container, vertical, and raised bed gardening. The kit aims to foster an understanding of diverse plant cultivation techniques while inspiring students to explore potential careers in agriculture, horticulture, and environmental sciences.

Author



Nicole Forsyth Gosselin is a plant science instructor at Norfolk County Agricultural High School in Walpole, MA. Her extensive academic and professional background underscores her deep commitment to advancing plant science education.

Forsyth Gosselin earned her A.S. in Landscape Contracting from the Stockbridge School of Agriculture, followed by a B.S. in Environmental Design and Horticulture and an M.S. in Regional Planning with a focus on Landscape and Environmental Planning, both from the University of Massachusetts, Amherst. Additionally, she holds an M.S. in Education with a specialization in Curriculum and Planning from Fitchburg State University.

Forsyth Gosselin's credentials include numerous industry certifications, such as Massachusetts Certified Arborist, Massachusetts Certified Horticulturist, Massachusetts Certified Landscape Professional, International Society of Arboriculture Tree Risk Assessment Qualification, a 2A Hoisting Engineer's License, and a Pesticides Core Applicator License. She is also licensed as a Professional Horticulture Teacher through the Massachusetts Department of Elementary and Secondary Education.

Since 2012, Forsyth Gosselin has worked as a Landscape Designer, Horticulturist, and Arborist, bringing practical field experience to her instructional methods. In 2015, she transitioned to teaching and has since inspired countless students to pursue careers in plant science and related industries.

Curriculum Structure

The *Plant Growing Methods Curriculum* is composed of the following lessons. Approximate lesson times are included.

Lesson	Title	Approximate Time
One	Seed Germination	100 minutes
Two	Container Gardening	60-95 minutes
Three	Vertical Gardening	65 minutes
Four	Raised Bed Gardening	80-95 minutes
Five	Career Exploration	50 minutes
	Total	5-7 hours

Lesson Structure

Each lesson begins with a Lesson Overview, Lesson Objectives, and a Lesson at a Glance table, which lists lesson activities, materials required, suggested preparation steps and approximate class time.

Lesson Sections

The actual lesson follows the overview, which contains the sections described below.

FOCUS

Every lesson begins with a FOCUS activity intended to capture participants' attention. This may be in the form of a small or large class discussion, game, demonstration, or review of previous lesson information. During this activity, participants are introduced to the topic of the lesson.

LEARN

The LEARN activity in each lesson varies in its presentation mode. It may be a slide presentation, group activity, or demonstration.

REVIEW

The majority of lessons end with a REVIEW activity intended to briefly review the lesson's key messages or main points.

Lesson One – Seed Germination

Lesson Overview

The lesson provides a hands-on approach to learning the biological processes and practical applications of seed germination, emphasizing pollinator plants' ecological and agricultural importance.

Lesson Objectives

After completing this lesson, participants will be able to:

- Explain the process of seed germination
- Demonstrate germination techniques
- Analyze experimental results
- Understand the importance of pollinator plants
- Apply practical skills
- Connect science to sustainability

Lesson at a Glance

Activity	Materials	Preparation	Approximate Class Time
FOCUS	• Pollinator seed mix • Gallon resealable bags • Reusable paper towels • Permanent markers • Plant Growing Methods Lab Workbook • <i>Lesson 1</i> slide presentation • <i>Seed Germination Quiz</i> • <i>Seed Germination Quiz – Answer Key</i>	1. Print/photocopy the <i>Seed Germination Introduction</i> and <i>Seed Germination Setup Instructions</i> from the lab workbook (one of each per participant). 2. Prepare the <i>Lesson 1</i> slide presentation for viewing. 3. Prepare seed germination materials for distribution. 4. Print/photocopy the <i>Seed Germination Quiz</i>. 5. Reference the quiz answer key.	35 minutes
LEARN	• Seed germination trays • Potting soil • Spray bottles (filled with water) • Rulers • Lab journals • Plant Growing Methods Lab Workbook • Light source (natural light or grow lights)	1. Print/photocopy the <i>Seed Observation and Data Collection</i> and <i>Stages of Germination Reference</i> from the lab workbook (one of each per participant). 2. Prepare seed germination materials for distribution.	35 minutes
REVIEW	• Completed <i>Seed Observation and Data Collection</i> • Plant Growing Methods Lab Workbook • <i>Seed Germination Assessment</i> • <i>Seed Germination Assessment – Answer Key</i> • Visual aids (optional) • Wastebasket for discarding old materials or waste from the setup	1. Obtain an empty wastebasket for discarded materials. 2. Print/photocopy the <i>Seed Germination Analysis Questions</i> from the lab workbook (one per participant). 3. Print/photocopy the <i>Seed Germination Assessment</i> (one per participant). 4. Access the assessment and quiz answer keys	30 minutes

Lesson One – Seed Germination

FOCUS: Introduction to Seed Germination

35 minutes

Purpose:

The purpose of this activity is to introduce students to the basic principles of seed germination and familiarize them with the tools and materials used for germination experiments.

Students will gain hands-on experience in setting up a simple germination experiment while learning about the importance of proper conditions for seed growth.

Materials:

- Pollinator seed mix
- Gallon resealable bags
- Reusable paper towels
- Permanent markers
- Plant Growing Methods Lab Workbook
- *Lesson 1* slide presentation
- *Seed Germination Quiz*
- *Seed Germination Quiz – Answer Key*

Facilitation Steps:

1. Distribute Materials (2 minutes): Give each participant a gallon resealable bag, reusable paper towels, pollinator seed mix, a permanent marker, the *Seed Germination Introduction*, and the *Seed Germination Setup Instructions*.
2. Introduction to Seed Germination (15 minutes): Use the *Lesson 1* slide presentation to briefly explain the seed germination process, focusing on the stages of germination: imbibition, activation, radicle emergence, and shoot development.

Slide 1: Seed Germination Overview

Slide 2: What is Seed Germination?

Seed germination is the process by which a seed transforms into a new plant under specific conditions. It marks the beginning of a plant's life cycle.

Slides 3: Stages of Seed Germination

Slide 4: Imbibition

Water absorption causes the seed to swell, activates enzymes, and prepares the seed for growth.

Slide 5: Activation

Enzymes break down stored nutrients for the growing embryo. Energy release begins the metabolic processes.

Slide 6: Radicle Emergence

The first root breaks through the seed coat and anchors the plant and absorbs water/nutrients.

Slide 7: Shoot Development

The stem grows upward, and leaves begin to form. This enables photosynthesis.

Slides 8-9: Essential Conditions for Germination

Water: Triggers imbibition and activates enzyme

Oxygen: Required for cellular respiration

Temperature: Each seed type has an optimal temperature range

Light: Some seeds need light to germinate; others need darkness

Slide 10: Why Germination Matters

Germination is relevant to agriculture, gardening, and environmental science. Discuss the importance of the correct conditions (water, oxygen, temperature, and light) for successful germination, with particular emphasis on pollinator plants' role in ecosystems.

3. Review of Materials and Setup (3 minutes): Walk students through the setup instructions.
 - a. Moisten a paper towel and place it inside the resealable bag.

- b. Sprinkle seeds from the pollinator seed mix on the paper towel and seal the bag.
 - c. Label the bag with a permanent marker and have students set up their experiment (5 minutes).
 - d. Have students follow the *Seed Germination Setup Instructions* to complete their experiment.
 - e. Ask students to record their observations on the *Seed Germination Introduction*, which includes space for the date, seed type, and setup notes.
4. Wrap-up and Instructions for Next Steps (10 minutes): Briefly review what students have done, emphasizing the importance of observing the germination process over the

following days. Have students complete the *Seed Germination Quiz*.

Remind students to place their setup in a location with appropriate temperature and light for the seeds to germinate.

Name: _____ Class: _____

Seed Germination Quiz

Purpose: This assessment evaluates your understanding of seed germination, the factors affecting germination, and the process of setting up and observing a germination experiment.

Part 1: Multiple Choice (1 point each)

1. Which of the following is the first step in the seed germination process?
 - a. Root development
 - b. Seed coat breaking
 - c. Imbibition (absorption of water)
 - d. Shoot emergence
2. What factor is NOT required for seed germination?
 - a. Water
 - b. Oxygen
 - c. Soil
 - d. Temperature
3. What does the radicle do during germination?
 - a. Grows into the soil to anchor the plant
 - b. Develops into leaves
 - c. Absorbs sunlight for photosynthesis
 - d. Sprouts into flowers
4. Which of the following statements about pollinator plants is true?
 - a. They are necessary for seed germination to occur
 - b. They attract insects that help in pollination
 - c. They inhibit seed germination by blocking light
 - d. They only grow in warm climates

Part 2: Short Answer (2 points each)

5. What are the four main factors that affect seed germination?

6. Why is it important to keep the paper towel moist when conducting a seed germination experiment?

7. What is the role of pollinator plants in agriculture or the environment?

Part 3: True or False (1 point each)

8. True or False: Seeds can germinate without water.
9. True or False: All seeds require light to germinate.
10. True or False: Temperature is an important factor for the germination of most seeds.

