Garden on Wheels

An Educational Mobile Microgreens Garden

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YENC25-239

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what to expect from this session

2024-38640-42989
YENC25-239

- SARE report on youth gardening summary
- SARE grant project summary
- **Garden on Wheels** Project Outcomes
- **Garden on Wheels** Project Summary
- **Garden on Wheels** as an Educational Tool
- Benefits for Students
- Microgreens 101
- Nutritional Benefits
- Types of Microgreens
- Using Microgreens
- Microgreens in First Grade

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A 2002 SARE Project Report on Youth Gardening:

Studies have shown that youth gardening programs can have several positive effects on children.

- psychological and social development
- academic skills and learning
- positive eating choices
- and environmental awareness.

Reference SARE Project

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A 2002 SARE Project Report on Youth Gardening:

Teachers and administrators have many concerns that often limit the development or use of a school garden.

Two main concerns are Logistical and Educational:

- development and sustainability of an outdoor classroom or garden area
- investment of time and money
- connection to curriculum where state standards and testing take precedence

Reference SARE Project

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A 2002 SARE Project Report on Youth Gardening:

Studies have found that the hands-on informal learning that is involved in gardening can help motivate students to learn and enjoy school curriculum. Yet, even with all the researched benefits and increasing interest, school gardening was not common at this time in Indiana.

Reference SARE Project

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YENC25-239

Garden on Wheels

-a SARE (Sustainable Agriculture Research and Education) Youth Educator grant-awarded project

SARE Youth Educator Grant projects

- develop innovative new ways to engage youth in learning about sustainable agriculture and share what they learn with their fellow educators.
- encourage young people to try sustainable practices and see sustainable agriculture as a viable career option.

General Outcomes of Garden on Wheels

- offers hands-on STEM learning
- boosts nutrition knowledge (more likely to eat what they grow!)
- builds crucial life skills like patience and responsibility
- fosters environmental stewardship
- improves students' mental well-being by connecting them with nature and reducing screen time
- builds understanding of how systems interact
- being outdoors in natural light and physical activity improve health

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Project Summary 1:

This project introduces indoor urban farming through vertical gardening using soil or compost.

- mobile educational units
- teach sustainable food production in urban settings
- minimal resources
- explore culinary applications and health benefits.

Reference

Project Summary 2:

The Project Highlights

- emphasizes local food production
- green entrepreneurship skills
- gaining insights into innovative and sustainable farming techniques

This project's prototype was accomplished at Maple Glen Elementary School with K-3 students. The following phases of the project will involve elementary, middle, and high schoolers from multiple school districts and the concept of growing vegetables through vertical gardening will be demonstrated and taught.

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YENC25-239

Garden on Wheels,

a Unique and Important Educational Tool 1

Hands-on Learning - Students actively participate in planting, growing, and harvesting microgreens, providing tangible experience with food production. This hands-on approach enhances understanding of plant biology and growth cycles.

Resource Efficiency - Microgreens demonstrate efficient use of space, water, and nutrients. Students learn to maximize yield in small areas, a key principle of sustainable agriculture.

Quick Results - The rapid growth cycle of microgreens (typically 1-2 weeks) allows students to see results quickly, maintaining engagement and providing multiple learning opportunities within a school term.

Garden on Wheels

a Unique and Important Educational Tool 2

Sustainability Education- The project can incorporate composting, water conservation, and organic growing methods, teaching broader sustainability concepts.

Year-Round Growing - Microgreens can be grown indoors year-round, demonstrating how sustainable agriculture can overcome seasonal limitations.

Interdisciplinary Learning - Growing microgreens integrate STEM concepts, nutrition education, and business skills, offering a comprehensive educational experience.

Urban Agriculture - Microgreens are ideal for urban environments, teaching students about local food systems and the potential for agriculture in cities.

Benefits for students include:

In this hands-on experience students gain knowledge in these areas

- **Introduction to supply chain logistics**
  Middle and High School students
- **Development of entrepreneurial skills**
  Middle and High students
- **Understanding Beginner-Level, Return on Investment Concepts**
  Elementary students
- **Exposure to Culinary and Microgreen Farming Careers**
  all student levels

Microgreens 101

Bigger is not always better, at least not when it comes to microgreens.

Microgreens are:

- young plants, under three inches tall, harvested anywhere from one to three weeks after planting.
- the seedlings of edible herbs, vegetables, grains (e.g. oats, wheat), and legumes (e.g. lentils).
- varied in taste - sweet, spicy, earthy, nutty, or bitter - depending on the plant. Their taste or aftertaste often mimics that of their mature plant.
- plants that provide more concentrated nutrients than their full-grown counterparts.