Part 4: Application/Observation (3 points)

11. Describe what you would do if you observed that your seed germination setup is too dry. How would you correct it?

Total Possible Points: 15

Seed Germination Quiz – Answer Key

Purpose: This assessment evaluates your understanding of seed germination, the factors affecting germination, and the process of setting up and observing a germination experiment.

Part 1: Multiple Choice (1 point each)

1. Which of the following is the first step in the seed germination process?
 - a. Root development
 - b. Seed coat breaking
 - c. Imbibition (absorption of water)**
 - d. Shoot emergence
2. What factor is NOT required for seed germination?
 - a. Water
 - b. Oxygen
 - c. Soil**
 - d. Temperature
3. What does the radicle do during germination?
 - a. Grows into the soil to anchor the plant**
 - b. Develops into leaves
 - c. Absorbs sunlight for photosynthesis
 - d. Sprouts into flowers
4. Which of the following statements about pollinator plants is true?
 - a. They are necessary for seed germination to occur
 - b. They attract insects that help in pollination**
 - c. They inhibit seed germination by blocking light
 - d. They only grow in warm climates

Part 2: Short Answer (2 points each)

5. What are the four main factors that affect seed germination?
Water, oxygen, temperature, and light (for some seeds)
6. Why is it important to keep the paper towel moist when conducting a seed germination experiment?
Moisture is necessary for seeds to absorb water, which triggers the germination process. Without enough moisture, the seeds cannot sprout.
7. What is the role of pollinator plants in agriculture or the environment?
Pollinator plants attract insects, like bees and butterflies, that aid in pollination, supporting biodiversity and increasing crop yields.

Part 3: True or False (1 point each)

11. True or **False**: Seeds can germinate without water.
12. True or **False**: All seeds require light to germinate.
13. **True** or False: Temperature is an important factor for the germination of most seeds.

Part 4: Application/Observation (3 points)

12. Describe what you would do if you observed that your seed germination setup is too dry. How would you correct it?

If the setup is too dry, I would add a small amount of water to re-moisten the paper towel, ensuring it is damp but not soaking wet. I would also check that the resealable bag is properly sealed to retain moisture.

Total Possible Points: 15

Lesson One – Seed Germination

LEARN: Seed Germination Observation

35 minutes

Purpose:

The purpose of this activity is to deepen students' understanding of seed germination by exploring the germination process in greater detail. Students will analyze the stages of germination, set up a controlled germination experiment using soil and trays, and learn how to record and analyze data on seedling development.

Materials:

- Seed germination trays
- Potting soil
- Spray bottles (filled with water)
- Rulers
- Lab journals
- Light source (natural light or grow lights)
- Plant Growing Methods Lab Workbook

Facilitation Steps:

1. Establish a Pollinator Plant Connection (10 minutes): Highlight the ecological importance of pollinator plants and their role in supporting biodiversity and food production. Provide examples of pollinator-friendly plants and how they contribute to ecosystems.
2. Distribute Materials (2 minutes): Make sure each has a seed germination tray, potting soil, seeds from the pollinator mix, ruler, and printed *Seed Observation Data* worksheet.
3. Demonstrate the Setup Process (3 minutes): Fill the tray with potting soil, ensuring an even layer, and gently plant seeds according to the instructions on the *Stages of Germination Reference* (spacing, depth). Lightly spray the soil with water using the spray bottle.

4. Hands-On Activity (10 minutes): Guide students as they replicate the demonstration, planting their seeds in germination trays.

Assist students in labeling their trays with their name, date, and seed type for identification. Instruct them to place their trays under the light source, ensuring conditions match the requirements for germination.

5. Data Collection and Observation (5 minutes): Explain how to use the *Seed Observation Data* worksheet. Record the date, observations of seed changes, and measurements of seedling growth using the ruler.

Students should make daily notes in their lab journals to track progress over the next week. Discuss the importance of systematic observation and how it relates to careers in agriculture, horticulture, and environmental science.

6. Wrap-up and Next Steps (5 minutes): Recap the stages of germination and key conditions discussed earlier. Instruct students to monitor their seeds daily and update their observation worksheets.

Remind students to ensure the soil remains moist and the trays are exposed to appropriate light conditions.

Lesson One – Seed Germination

REVIEW: Seed Germination Analysis

30 minutes

Purpose:

The purpose of this section is to guide students in analyzing and reflecting on the results of their seed germination experiment. By reviewing their data, discussing observations, and answering analysis questions, students will deepen their understanding of the germination process and its implications.

Materials:

- Completed *Seed Observation Data* worksheet
- Plant Growing Methods Lab Workbook
- *Seed Germination Assessment*
- *Seed Germination Assessment* – Answer Key
- Visual aids (optional)
- Wastebasket for discarding old materials or waste from the setup

Facilitation Steps:

1. Obtain visual aids (optional), such as charts, graphs, or images of germination stages for comparison. These can help students better understand their findings in context of typical outcomes
2. Introduction to Analysis (5 Minutes): Begin by discussing the importance of analyzing data in scientific experiments. Explain that their observations will help determine the success of their germination experiment and provide insights into the factors that influenced their results.
3. Data Sharing and Comparison (10 Minutes): Have students revisit their completed lab journals or data sheets, focusing on recorded observations (number of seeds germinated, time taken for radicle emergence, variations in seedling growth rates). Encourage students to look for trends or anomalies.
4. Group Discussion: Divide students into small groups to share and compare their results. Prompt them to discuss questions like:
 - What conditions led to the highest germination success?
 - Were there any seeds that did not germinate, and why might this have happened?
 - How did light, water, and temperature impact their seeds?
5. Reflective Analysis (10 Minutes): Distribute the *Seed Germination Analysis Questions* to each participant. Guide them as they write their responses, ensuring participants draw on specific data and observations to support their answers.
6. Wrap-up and Reflection (5 Minutes): Invite a few students to share their answers to the analysis questions with the class. Highlight key takeaways, such as the importance of environmental conditions and the variability of germination outcomes. Give students the *Seed Germination Assessment*.

Name: _____

Class: _____

Seed Germination Assessment

Instructions: Answer the following questions based on what you have learned about seed germination. Each question is worth one point unless otherwise noted.

Part 1: Multiple Choice (Choose the best answer)

1. What is the first stage of seed germination?
 - a. Photosynthesis
 - b. Radicle emergence
 - c. Imbibition
 - d. Root development
2. Which of the following is *not* a factor required for seed germination?
 - a. Water
 - b. Oxygen
 - c. Fertilizer
 - d. Proper temperature
3. Pollinator plants are important because they:
 - a. Provide shade for crops
 - b. Attract insects and animals that help with pollination
 - c. Increase the amount of soil nutrients available
 - d. Prevent seed germination
4. What is the function of the cotyledon in a seed?
 - a. Absorbs water during imbibition
 - b. Protects the embryo from damage
 - c. Facilitates photosynthesis in mature plants
 - d. Provides stored energy for the seedling

Part 2: True/False

5. True or False: The seed coat must remain intact for the seed to germinate.
6. True or False: Light is always necessary for seeds to germinate.
7. True or False: High temperatures can inhibit seed germination.

Part 3: Short Answer

8. List three factors that influence seed germination.

9. Explain why pollinator plants are important in agriculture.

Part 4: Practical Application (Bonus)

10. (2 points) You are conducting a seed germination experiment using pollinator seeds. You observe that some seeds are not germinating. List two possible reasons why this might happen and suggest a solution for each.

Total Points Possible: 11

Seed Germination Assessment – Answer Key

Instructions: Answer the following questions based on what you have learned about seed germination. Each question is worth one point unless otherwise noted.

Part 1: Multiple Choice (Choose the best answer)

1. What is the first stage of seed germination?
 - a. Photosynthesis
 - b. Radicle emergence
 - c. Imbibition**
 - d. Root development
2. Which of the following is *not* a factor required for seed germination?
 - a. Water
 - b. Oxygen
 - c. Fertilizer**
 - d. Proper temperature
3. Pollinator plants are important because they:
 - a. Provide shade for crops
 - b. Attract insects and animals that help with pollination**
 - c. Increase the amount of soil nutrients available
 - d. Prevent seed germination
4. What is the function of the cotyledon in a seed?
 - a. Absorbs water during imbibition
 - b. Protects the embryo from damage
 - c. Facilitates photosynthesis in mature plants
 - d. Provides stored energy for the seedling**

Part 2: True/False

5. True or **False**: The seed coat must remain intact for the seed to germinate.
6. True or **False**: Light is always necessary for seeds to germinate.
7. **True** or False: High temperatures can inhibit seed germination.

Part 3: Short Answer

8. List three factors that influence seed germination.

Water, oxygen, and proper temperature

9. Explain why pollinator plants are important in agriculture.

Pollinator plants attract insects, like bees and butterflies, which transfer pollen between flowers, enabling fruit and seed production.

Part 4: Practical Application (Bonus)

10. (2 points) You are conducting a seed germination experiment using pollinator seeds. You observe that some seeds are not germinating. List two possible reasons why this might happen and suggest a solution for each.

Reason 1: Seeds are too dry. Solution: Ensure the paper towel or soil remains consistently moist.

Reason 2: Temperature is not optimal. Solution: Move seeds to an area with a more suitable temperature range for germination.

Total Points Possible: 11

Sources

1. Britannica. (n.d.). Germination. *Encyclopedia Britannica*. Retrieved January 1, 2025, from <https://www.britannica.com/science/germination>
2. Burpee Seeds. (n.d.). *Seed starting and growing guide*. Retrieved from <https://www.burpee.com>
3. BYJU'S. (n.d.). Seed germination. *BYJU'S*. Retrieved January 1, 2025, from <https://byjus.com/biology/seed-germination/>
4. Farmers.gov. (2020, October 15). The value of birds and bees in agriculture. *Farmers.gov*. Retrieved January 1, 2025, from <https://www.farmers.gov/blog/value-birds-and-bees>
5. Kaufman, S. R., & Kaufman, W. (2012). *Invasive plants: A guide to identification and the impacts and control of common North American species*. Stackpole Books.
6. LibreTexts. (2020, August 12). Germination. *Biology LibreTexts*. Retrieved January 1, 2025, from [https://bio.libretexts.org/Bookshelves/Botany/Botany %28Ha Morrow and Algiers%29/04%3A Plant Physiology and Regulation/4.06%3A Development/4.6.04%3A Germination](https://bio.libretexts.org/Bookshelves/Botany/Botany_%28Ha_Morrow_and_Algiers%29/04%3A_Plant_Physiology_and_Regulation/4.06%3A_Development/4.6.04%3A_Germination)
7. Missouri Botanical Garden. (n.d.). *Plant Finder*. Retrieved from <https://www.missouribotanicalgarden.org>
8. National Gardening Association. (n.d.). *Seed germination basics*. Retrieved from <https://www.garden.org>
9. Pollinator Partnership. (n.d.). Pollinators. *Pollinator.org*. Retrieved January 1, 2025, from <https://www.pollinator.org/pollinators>
10. Royal Horticultural Society. (n.d.). *Growing sunflowers, zinnias, and other pollinator-friendly plants*. Retrieved from <https://www.rhs.org.uk>
11. U.S. Department of Agriculture. (n.d.). Pollinators. *USDA*. Retrieved January 1, 2025, from <https://www.usda.gov/peoples-garden/pollinators>
12. USDA Forest Service. (2006). *Pollinator plants and their significance*. Retrieved from <https://www.fs.usda.gov>

Lesson Two – Container Gardening

Lesson Overview

This lesson introduces students to the principles and practices of container gardening, a versatile and space-efficient gardening method. Students will learn how to select appropriate containers, soil, plants, and locations to create thriving container gardens. They will also explore the benefits of container gardening, including its role in urban and small-space gardening, ability to improve biodiversity, and applications in horticulture careers.

Lesson Objectives

After completing this lesson, participants will be able to:

- Explain the advantages and challenges of container gardening
- Identify appropriate containers, soil types, and plants for container gardening
- Demonstrate proper planting techniques for container gardens
- Develop and follow a maintenance plan for a container garden
- Evaluate the ecological and practical benefits of container gardening in urban and small-scale settings

Lesson at a Glance

Activity	Materials	Preparation	Approximate Class Time
FOCUS	• Grow bags • Images of container gardens • Whiteboard and markers • Plant Growing Methods Lab Workbook	1. Print the <i>Container Gardening Overview</i> from the lab workbook (one per participant). 2. Gather sample containers and images of container gardens.	10-15 minutes
LEARN	• 20 grow bags • Soil • Compost (optional) • Plants or seeds (easy-to-grow pollinator plants, herbs, vegetables, or flowers) • Tools (hand trowels, gloves, rulers, and watering cans) • Light source • Plant Growing Methods Lab Workbook • <i>Lesson 2</i> slide presentation	1. Print the <i>Container Gardening Setup and Maintenance Guide</i> and <i>Container Gardening Observation and Data</i> worksheets from the lab workbook (one of each per participant). 2. Gather containers, soil, and plants or seeds. 3. Prepare the slide presentation for sharing.	30-60 minutes
REVIEW	• Completed <i>Container Gardening Observation and Data</i> worksheets from students • Whiteboard or chart paper for group discussion notes • Plant Growing Methods Lab Workbook • Visual aids (optional): Examples of healthy container gardens and common issues (e.g., overwatering, poor drainage)	1. Print the <i>Container Gardening Reflection</i> from the lab workbook (one per participant). 2. Have the completed <i>Container Gardening Observation and Data</i> worksheets available. 3. Gather optional visual aids desired	20 minutes

Lesson Two – Container Gardening

FOCUS: Introduction to Container Gardening

10-15 minutes

Purpose:

Spark curiosity and introduce students to the concept of container gardening by highlighting its practical applications, versatility, and benefits. This section sets the stage for hands-on activities and deeper learning by engaging students with real-world examples and interactive discussions.

Materials:

- Containers for planting – grow bags
- Images of container gardens
- Whiteboard and markers
- Plant Growing Methods Lab Workbook

Facilitation Steps:

1. Showcase Diverse Examples (3 minutes): Begin by displaying images of container gardens on a screen or passing them around as printed visuals. Highlight different applications such as:
 - Urban gardening in small spaces
 - Functional gardens for growing herbs and vegetables
 - Decorative arrangements for aesthetic appeal
2. Interactive Discussion (5 minutes): Lead a discussion to explore students' existing knowledge and opinions on container gardening. You may want to ask questions such as:
 - What do you know about gardening in containers?
 - Why might someone choose to garden in a container instead of the ground?
 - Can you think of situations where container gardening would be especially useful?

Write key ideas on the whiteboard to create a collective knowledge base.

3. Access the *Container Gardening Overview* (2 minutes): Distribute *the Container Gardening Overview* to each student. Walk them through the key sections briefly, pointing out:

- The benefits of container gardening, such as portability and suitability for small spaces
- Examples of plants commonly grown in containers
- Basic requirements for success: containers, soil, plants, water, and light

Example Script: "This overview will serve as your guide throughout today's lesson. As we go along, you will see how these principles apply to the container gardens we will create."

4. Wrap-up and Transition: Conclude this section by emphasizing the relevance of container gardening to their lives and potential careers.

Explain that students will learn hands-on skills to design, plant, and care for their own container gardens in the next part of the lesson.

Lesson Two – Container Gardening

LEARN: Hands-On Container Gardening

30 -60 minutes

Purpose:

Provide students with an in-depth understanding of container gardening by teaching essential techniques, demonstrating the setup process, and guiding them through hands-on practice.

This section focuses on the practical skills needed to design, plant, and care for a successful container garden, emphasizing real-world applications and benefits.

Materials:

- 20 containers – grow bags
- Soil
- Compost (optional)
- Plants or seeds (easy-to-grow pollinator plants, herbs, vegetables, or flowers)
- Tools (hand trowels, gloves, rulers, and watering cans)
- Light source
- Plant Growing Methods Lab Workbook
- *Lesson 2* slide presentation

Facilitation Steps:

1. Slide Presentation and Demonstration (10 minutes): Use the *Lesson 2* slides presentation to introduce key concepts:
 - **Container Selection:** Discuss size, material, and drainage requirements. Provide examples of how different containers suit different plants and environments.
 - **Soil Preparation:** Explain the importance of potting soil over garden soil. Demonstrate how to fill a container with soil, ensuring proper aeration and drainage.
 - **Plant or Seed Selection:** Highlight factors such as plant size, light requirements, and growth habits.
 - **Planting Techniques:** Show how to plant seeds or seedlings at the proper depth, spacing, and positioning for optimal growth.

- **Maintenance Basics:** Cover watering, fertilizing, and pruning to ensure healthy growth.

Slide 1: Title Slide

Slide 2: What Is Container Gardening?

Definition: Growing plants in containers instead of directly in the ground

Key Point: Ideal for urban spaces, small yards, and areas with poor soil quality

Slide 3: Benefits of Container Gardening

Slides 4-5: Components

Types: Terracotta pots, hanging baskets, recycled items

Key Feature: Drainage holes to prevent waterlogging

Soil: Use high-quality potting soil, not garden soil. Add compost for enrichment.

Slide 6: Choosing the Right Container

Slide 7: Setting Up Your Container Garden

Slide 8: Maintenance Tips

Slide 9: Common Challenges and Solutions

Slide 10: Real-World Applications

Slide 11: Questions and Discussion

2. Hands-On Practice (15-45 minutes): Distribute materials (containers, soil, seeds/plants, tools). There are 20 containers available in the lab. Give each individual or pair a container.