Nutritional Benefits:

The nutritional benefits of each type of microgreen depends on the plant.

Research shows that microgreens may contain 4 to 40 times the nutrients of mature plant leaves.The minerals and phytochemicals in microgreens offer even more nutritional value compared to vegetables.

Many of the nutrients in microgreens act as antioxidants with the power to prevent cell damage. Research on microgreens is still in the early stages, but based on what experts know about the benefits of vegetables, they may:

help manage Type 2 diabetes

broccoli and fenugreek microgreens regulate blood sugar by improving insulin resistance.

improve thinking and reasoning

polyphenols in microgreens helps improving thinking and reasoning

lower the risk of heart disease

polyphenols eg: cabbage microgreen reduces body weight, triglycerides and LDL

prevent cancer

Brassicaceae microgreens contain sulforaphane which prevents, block or reverse cancer cell growth and also useful for colon cancer prevention

protect vision

lutein in spinach, broccoli, dandeljon, cress improve or prevent age related macular disease

reduce the risk of anemia

lettuce and those in the Brassicaceae family, are rich in iron

studies show that fenugreek microgreens have the highest levels of iron

Types of Microgreens

Experts categorize microgreens into different plant families, which include:

- **Amaranthaceae:** amaranth, beet, spinach
- **Amaryllidaceae:** garlic, leek, onion
- **Apiaceae:** carrot, celery, dill, fennel
- **Asteraceae:** endive, chicory, lettuce, radicchio
- **Brassicaceae**: arugula, broccoli, cabbage, cauliflower, radish, watercress
- **Cucurbitaceae:** cucumber, melon, squash

Types of Microgreens

Poaceae (or Gramineae) Family: Microgreens from **grains** include wheat, barley, oats, corn, and buckwheat. They're often called "cereal greens," providing mild, grassy flavors and nutrients.

Fabaceae (pea) Family: Microgreens from legumes include Alfalfa; Mung Beans, Fava Beans, and Adzuki Beans; Lentils and Black Garbanzo Beans; Chickpeas; Sugar Snap and Snow Peas; Clover: Fenugreek. They have sweet, crisp, crunchy, mild, grassy, and nutty flavors.

Microgreens Life Cycle

The Germination Stage

Like all plants, the life cycle of microgreens starts with a seed. Each seed is a tiny package containing the genetic material needed to grow a new plant. When conditions are right – with adequate moisture, the right temperature, and in some cases, light – the seed begins to germinate. This first stage of the plant's life cycle is the starting point of our microgreen's journey.

The seed absorbs water during germination, causing it to swell and break open. The embryonic plant inside the seed begins to grow, using the nutrients stored in the seed. The first part of the plant to emerge is the root, which grows downwards into the soil. Following this, the shoot emerges and grows upwards towards the light. This shoot consists of the stem and the seed leaves, also known as cotyledons. These cotyledons are the first 'leaves' we see on our microgreens.

The Seedling Stage

The plant enters the seedling stage once the cotyledons have fully emerged and opened up. This second stage is when you harvest the microgreens. At this point, the plant still primarily relies on the nutrients stored in the seed. It's also beginning to photosynthesize, using light to produce its food.

The seedling stage is a critical period in the plant's life cycle. It's a time of rapid growth and development, where the plant establishes its root system and prepares to produce its first true leaves. These true leaves, which look different from the cotyledons, signify that the plant is maturing and moving into the next stage of its life cycle.

The Vegetative and Flowering Stages

If we let our microgreens grow beyond the seedling stage, they will enter the vegetative stage. This stage is when the plant focuses on growing larger and producing more leaves. The plant continues to photosynthesize, converting light into energy to fuel its growth. The root system also expands during this stage, allowing the plant to take up more water and nutrients from the soil.

In the case of microgreens, you rarely see them reach this stage. You typically harvest them during the seedling stage. However, if allowed to grow, the plant would eventually move into the flowering stage. This stage is when the plant produces flowers, the plant's reproductive structures. The flowers contain the plant's male and female reproductive organs, and through pollination and fertilization, they produce seeds.

The Seed Production and Dormancy Stages

The plant's final life cycle stages are seed production and dormancy. After fertilization, the plant produces seeds dispersed in various ways – by wind, water, or animals. Once dispersed, the seeds enter a period of dormancy. They remain inactive until the conditions are suitable for germination and the life cycle begins anew.