Assist students in preparing their containers and ensure proper drainage by poking holes, if necessary. Fill the containers with soil, leaving room for plants or seeds.

Have students plant seeds or seedlings, following the depth and spacing guidelines provided on the *Container Gardening Setup and Maintenance Guide*.

Demonstrate proper watering techniques, ensuring the soil is moist, but not soggy. Encourage students to use the *Container Gardening Observation and Data* worksheet to record initial measurements and observations, including plant type, planting date, and container details.

3. **Group Discussion and Real-World Connections (5 minutes):** Facilitate a brief discussion on the real-world applications of container gardening listed below.
 - Urban agriculture and food security
 - Beautification of small spaces and community projects
 - Career paths in horticulture, landscaping, and urban planning

Encourage students to share their thoughts on how they might use container gardening in their own lives or communities.

4. **Wrap-Up and Transition:** Provide students with care instructions for their container gardens and encourage them to observe and document changes over the coming weeks.

Lesson Two – Container Gardening

REVIEW: Reflecting on Container Gardening

20 minutes

Purpose:

Reinforce the key concepts of container gardening, evaluate the success of the activity, and encourage critical thinking about what worked well and what could be improved.

This section helps students connect their observations and experiences to the broader applications of container gardening.

Materials:

- Completed *Container Gardening Observation and Data* worksheets from students
- Whiteboard or chart paper for group discussion notes
- Plant Growing Methods Lab Workbook
- Visual aids (optional): Examples of healthy container gardens and common issues (e.g., overwatering, poor drainage)

Facilitation Steps:

1. Group Discussion (5 Minutes): Ask students to share key observations from their data sheets. You may want to ask questions such as:
 - What trends did you notice in your plants' growth?
 - How did the container type and location impact your results?

Write responses on the whiteboard and encourage students to think critically about the factors influencing their results.

2. Reflection Questions (5 Minutes): Distribute the *Container Gardening Reflection* worksheet from the lab workbook for students to answer individually or in small groups.

These questions are designed to encourage critical thinking and meaningful reflection on the container gardening process and its broader implications.

3. Problem-Solving Activity (5 Minutes): Show students a common container gardening issue, such as wilting plants, stunted growth, or waterlogged soil. Have students brainstorm solutions to the problem based on their knowledge and experience.

Example Questions:

- What steps would you take to improve drainage in this container?
- How would you adjust watering schedules to prevent over- or under-watering?

4. Class Wrap-up (5 Minutes): Highlight the importance of proper container selection, soil, watering, and maintenance for successful container gardening.

Discuss how the skills learned can be applied to urban gardening, environmental projects, or personal hobbies. Suggest additional projects, such as creating pollinator-friendly container gardens or experimenting with different plants.

Sources

1. Britannica. (n.d.). Container gardening. *Encyclopedia Britannica*. Retrieved January 1, 2025, from <https://www.britannica.com/topic/container-gardening>
2. Burpee Seeds. (n.d.). *Seed starting and growing guide*. Retrieved January 1, 2025, from <https://www.burpee.com>
3. Kaufman, S. R., & Kaufman, W. (2012). *Invasive plants: A guide to identification and the impacts and control of common North American species*. Stackpole Books.
4. LibreTexts. (2020, August 12). *Germination*. [Biology LibreTexts](https://bio.libretexts.org/Bookshelves/Botany/Botany_%28Ha_Morrow_and_Algiers%29/04%3A_Plant_Physiology_and_Regulation/4.06%3A_Development/4.6.04%3A_Germination). Retrieved January 1, 2025, from https://bio.libretexts.org/Bookshelves/Botany/Botany_%28Ha_Morrow_and_Algiers%29/04%3A_Plant_Physiology_and_Regulation/4.06%3A_Development/4.6.04%3A_Germination
5. Missouri Botanical Garden. (n.d.). *Plant Finder*. Retrieved January 1, 2025, from <https://www.missouribotanicalgarden.org>
6. National Gardening Association. (n.d.). *Seed germination basics*. Retrieved January 1, 2025, from <https://www.garden.org>
7. Pollinator Partnership. (n.d.). *Creating pollinator habitats*. Pollinator Partnership. Retrieved January 1, 2025, from <https://www.pollinator.org/create-pollinator-garden>
8. Royal Horticultural Society. (n.d.). *Growing sunflowers, zinnias, and other pollinator-friendly plants*. Retrieved January 1, 2025, from <https://www.rhs.org.uk>
9. U.S. Department of Agriculture. (n.d.). *Pollinators*. USDA. Retrieved January 1, 2025, from <https://www.usda.gov/peoples-garden/pollinators>
10. University of Illinois Extension. (n.d.). *Successful container gardens*. University of Illinois Extension. Retrieved January 1, 2025, from <https://extension.illinois.edu/container-gardens>

Lesson Three – Vertical Gardening

Lesson Overview

Vertical gardening is a space-efficient method of growing plants upward using structures like trellises, wall-mounted containers, or hanging systems. This lesson introduces students to the principles, benefits, and applications of vertical gardening. Through hands-on activities, students will design and set up a small vertical gardening system, understand its maintenance, and explore its real-world applications in urban agriculture, sustainability, and decorative landscaping.

Lesson Objectives

After completing this lesson, participants will be able to:

- Define vertical gardening and explain its advantages compared to traditional gardening methods
- Identify suitable plants, materials, and structures for vertical gardening
- Design and set up a small-scale vertical gardening system
- Discuss the maintenance requirements of vertical gardens, including watering and pruning
- Explore the role of vertical gardening in urban settings and sustainability initiatives

Lesson at a Glance

Activity	Materials	Preparation	Approximate Class Time
FOCUS	• Images or examples of vertical gardens • Whiteboard • Markers • Plant Growing Methods Lab Workbook	1. Gather examples of vertical gardens, containers, and/or photos. 2. Print/photocopy the <i>Vertical Gardening Overview</i> from the lab workbook (one per participant).	10 minutes
LEARN	• 10 vertical garden planters with growing cups • Potting soil and compost • Seeds or plants (e.g., herbs, flowers, vegetables suitable for vertical growth) • Watering cans or spray bottles • Gloves and tools (e.g., trowels, scissors) • Plant Growing Methods Lab Workbook • <i>Lesson 3</i> slide presentation	1. Print/photocopy the <i>Vertical Gardening Setup and Maintenance Guide</i> and <i>Stacked Vertical Planter Observation and Data</i> worksheets from the lab workbook (one of each per participant). 2. Prepare the <i>Lesson 3</i> slide presentation for viewing. 3. Prepare vertical garden materials for distribution.	45 minutes
REVIEW	• Completed vertical gardens • Plant Growing Methods Lab Workbook • Whiteboard or chart paper for group notes	1. Facilitate a gallery walk in which students view each other's vertical gardens and share design choices. 2. Print/photocopy the <i>Vertical Gardening Reflection Questions</i> from the lab workbook (one per participant).	10 minutes

Lesson Three – Vertical Gardening

FOCUS: Introduction to Vertical Gardening

10 minutes

Purpose:

Introduce students to the concept of vertical gardening, emphasizing its benefits, applications, and how it differs from traditional gardening. This section sets the stage for hands-on activities by engaging students with real-world examples and interactive discussions.

Materials:

- Images or visual aids: (e.g., photos of trellises, living walls, hanging planters, hydroponic towers)
- Whiteboard and markers
- Plant Growing Methods Lab Workbook
- Optional: Small, potted plant and a vertical support (e.g., stake, trellis) for demonstration

Facilitation Steps:

1. Engage Students with Visuals (3 Minutes): Display images or real-life examples of vertical gardens. Ask students what they notice about the gardens and how the gardens differ from traditional gardening. Allow students to share their initial thoughts.
2. Real-World Applications Group Discussion (4 Minutes): Facilitate a conversation using the guiding questions below.
 - Why might someone choose a vertical garden instead of a traditional one?
 - Where have you seen vertical

gardening used in real life (e.g., cities, restaurants, homes)?

- What benefits do you think vertical gardening might offer for small spaces or urban areas?

Record student responses on the whiteboard.

3. Introduce Key Concepts (3 Minutes): Distribute the *Vertical Gardening Overview* handout from the lab workbook. Walk through the following key points:
 - Definition of vertical gardening
 - Benefits: Space efficiency, improved air quality, decorative appeal, and sustainability
 - Common structures and plant types used in vertical gardening

Allow students to skim the handout and ask any immediate questions.

4. Wrap-up and Transition: Summarize the key ideas discussed. Explain that, in the next section, students will design and build their own small, vertical garden using the principles introduced.

Pose a final question: How might vertical gardening be useful in your own home, school, or community?

Lesson Three – Vertical Gardening

LEARN: Designing a Vertical Garden

45 minutes

Purpose:

Give students hands-on experience designing and building a small-scale vertical garden. Students will learn how to select appropriate plants, structures, and materials while understanding the maintenance requirements of a successful vertical garden.

Materials:

- 10 vertical garden planters with grow cups
- Plants and seeds that are suitable for vertical gardening (e.g., cherry tomatoes, basil, ivy, petunias)
- High-quality potting soil and compost
- Tools (small trowels, gloves, pruning shears)
- Watering equipment (spray bottles or watering cans)
- Support materials (hooks, cable ties, twine)
- Plant Growing Methods Lab Workbook
- *Lesson 3* slide presentation

Facilitation Steps:

1. Present the *Lesson 3* slide presentation (15 Minutes): Walk students through the slide presentation, highlighting key points such as:
 - Definition and importance of vertical gardening
 - Different structures and their benefits
 - Best plants for vertical gardening
 - Real-world applications and sustainability benefits

Encourage students to take notes and ask questions during the presentation. Additionally, you can show students examples of vertical garden designs (trellises, pallet gardens, hanging planters) and discuss which types of plants work best for each structure, asking them how vertical gardening can be useful in urban spaces.

Slide 1: Title Slide

Slide 2: Welcome to the World of Vertical Gardening

Welcome students to the lesson on vertical gardening. Briefly introduce the topic by asking: Who has seen a garden growing vertically on a wall, fence, or trellis?

Explain that today's lesson will cover the essentials of vertical gardening, its benefits, and how to set one up.

Slide 3: What Is Vertical Gardening?

Define vertical gardening as the practice of growing plants upward, rather than outward, using structures like trellises, wall planters, and hydroponic systems.

Emphasize how this method maximizes space, making it ideal for urban environments and small spaces. Ask students why someone might choose vertical gardening over traditional gardening.

Slides 4-5: Benefits

Highlight key benefits and show images of real-life vertical gardens and discuss their different applications.

Slide 6-7: Common Structures

Discuss different types of vertical gardening setups and encourage students to think about which structure would work best in their environment.

Slide 8: Best Plants

Provide examples of plants that thrive in vertical gardens and ask students which plants they would like to grow in a vertical garden.

Slides 9-10: Setting Up

Walk through the step-by-step process and conduct a quick demonstration, if possible.

Slides 11-12: Maintenance Tips

Discuss important care practices and ask students what maintenance challenges they think vertical gardens present. Discuss solutions to these challenges.

Slide 16: Wrap-up and Reflection

Recap key points and ask students to share one thing they learned from the lesson. Encourage students to think about how they can implement vertical gardening at home or in their community.

2. Hands-on Garden Design (10 Minutes):
Divide students into 10 pairs or small groups. Give each pair or group a vertical gardening planter and discuss which plants they would like to grow.

Students should sketch a simple layout of their vertical garden, considering factors like sunlight and space. Distribute the *Vertical Garden Setup and Maintenance Guide* from the lab workbook.

3. Building Vertical Gardens (15 Minutes):
Guide students as they fill containers with soil, plant seeds or transplant seedlings at appropriate depths, secure plants using twine or stakes (if needed), and position their gardens for optimal sunlight exposure.
4. Watering and Maintenance Discussion (5 Minutes): Demonstrate proper watering techniques to prevent over/under-watering. Explain the importance of pruning and fertilization.

Ask students what challenges might arise in maintaining a vertical garden and how they can be solved. Distribute and have students fill out the *Stacked Vertical Planter Observation and Data* worksheets from the lab workbook.

Lesson Three – Vertical Gardening

REVIEW: Reflecting on Vertical Gardening

10 minutes

Purpose:

Reinforce key concepts of stacked vertical gardening, assess the effectiveness of the students' planters, and encourage reflection on lessons learned.

Students will discuss their experiences, evaluate their vertical gardens, and explore how vertical gardening can be applied in real-world scenarios.

Materials:

- Completed *Stacked Vertical Planter Observation and Data* worksheets
- Whiteboard or chart paper
- Plant Growing Methods Lab Workbook
- Examples of successful vertical gardens (images or real-life models)
- Measuring tape (optional, for plant growth comparison)
- Markers and sticky notes

Facilitation Steps:

1. Group Discussion (5 Minutes): Have students refer to their *Stacked Vertical Planter Observation and Data* worksheets.

Ask guiding questions, such as:

- What changes have you noticed in your plants over time?
- Which plants thrived the most? Why?
- Did any plants struggle? What might have caused this?

List common observations on the whiteboard.

2. Peer Evaluation (5 Minutes): Organize a gallery walk in which students view each other's stacked vertical planters. Have students write a positive comment and one suggestion for improvement on sticky notes for their peers. Encourage students to discuss differences in plant growth and container effectiveness.
3. Reflection Activity (5 Minutes): Distribute the *Vertical Gardening Reflection Questions* from the lab workbook. Have students write their responses individually or discuss in pairs.
4. Troubleshooting and Problem Solving (5 Minutes): Present common vertical gardening issues, such as dry soil in the upper tiers, plants growing unevenly, and water pooling at the bottom, and invite students to suggest solutions.

Encourage students to share how they overcame similar challenges in their planters.

5. Wrap-up and Key Takeaways (5 Minutes): Summarize key takeaways from the lesson and ask students to share one thing they learned from their vertical gardening experience.

Discuss future gardening opportunities and how students can implement these skills in home or community gardens.

Sources

1. Britannica. (n.d.). Container gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/container-gardening>
2. Britannica. (n.d.). Germination. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/science/germination>
3. Britannica. (n.d.). Vertical gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/vertical-gardening>
4. BYJU'S. (n.d.). Seed germination. *BYJU'S*. Retrieved from <https://byjus.com/biology/seed-germination/>
5. LibreTexts. (2020, August 12). Germination. *Biology LibreTexts*. Retrieved from <https://bio.libretexts.org>
6. Missouri Botanical Garden. (n.d.). *Plant Finder*. Retrieved from <https://www.missouribotanicalgarden.org>
7. National Gardening Association. (n.d.). *Seed germination basics*. Retrieved from <https://www.garden.org>
8. Pollinator Partnership. (n.d.). Benefits of vertical gardens for pollinators. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/vertical-gardens>
9. Pollinator Partnership. (n.d.). Creating pollinator habitats. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/create-pollinator-garden>
10. Royal Horticultural Society. (n.d.). *Growing sunflowers, zinnias, and other pollinator-friendly plants*. Retrieved from <https://www.rhs.org.uk>
11. The Spruce. (2021). How to start a vertical garden. *The Spruce*. Retrieved from <https://www.thespruce.com/start-vertical-garden-5082262>
12. U.S. Department of Agriculture. (n.d.). Pollinators. *USDA*. Retrieved from <https://www.usda.gov/peoples-garden/pollinators>
13. U.S. Department of Agriculture. (n.d.). Urban agriculture and gardening. *USDA*. Retrieved from <https://www.usda.gov/topics/farming/urban-agriculture>
14. U.S. Department of Agriculture. (n.d.). Urban farming and green spaces. *USDA*. Retrieved from <https://www.usda.gov/urban-farming>
15. University of Illinois Extension. (n.d.). Successful container gardens. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/container-gardens>
16. University of Illinois Extension. (n.d.). Vertical gardens: Maximizing space. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/vertical-gardens>

Lesson Four – Raised Bed Gardening

Lesson Overview

Raised bed gardening is a method of growing plants in elevated soil beds, which offers better drainage, improved soil conditions, and easier maintenance. This lesson will teach students the fundamentals of raised bed gardening, including planning, construction, planting techniques, and long-term maintenance. Through hands-on activities, students will build and plant a small-scale raised bed garden while learning how this method contributes to sustainable agriculture and food security.

Lesson Objectives

After completing this lesson, participants will be able to:

- Explain the benefits of raised bed gardening compared to traditional gardening
- Identify the materials and tools needed to construct a raised bed
- Build and plant a small-scale raised bed garden
- Understand proper soil preparation, plant spacing, and maintenance techniques
- Discuss the role of raised bed gardening in urban and community agriculture

Lesson at a Glance

Activity	Materials	Preparation	Approximate Class Time
FOCUS	• Visuals: Images or diagrams of raised bed gardens, including different designs and plant arrangements • Plant Growing Methods Lab Workbook • Whiteboard • Markers • Demonstration Tools: Small containers or trays with different soil types to show the difference in drainage and quality	1. Gather images/diagrams of raised bed gardens. 2. Print/photocopy the <i>Raised Bed Gardening Overview</i> from the lab workbook (one per participant).	10 minutes
LEARN	• Raised bed growing system with modular containers (enough for 4-5 small groups to have multiple containers) • Soil and compost (high-quality garden soil, compost, mulch) • Plants and seeds (suitable vegetables, herbs, flowers for raised beds) • Tools (measuring tape, trowels, shovels, gloves, watering cans) • Plant Growing Methods Lab Workbook • <i>Lesson 4</i> slide presentation	1. Prepare to show the <i>Lesson 4</i> slide presentation. 2. Print/photocopy the <i>Raised Bed Gardening Setup Guide</i> and <i>Raised Bed Garden Observation and Data</i> worksheets from the lab workbook (one of each per participant). 3. Assemble soil, plants, and gardening tools.	45-60 minutes
REVIEW	• Completed <i>Raised Bed Gardening Observation and Data</i> worksheets from students • Whiteboard or chart paper for recording group insights • Plant Growing Methods Lab Workbook	1. Set up a gallery walk in which students provide feedback on each other's raised beds. 2. Print/photocopy the <i>Raised Bed Gardening Reflection Questions</i> from the lab workbook (one per participant).	25 minutes

Plant Growing Methods Curriculum

	• Measuring tape for assessing plant growth • Markers and sticky notes for interactive activities		
--	---	--	--

Lesson Four – Raised Bed Gardening

FOCUS: Introduction to Raised Bed Gardening

10 minutes

Purpose:

Introduce students to the concept of raised bed gardening, highlighting its benefits, uses, and practical applications in various settings. The focus is on engaging students' curiosity and providing foundational knowledge that will support hands-on learning in the subsequent parts of the lesson.