Understanding the life cycle of microgreens allows us to appreciate the intricate processes involved in their growth and helps us optimize their care. By providing the right conditions at each life cycle stage, we can ensure that our microgreens thrive and provide us with a nutritious and delicious harvest.

Using Microgreens:

Adding them to your favorite dish takes a balanced diet to the next level.

Microgreens are often used in upper-end restaurants to add color, flavor, and visual appeal.

- Add them to salads, sandwiches, and wraps.
- Blend them into pesto or smoothies.
- Use them as a garnish for soups, pizza, tacos, or pasta dishes.

Microgreens

A First Grade STEM Project

Indiana Science and Engineering Process Standards

Indiana Life Science Standards

Indiana Integrated STEM Standards

Leverages CKLA (Common Knowledge Language Arts) Topics

plant parts, growth, types (deciduous vs. evergreen), life cycles (germination, pollination), basic needs (air, water, light, nutrients), photosynthesis, and the importance of plants

Indiana Science and Engineering Process Standards

SEPS.1 Posing questions (for science) and defining problems (for engineering)

SEPS.2 Developing and using models and tools

SEPS.3 Constructing and performing investigations

SEPS.4 Analyzing and interpreting data

SEPS.5 Using mathematics and computational thinking

SEPS.6 Constructing explanations (for science)
and designing solutions (for engineering)

SEPS.7 Engaging in argument from evidence

SEPS.8 Obtaining, evaluating, and communicating information

Indiana Life Science (LS) Standards

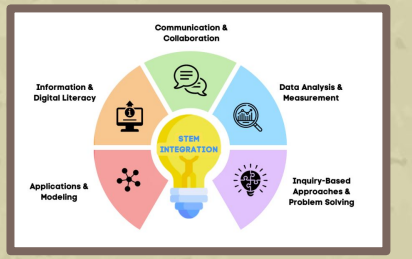
1.LS.1 Develop representations to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

1.LS.2 Develop a model mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. Explore how those external parts could solve a human problem.

1.LS.3 Make observations of plants and animals to compare the diversity of life in different habitats.

1.LS.4 Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

Indiana Integrated STEM Standards

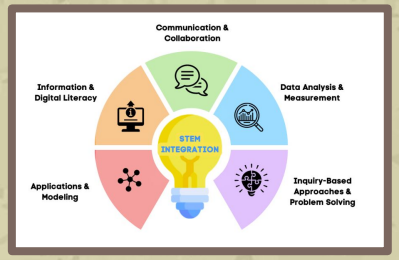


Communication and Collaboration

1.CC.1 Collect and document evidence to share information with others in pictures, diagrams, or text.

1.CC.2 Communicate the solution(s) of a problem/analysis either orally, visually or in writing, which may include process steps, findings, or conclusions.

1.CC.3 Identify roles and responsibilities to collaborate in various group settings and situations.



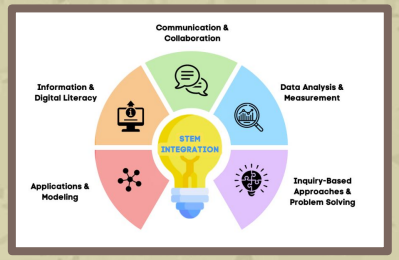
Data Analysis and Measurement

1.DM.1 Estimate to determine appropriate measurement tools to use and apply measurements (e.g., time, length) defined in grade level content standards to analyze real-world scenarios.

1.DM.2 Construct visual representations defined in grade level content standards (e.g., bar graphs, charts) to determine patterns.

1.DM.3 Evaluate reasonableness of observations, results, and solutions throughout processes.

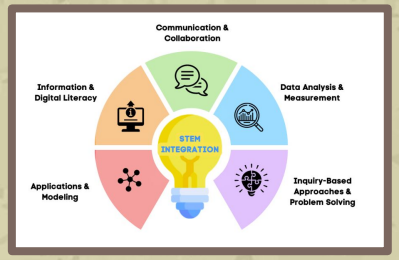
Inquiry-Based Approaches and Problem Solving



1.IPS.1 Form observations, ask questions, plan and conduct investigations to answer questions or solve problems.

1.IPS.2 Decompose a complex problem into smaller steps or sequences to evaluate (e.g., what should be done first, second) appropriate to grade-level content.

1.IPS.3 Determine one or more viable solutions using data and information to resolve a given scenario.



Applications and Modeling

1.AM.1 Apply modeling to represent physical or conceptual objects (e.g., plants, animals, base-ten blocks).

1.AM.2 Apply symbols and relationships (e.g., place value, <, =, >, operations) to represent physical or conceptual objects (e.g., etters or numbers may represent objects).