Materials:

- Visuals: Images or diagrams of raised bed gardens, including different designs and plant arrangements
- Plant Growing Methods Lab Workbook
- Whiteboard
- Markers
- Demonstration Tools: Small containers or trays with different soil types to show the difference in drainage and quality

Facilitation Steps:

1. Engage Students with Visuals (3 Minutes): Show images of various raised bed gardens. Highlight different styles, including wooden frames, stone beds, and recycled material beds.

Ask students: What do you notice about these gardens? How might they be different from traditional gardening?

2. Group Discussion on Benefits and Applications (4 Minutes): Lead a discussion using the guiding questions below.
 - Why do you think gardeners might choose raised beds over planting directly in the ground?
 - What challenges in gardening could raised beds help solve?

- Where have you seen raised bed gardens used in real life (e.g., schools, community gardens, backyards)?

Write responses on the whiteboard under categories like soil quality, accessibility, pest control, and aesthetic appeal.

3. Introduce Key Concepts (3 Minutes): Distribute the *Raised Bed Gardening Overview* from the lab workbook.

Highlight key points:

- Definition of raised bed gardening
- Benefits: Improved drainage, better soil quality, ease of maintenance, and versatility
- Types of materials used to build raised beds (e.g., wood, metal, stone)

Allow students to skim the handout and ask questions.

4. Wrap-up and Transition: Summarize the main takeaways, emphasizing how raised beds can enhance gardening success.

Explain that the next section will involve students designing and building their own small, raised bed gardens, applying the concepts introduced.

Encourage students to think about what types of plants they might want to include in their raised bed project.

Lesson Four – Raised Bed Gardening

LEARN: Designing and Building a Raised Garden Bed

45-60 minutes

Purpose:

Provide students with hands-on experience designing, constructing, and planting a raised bed garden. Students will learn about soil preparation, plant selection, and maintenance techniques, gaining practical skills that they can apply in personal or community gardening projects.

Materials:

- Raised bed growing system with modular containers (enough for 4-5 small groups to have multiple containers)
- Soil and compost (high-quality garden soil, compost, and mulch)
- Plants and seeds (suitable vegetables, herbs, and flowers for raised beds)
- Tools (measuring tape, trowels, shovels, gloves, watering cans)
- Plant Growing Methods Lab Workbook
- *Lesson 4* slide presentation

Facilitation Steps:

1. Present Slide Presentation (15 Minutes): Walk students through the *Lesson 4* slide presentation, highlighting key points.

Slide 1: Title Slide

Slide 2: What Is Raised Bed Gardening?
Define the concept and set the context.

Slide 3: Benefits of Raised Bed Gardening
Highlight advantages such as improved drainage, soil quality, and accessibility.

Slide 4: Type of Raised Bed Materials

Slide 5: Building a Raised Garden Bed
Walk through the process of building a raised bed garden, from site selection to maintenance.

Slide 6: Best Plants

Share examples of vegetables, herbs, and flowers that thrive in raised beds.

Slide 7: Maintenance and Care Tips

Offer guidance on watering, fertilizing, and pest management.

Slide 8: Common Challenges and Solutions

Go over some common challenges and solutions when using a raised garden bed.

Slide 9: Wrap-up and Reflection

Open the floor for student questions and reflections.

2. Present the Raised Bed Gardening Setup Guide (5 Minutes): Walk students through the guide, explaining key steps. Highlight the benefits of raised beds in preventing common gardening issues, like poor drainage and soil compaction.
3. Group Activity (20 Minutes): Divide students into four or five small groups and assign roles, such as builders, planters, and waterers.

Distribute tools, soil, and seeds to each group and guide the construction with the following steps.

- 1) Distribute the raised bed containers.
- 2) Fill the bed with the prepared soil mix, ensuring even distribution.
- 3) Demonstrate planting techniques, showing how to space seeds or seedlings properly.
- 4) Water the soil thoroughly after planting.

Plant Growing Methods Curriculum

Students should help each other and share ideas on plant arrangement and care strategies.

4. Demonstrate Maintenance Techniques (5 Minutes): Explain how to water plants in raised garden beds efficiently, focusing on the root zones.

Show how to manage weeds and maintain healthy plants. Discuss natural methods to reduce pests without harmful chemicals. Introduce organic methods to enrich soil and retain moisture.

5. Monitor and Reflect (5 Minutes): Encourage students to observe their raised beds closely, noting changes in plant growth and soil condition.

Distribute the *Raised Bed Gardening Observation and Data* worksheets from the lab workbook to track plant progress and identify any care needs.

6. Wrap-up and Transition: Review the steps students completed and emphasize the importance of each phase in creating a healthy garden.

Encourage students to think about how they could apply these skills at home or in community gardening projects.

Lesson Four – Raised Bed Gardening

REVIEW: Reflecting on Raised Bed Gardening

25 minutes

Purpose:

Reinforce the key concepts of raised bed gardening, evaluate the success of the students' garden projects, and encourage thoughtful reflection on the learning process.

Students will analyze their gardening experiences, discuss challenges and solutions, and explore how raised bed gardening techniques can be applied in real-world scenarios.

Materials:

- Completed *Raised Bed Gardening Observation and Data* worksheets from students
- Whiteboard or chart paper for recording group insights
- Plant Growing Methods Lab Workbook
- Measuring tape for assessing plant growth
- Markers and sticky notes for interactive activities

Facilitation Steps:

1. Group Discussion (5 Minutes): Ask students to refer to their *Raised Bed Gardening Observation and Data* worksheets.

Prompt critical thinking with questions such as:

- What changes did you notice in your plants' growth?
- Which plants thrived the most? What factors contributed to their success?
- What challenges did you encounter, and how did you address them?

Write key observations and reflections on the whiteboard under categories like growth trends, success factors, and challenges.

2. Peer Feedback and Problem Solving (5 Minutes): Organize a gallery walk by having students display their raised bed

gardens or data sheets. Students should move around the room, observing each other's work.

Provide sticky notes for students to leave one positive comment and one suggestion for improvement on each project. Highlight common themes in the feedback and discuss practical solutions for any challenges noted.

3. Reflection Activity (5 Minutes): Distribute the *Raised Bed Gardening Reflection Questions*. Encourage students to consider how raised bed gardening can be used in urban areas, community gardens, or personal projects.

Have students discuss their responses in pairs before sharing with the class.

4. Troubleshooting and Problem Solving (5 Minutes): Ask students what they would do if their raised bed had poor drainage and how they could improve plant growth if some plants were not thriving.

Have groups brainstorm ideas and share their strategies. Highlight effective problem-solving techniques and creative approaches.

5. Wrap-up and Key Takeaways (5 Minutes): Reinforce the benefits of raised bed gardening, such as improved soil quality, better drainage, and increased plant yield.

Discuss how raised bed gardening aligns with sustainability, food security, and urban agriculture. Motivate students to think about how they might continue gardening at home or participate in community gardening projects.

Closing Question: What is one lesson you will take away from your raised bed gardening experience?

Invite students to share their reflections aloud or write them on an index card for display.

Sources

1. Britannica. (n.d.). Container gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/container-gardening>
2. Britannica. (n.d.). Germination. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/science/germination>
3. Britannica. (n.d.). Vertical gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/vertical-gardening>
4. BYJU'S. (n.d.). Seed germination. *BYJU'S*. Retrieved from <https://byjus.com/biology/seed-germination/>
5. LibreTexts. (2020, August 12). Germination. *Biology LibreTexts*. Retrieved from <https://bio.libretexts.org>
6. Missouri Botanical Garden. (n.d.). *Plant Finder*. Retrieved from <https://www.missouribotanicalgarden.org>
7. National Gardening Association. (n.d.). *Seed germination basics*. Retrieved from <https://www.garden.org>
8. Pollinator Partnership. (n.d.). Benefits of vertical gardens for pollinators. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/vertical-gardens>
9. Pollinator Partnership. (n.d.). Creating pollinator habitats. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/create-pollinator-garden>
10. Royal Horticultural Society. (n.d.). *Growing sunflowers, zinnias, and other pollinator-friendly plants*. Retrieved from <https://www.rhs.org.uk>
11. The Spruce. (2021). How to start a vertical garden. *The Spruce*. Retrieved from <https://www.thespruce.com/start-vertical-garden-5082262>
12. U.S. Department of Agriculture. (n.d.). Pollinators. *USDA*. Retrieved from <https://www.usda.gov/peoples-garden/pollinators>
13. U.S. Department of Agriculture. (n.d.). Urban agriculture and gardening. *USDA*. Retrieved from <https://www.usda.gov/topics/farming/urban-agriculture>
14. U.S. Department of Agriculture. (n.d.). Urban farming and green spaces. *USDA*. Retrieved from <https://www.usda.gov/urban-farming>
15. University of Illinois Extension. (n.d.). Successful container gardens. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/container-gardens>
16. University of Illinois Extension. (n.d.). Vertical gardens: Maximizing space. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/vertical-gardens>

Lesson Five – Career Exploration

Lesson Overview

This lesson introduces students to careers in greenhouse management, horticulture, aeroponics, hydroponics, and aquaponics, highlighting job roles, skills, and educational pathways. It begins with a brainstorming activity to explore potential careers, followed by a group research project in which students investigate and present findings on specific career categories.

The lesson concludes with a career matching game, reflection activity, and exit ticket to reinforce learning. Through discussion, collaboration, and real-world examples, students gain insight into sustainable agriculture and innovative farming careers, connecting science and technology to job opportunities.

Lesson Objectives

After completing this lesson, participants will be able to:

- Identify various career paths in horticulture and their roles
- Understand the education, skills, and certifications required for different horticulture careers
- Explore job market trends and opportunities in the field
- Reflect on personal interests and potential career pathways in horticulture

Lesson at a Glance

Activity	Materials	Preparation	Approximate Class Time
FOCUS	• Plant Growing Methods Lab Workbook • Whiteboard and markers • Career spotlight videos (optional)	1. Print/photocopy the <i>Horticulture Career Exploration</i> handout from the lab workbook (one per participant). 2. Set up career spotlight visuals or videos if available.	10 minutes
LEARN	• Computers or tablets for research (if available) • Plant Growing Methods Lab Workbook • List of horticulture industry certifications	1. Set up a list of trusted websites for students to research horticulture careers (e.g., USDA, American Society for Horticultural Science, Bureau of Labor Statistics). 2. Print/photocopy the <i>Horticulture Career Pathways</i> worksheet from the lab workbook (one per participant).	30 minutes
REVIEW	• Plant Growing Methods Lab Workbook • Whiteboard or chart paper • Markers and sticky notes	1. Print/photocopy the <i>Horticulture Career Reflection Questions</i> from the lab workbook (one of each per participant). 2. Set up a space for students to post their top career choices and key takeaways.	10 minutes

Lesson Five – Career Exploration

FOCUS: Introduction to Horticulture Careers

10 minutes

Purpose:

The purpose of this section is to introduce students to the vast range of careers within horticulture, spark curiosity about opportunities in the industry, and challenge preconceived ideas about working with plants.

This section engages students in an interactive discussion that encourages critical thinking about how horticulture affects various industries and daily life.

Materials:

- Plant Growing Methods Lab Workbook
- Whiteboard and markers
- Career spotlight videos (optional)
- Images of professionals working in different horticulture fields (e.g., greenhouse manager, landscape designer, arborist, horticulture therapist, urban farmer)

Facilitation Steps:

1. Engage Students with a Career Brainstorm (3 Minutes): Write “Horticulture Careers” on the whiteboard. Ask students what jobs they think involve plants and what industries might require knowledge of horticulture.

List responses and categorize them into different fields (e.g., landscape design, research, agriculture, urban planning, sustainability).

2. Discussion on Horticulture’s Impact (3 Minutes): Ask students how horticulture impacts our everyday lives (besides growing plants).

Guide a discussion on topics such as:

- Environmental benefits (e.g., urban greening, air quality improvement)
- Food production and sustainable agriculture

- Therapeutic and mental health benefits
- Career opportunities in public spaces, education, and research

3. Introduce Career Pathways in Horticulture (4 Minutes): Distribute the *Horticulture Career Exploration* handout from the lab workbook.

Highlight a few careers from different categories:

- Landscape and garden design (landscape architect, park planner)
- Agriculture and crop science (greenhouse manager, hydroponics specialist)
- Research and education (botanist, plant geneticist, horticulture educator)
- Urban and environmental planning (urban farmer, sustainability consultant)
- Therapeutic horticulture (horticulture therapist, community garden coordinator)

Share brief insights into job responsibilities, required education, and skills needed.

If time permits, show a short career spotlight video:

<https://www.youtube.com/watch?v=WCdQeZKlcXQ>

<https://www.youtube.com/watch?v=gajUCaN9MQI>

<https://www.youtube.com/watch?v=i8jjJeFnjKo>

4. Wrap-up: Encourage students to think about which areas of horticulture interest them the most. Explain that, in the next section, they will conduct research on a specific career to learn about education paths, salary expectations, and job market trends.

Lesson Five – Career Exploration

LEARN: Career Exploration and Research

30 minutes

Purpose:

This section provides students with hands-on experience researching careers in horticulture, exploring job opportunities, education requirements, and industry trends.

By conducting research and completing guided worksheets, students gain insight into the variety of career pathways in horticulture and reflect on their interests and strengths.

Materials:

- Computers or tablets for research (if available)
- Plant Growing Methods Lab Workbook
- List of horticulture industry certifications and degree programs
- Career information from industry websites (USDA, Bureau of Labor Statistics, ASHS, local universities)

Facilitation Steps:

1. Introduction to Career Research (5 Minutes): Explain that students will research horticulture careers and find key details about their chosen career.

Distribute the *Horticulture Career Pathways* worksheet from the lab workbook and walk through its sections:

- Job title and description
- Required education and training
- Salary expectations and job market trends
- Required certifications or skills
- Work environments and typical job tasks

2. Independent or Group Research (15 Minutes): Allow students to research individually or in small groups. Direct them to use industry websites (e.g., USDA, Bureau of Labor Statistics, professional horticulture associations) to find credible information. Monitor and assist students as they gather information.
3. Small Group Career Discussions (5 Minutes): Have students share their findings in small groups. Each student presents:
 - The career they researched
 - A surprising fact they learned
 - Whether they see themselves pursuing that career
4. Class Discussion (5 Minutes): Ask each group to share one interesting career pathway with the class. Facilitate a brief discussion about trends in horticulture careers.

Highlight emerging careers in urban agriculture, sustainable landscaping, and plant biotechnology.
5. Wrap-up: Ask students to think about how their personal skills and interests align with the careers they explored.

Lesson Five – Career Exploration

REVIEW: Reflection and Career Discussion

10 minutes

Purpose:

This section allows students to reflect on what they learned, assess how their interests align with horticulture careers, and discuss possible next steps in exploring these career opportunities.

Materials:

- Plant Growing Methods Lab Workbook
- Whiteboard or chart paper
- Markers and sticky notes

Facilitation Steps:

1. Group Discussion (5 Minutes): Ask students which horticulture career interests them the most and why. Facilitate a discussion on different career paths and students' personal preferences.

Have students write their top career choice on a sticky note and post it on a career exploration board.

2. Individual Reflection (5 Minutes): Distribute the *Career Reflection Questions* worksheet from the lab workbook. Allow time for students to complete the questions and prepare for a future discussion on next steps in career planning.

This review session reinforces key learnings and encourages students to think critically about their future career pathways in horticulture.