1.AM.3
Describe that systems have parts that work together to accomplish a goal (e.g., plant life cycle, computer hardware and software).

Microgreens

baby plants that are quick to grow, yummy, and healthy to eat

STEM

First Grade

What are plants?

Living

Plants need water, air, and sunlight to live and grow, just like we need food and water.

Stationary

Plants usually stay put in one spot, growing in the ground or in a pot.

Kitchen and Cook

Plants use sunlight, water, and air (carbon dioxide) to make their own food (sugar) in their leaves. and release oxygen we breathe.

roots
Like straws underground, they drink water and food (nutrients) and hold the plant steady.

stem
The plant's backbone; it holds leaves and flowers up and carries water from roots to leaves and food from leaves to roots.

leaves
Green kitchens that use sunlight, air, and water to make food for the plant.

flowers
Pretty parts that attract bees and butterflies to help make seeds.

fruits
The part that grows around the seeds, like an apple or berry, to keep them safe.

seeds
Tiny packages with a baby plant and food inside, ready to grow a new plant when planted.

Photosynthesis: how plants eat and grow

Ingredients

Plants take in water from their roots and carbon dioxide from the air.

Energy

The green stuff in their leaves (chlorophyll) catches energy from the sun.

Magic! (Photosynthesis)

The plant uses the sun's energy to mix the water and air to create sugary food.

Leftovers

They release oxygen back into the air for us to breathe.

A Plant's Life Cycle

Seed

Every plant starts as a seed. Inside the hard outer seed coat, there is a "baby plant" and some food to help it start growing.

Germination

When the seed gets enough water, warmth, and air, it "wakes up" and starts to grow. This is called germination.

Seedling (Sprout)

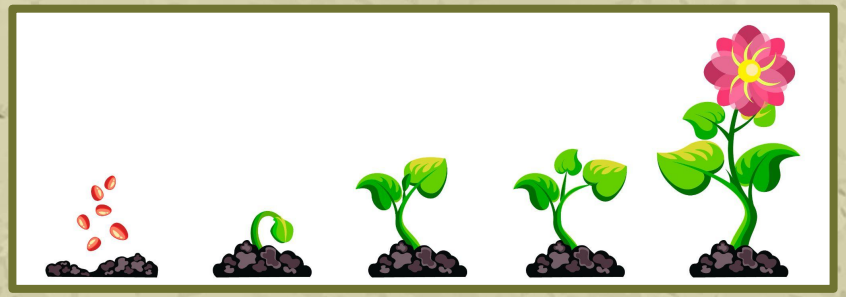
A tiny green shoot pushes up through the soil toward the sun, while roots grow down into the dirt to find water.

Adult Plant

The plant grows taller and stronger, developing more leaves and a thick stem. At this stage, the plant can make its own food using sunlight in a process called photosynthesis.

Flower & Seeds

Once it is an adult, the plant grows flowers. These flowers make new seeds through pollination (often with the help of bees or wind). These new seeds can then fall to the ground or be carried away by wind, water or animals to start the cycle all over again.



Let's visit our Maple Glen Garden!

plant parts, similarities and differences, flowers, fruit, vegetables, smells, defenses

What are microgreens?

They are super tiny, baby vegetables you can grow quickly.

In one to three weeks we can watch their seeds turn into food.

Tiny Veggies

They're young seedlings of vegetables and herbs, harvested very early.

Flavor & Color

They taste stronger than regular veggies and add a pop of color to sandwiches, salads, or soups.

Easy to Grow

They don't need much space or time.