Sources

1. Britannica. (n.d.). Container gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/container-gardening>
2. Britannica. (n.d.). Germination. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/science/germination>
3. Britannica. (n.d.). Vertical gardening. *Encyclopedia Britannica*. Retrieved from <https://www.britannica.com/topic/vertical-gardening>
4. BYJU'S. (n.d.). Seed germination. *BYJU'S*. Retrieved from <https://byjus.com/biology/seed-germination/>
5. LibreTexts. (2020, August 12). Germination. *Biology LibreTexts*. Retrieved from <https://bio.libretexts.org>
6. Missouri Botanical Garden. (n.d.). *Plant Finder*. Retrieved from <https://www.missouribotanicalgarden.org>
7. National Gardening Association. (n.d.). *Seed germination basics*. Retrieved from <https://www.garden.org>
8. Pollinator Partnership. (n.d.). Benefits of vertical gardens for pollinators. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/vertical-gardens>
9. Pollinator Partnership. (n.d.). Creating pollinator habitats. *Pollinator Partnership*. Retrieved from <https://www.pollinator.org/create-pollinator-garden>
10. Royal Horticultural Society. (n.d.). *Growing sunflowers, zinnias, and other pollinator-friendly plants*. Retrieved from <https://www.rhs.org.uk>
11. The Spruce. (2021). How to start a vertical garden. *The Spruce*. Retrieved from <https://www.thespruce.com/start-vertical-garden-5082262>
12. U.S. Department of Agriculture. (n.d.). Pollinators. *USDA*. Retrieved from <https://www.usda.gov/peoples-garden/pollinators>
13. U.S. Department of Agriculture. (n.d.). Urban agriculture and gardening. *USDA*. Retrieved from <https://www.usda.gov/topics/farming/urban-agriculture>
14. U.S. Department of Agriculture. (n.d.). Urban farming and green spaces. *USDA*. Retrieved from <https://www.usda.gov/urban-farming>
15. University of Illinois Extension. (n.d.). Successful container gardens. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/container-gardens>
16. University of Illinois Extension. (n.d.). Vertical gardens: Maximizing space. *University of Illinois Extension*. Retrieved from <https://extension.illinois.edu/vertical-gardens>

Name _____ Class: _____

Summative Assessment

1. What is the first stage of seed germination?
 - a. Shoot development
 - b. Radicle emergence
 - c. Imbibition
 - d. Activation
2. Which factor is **not** essential for seed germination?
 - a. Water
 - b. Oxygen
 - c. Light
 - d. Fertilizer
3. What part of the seed emerges first during germination?
 - a. Cotyledon
 - b. Radicle
 - c. Hypocotyl
 - d. Plumule
4. Seeds require an optimal _____ range to germinate successfully.
 - a. Humidity
 - b. Temperature
 - c. Soil pH
 - d. Wind speed
5. Why is moisture important in seed germination?
 - a. It keeps insects away from seeds
 - b. It helps break dormancy and activate enzymes
 - c. It makes the seed heavier for planting
 - d. It prevents sunlight from drying out the seed
6. What is an advantage of container gardening?
 - a. It requires no maintenance
 - b. It allows gardening in small spaces
 - c. It eliminates the need for water
 - d. It only works for flowers
7. What type of soil is best for container gardening?

- a. Clay soil
 - b. Sandy soil
 - c. Well-draining potting mix
 - d. Rocky soil
8. How often should container plants typically be watered?
- a. Once a month
 - b. Every day
 - c. When the soil feels dry
 - d. Only during the summer
9. Which of the following is **not** a suitable container material?
- a. Plastic
 - b. Metal
 - c. Cardboard
 - d. Terra cotta
10. Why is drainage important in container gardening?
- a. It prevents soil from drying out
 - b. It prevents root rot and excess water buildup
 - c. It makes containers heavier
 - d. It keeps plants in place
11. What is a major benefit of vertical gardening?
- a. It requires no sunlight
 - b. It maximizes space usage
 - c. It only works for vines
 - d. It requires no maintenance
12. What is a common plant used in vertical gardens?
- a. Corn
 - b. Carrots
 - c. Tomatoes
 - d. Cacti
13. What type of structure is commonly used in vertical gardening?
- a. Raised beds
 - b. Hanging planters
 - c. Tractors
 - d. Greenhouses
14. Which of the following is **not** a challenge in vertical gardening?

- a. Weight distribution
 - b. Water retention
 - c. Lack of plant variety
 - d. Accessibility
15. How does vertical gardening contribute to sustainability?
- a. It increases land use
 - b. It reduces soil erosion and improves air quality
 - c. It decreases plant production
 - d. It requires more pesticides
16. What is a benefit of raised bed gardening?
- a. It decreases soil quality
 - b. It improves drainage and soil aeration
 - c. It eliminates plant growth
 - d. It is only suitable for flowers
17. What material is commonly used for building raised beds?
- a. Glass
 - b. Sand
 - c. Wood
 - d. Paper
18. Raised beds typically require:
- a. Poorly draining soil
 - b. Compact soil
 - c. A mix of soil and compost
 - d. Only gravel
19. Which factor should be considered when selecting a location for a raised bed?
- a. Access to wind
 - b. Sunlight availability
 - c. Distance from a power outlet
 - d. Proximity to pavement
20. Why do raised beds warm up faster in spring?
- a. They are closer to the sun
 - b. They allow better drainage and air circulation
 - c. They are placed inside a greenhouse
 - d. They contain more water
21. Which of the following is a career in horticulture?

- a. Software engineer
 - b. Landscape architect
 - c. Lawyer
 - d. Pilot
22. What education level is typically required for an entry-level horticulture career?
- a. No education required
 - b. High school diploma or associate degree
 - c. Doctorate degree
 - d. Law degree
23. What is a major industry that employs horticulturists?
- a. Aerospace
 - b. Agriculture and landscaping
 - c. Automotive
 - d. Finance
24. Which of the following skills is important for a horticulture career?
- a. Computer programming
 - b. Plant identification and soil science
 - c. Welding
 - d. Accounting
25. How does horticulture contribute to sustainability?
- a. By improving plant diversity and green spaces
 - b. By increasing pollution
 - c. By decreasing the number of plants
 - d. By eliminating soil conservation efforts

Summative Assessment – Answer Key

1. What is the first stage of seed germination?
 - a. Shoot development
 - b. Radicle emergence
 - c. Imbibition**
 - d. Activation
2. Which factor is **not** essential for seed germination?
 - a. Water
 - b. Oxygen
 - c. Light**
 - d. Fertilizer
3. What part of the seed emerges first during germination?
 - a. Cotyledon
 - b. Radicle**
 - c. Hypocotyl
 - d. Plumule
4. Seeds require an optimal _____ range to germinate successfully.
 - a. Humidity
 - b. Temperature**
 - c. Soil pH
 - d. Wind speed
5. Why is moisture important in seed germination?
 - a. It keeps insects away from seeds
 - b. It helps break dormancy and activate enzymes**
 - c. It makes the seed heavier for planting
 - d. It prevents sunlight from drying out the seed
6. What is an advantage of container gardening?
 - a. It requires no maintenance**
 - b. It allows gardening in small spaces
 - c. It eliminates the need for water
 - d. It only works for flowers
7. What type of soil is best for container gardening?
 - a. Clay soil

- b. Sandy soil
 - c. Well-draining potting mix**
 - d. Rocky soil
8. How often should container plants typically be watered?
- a. Once a month
 - b. Every day
 - c. When the soil feels dry**
 - d. Only during the summer
9. Which of the following is **not** a suitable container material?
- a. Plastic
 - b. Metal
 - c. Cardboard**
 - d. Terra cotta
10. Why is drainage important in container gardening?
- a. It prevents soil from drying out
 - b. It prevents root rot and excess water buildup**
 - c. It makes containers heavier
 - d. It keeps plants in place
11. What is a major benefit of vertical gardening?
- a. It requires no sunlight
 - b. It maximizes space usage**
 - c. It only works for vines
 - d. It requires no maintenance
12. What is a common plant used in vertical gardens?
- a. Corn
 - b. Carrots
 - c. Tomatoes**
 - d. Cacti
13. What type of structure is commonly used in vertical gardening?
- a. Raised beds
 - b. Hanging planters**
 - c. Tractors
 - d. Greenhouses
14. Which of the following is **not** a challenge in vertical gardening?
- a. Weight distribution

- b. Water retention
 - c. Lack of plant variety**
 - d. Accessibility
15. How does vertical gardening contribute to sustainability?
- a. It increases land use
 - b. It reduces soil erosion and improves air quality**
 - c. It decreases plant production
 - d. It requires more pesticides
16. What is a benefit of raised bed gardening?
- a. It decreases soil quality
 - b. It improves drainage and soil aeration**
 - c. It eliminates plant growth
 - d. It is only suitable for flowers
17. What material is commonly used for building raised beds?
- a. Glass
 - b. Sand
 - c. Wood**
 - d. Paper
18. Raised beds typically require:
- a. Poorly draining soil
 - b. Compact soil
 - c. A mix of soil and compost**
 - d. Only gravel
19. Which factor should be considered when selecting a location for a raised bed?
- a. Access to wind
 - b. Sunlight availability**
 - c. Distance from a power outlet
 - d. Proximity to pavement
20. Why do raised beds warm up faster in spring?
- a. They are closer to the sun
 - b. They allow better drainage and air circulation**
 - c. They are placed inside a greenhouse
 - d. They contain more water
21. Which of the following is a career in horticulture?
- a. Software engineer

b. Landscape architect

c. Lawyer

d. Pilot

22. What education level is typically required for an entry-level horticulture career?

a. No education required

b. High school diploma or associate degree

c. Doctorate degree

d. Law degree

23. What is a major industry that employs horticulturists?

a. Aerospace

b. Agriculture and landscaping

c. Automotive

d. Finance

24. Which of the following skills is important for a horticulture career?

a. Computer programming

b. Plant identification and soil science

c. Welding

d. Accounting

25. How does horticulture contribute to sustainability?

a. By improving plant diversity and green spaces

b. By increasing pollution

c. By decreasing the number of plants

d. By eliminating soil conservation efforts