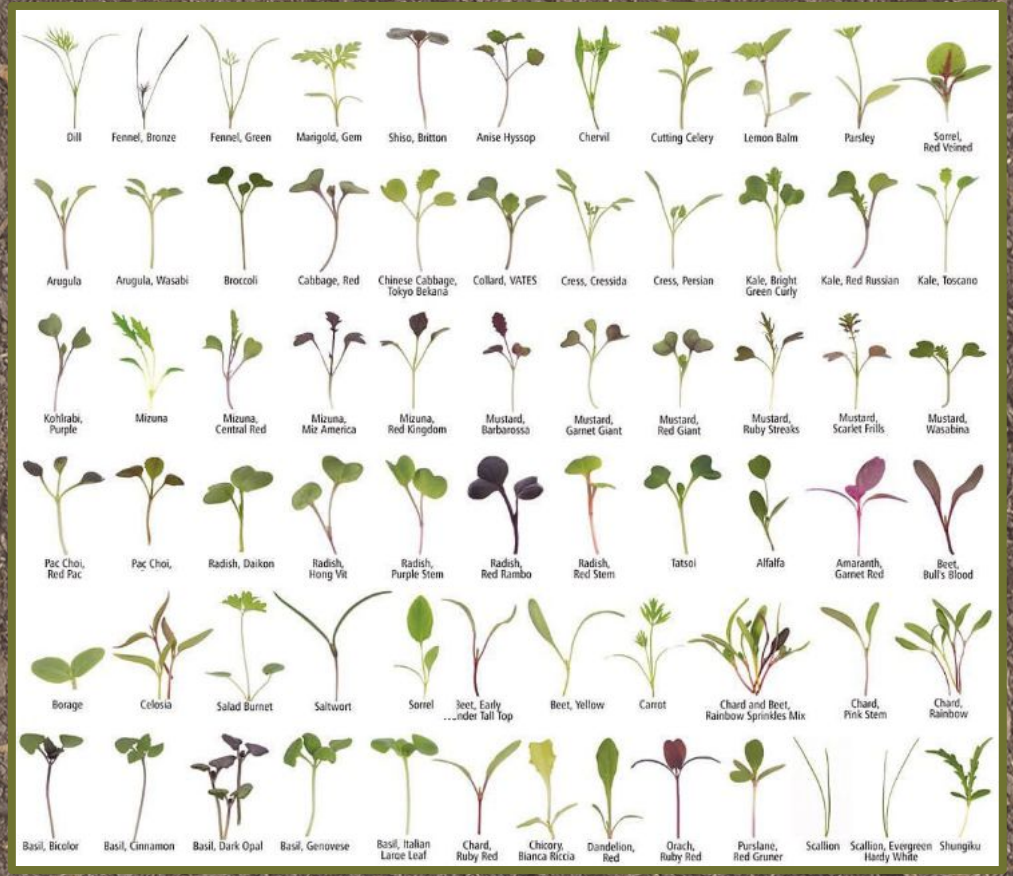
Healthy

They have great nutrients to help us grow and stay healthy.

How healthy are they?

A one ounce bowl of red cabbage microgreens has as much nutrition as 40 heads of read cabbage!

Microgreens can be vegetables, herbs, grains, or beans.



You can put microgreens on almost anything!

Sprinkle them on a pizza or into a sandwich.

Mix them into your favorite smoothie or scrambled eggs.

Put them on top of soup or a salad.

www.growjourney.com

Let’s plant some microgreens!

Materials

- seed trays
- microgreen seeds
- coconut coir
- grow lights
- trays for mixing
- water spray bottle
- culinary supplies (depends on the recipe)
- gloves
- zipper storage bags
- journal book

Method

Set Up

- Prepare the coconut coir by soaking the bricks in water half to an hour prior to the session.
- Assign students to a group and provide each group with mixing tray, seed trays, seeds, gloves, water spray bottle, scooper, markers

- Label seed trays with students' names.

Preparing Seed Trays

- Use scooper to fill trays ¾ full with prepared moist coconut coir.
- Sow microgreens seeds on the prepared tray making sure seeds are not overcrowded
- Moisten the seed bed with the water spray bottle. Do not overwater.
- Cover the tray with the lid for about two days to encourage germination.
- Place trays under grow lights.
- Monitor water, humidity and growth of the microgreens.
- Harvest time differs depending on the seed variety (one to three weeks)

Note: *The tray will hold moisture as it's covered. Throughout growing phase, moisture needs to be kept in check as over watering will lead to fungus and mold formation, and rotting of the microgreens.*

Growth Observations

- Invite students to check microgreens daily to observe changes in appearance and size. Allow students time to journal their observations though sketches and words.
- Invite students to identify which stage of development Their microgreens are in.

Our microgreens!

Harvest Microgreens

To harvest microgreens, use scissors to cut the stems just above the soil line, taking only what you need for freshness, and avoid pulling up the growing medium. Cleanliness is key: sanitize tools and hands, cut in sections, and gently fluff the greens to remove hulls before storing in the fridge to maintain freshness.

We tasted microgreens and added them with other ingredients to make garnishes. Students took microgreens home to their families.

Effects

Microgreens were sent home with students and accompanied by educational information improve our community's understandings of microgreens benefits.

Our PTO has granted us grow carts at every grade level to continue the microgreens project and other gardening initiatives.

Our school has a partnership with the high school's Culinary Arts program. We donated microgreens to their program. The microgreens were added to dishes the Foodies Rock Catering Club prepared for an event. The community became consumers.

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THANK YOU!

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