cultivating connections

A Partnership Between the University of Oregon Environmental Leadership Program and the School Garden Project of Lane County

UNIVERSITY OF OREGON

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school garden project OF LANE COUNTY

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Acknowledgements

On behalf of everyone within the Cultivating Connections team we would like to take this time and space to acknowledge those who made this opportunity possible. We are so grateful for their commitment to our mission, assistance in creating the Environmental Leadership Program and the framework for a service learning project, and their support throughout this entire experience.

Thank you to Katie Lynch, our expert instructor, inspiration, advisor, teacher, and genuine role model to everyone associated with the Environmental Leadership Program. We admire your commitment to your students and the many other hats that you wear for our benefit.

Thank you to our wonderful team manager, Kassandra Hishida, for your wisdom and guidance throughout the Environmental Leadership Program, keeping us all on track, and being adaptable to our team needs.

Thank you, Ashley Studholme, for all the work that you do in the Environmental Leadership Program. You have been a valuable resource throughout our experience in the program.

Thank you to our friends at the School Garden Project of Lane County. We are especially thankful to John Moriarty, Sarah Wheeler, Amoreena Guerrero, Tessa McCusker, Lucy Miner, and Elizabeth Goward.

Thank you to The Robert and Catherine Miller Foundation and the Environmental Studies Program at the University of Oregon.

Thank you to Alicia Kirsten and Rees Maxwell at the Whole Earth Nature School for showing us how fun it is to teach!

Thank you to Jenny Laxton and August Jackson at the Mt. Pisgah Arboretum for letting us into your world and sharing an incredible wealth of knowledge with us!

Thank you to all the students, teachers, and faculty at the following schools!

- Danebo Elementary School
- Clear Lake Elementary School
- Bertha Holt Elementary
- River Road Elementary
- Guy Lee Elementary
- Howard Elementary
- Thurston Elementary
- Chavez Elementary
- Dos Rios Elementary

Overview & Introduction

Environmental education aims to increase students' awareness of environmental issues, build a foundation of knowledge to comprehend their complexity, and encourage civic engagement. From this framework, our team of 8 was organized to pilot a new project within the Environmental Leadership Program (ELP), a service-learning experience that pairs undergraduates with community partners. We collaborated with the School Garden Project (SGP), a nonprofit organization that supports on-site gardens at K-12 schools within Lane County. As part of their mission, SGP aims to provide garden-based teaching resources to educators to increase usability of on-site gardens. To help them further this goal, our team developed five lesson plans that were designed to teach STEM (science, technology, engineering, and mathematics) in the garden during after-school programs. We implemented our lessons every week for five weeks, and assisted with SGP's in-school sessions, each of us providing 120 hours of community service in the garden at local elementary schools. Our experience facilitating lessons enabled us to evaluate and improve our materials. Through this iterative process, we were able to develop high-quality lesson plans for SGP to share with a broad community of educators. By increasing the availability of environmental education for students in our community, we are empowering students to connect with nature and feel a sense of responsibility for the environment they inherit.

Pedagogical Approach

Gardening with children provides an opportunity to help them connect to the natural world in a physical and emotional way. Caring for plants as well as the other life that inhabits a garden is an exercise of empathy, responsibility, and environmental stewardship. Perhaps best of all, being outside is good for a child's brain. Scientific research now supports the notion that spending time outside is vital to a child's healthy development (Louv, 2005). Our team considered all of these benefits when we designed our curriculum, and we are excited to be a part of our community's efforts to get kids outside as much as possible.

School gardens provide an opportunity for more kids to get outside during the school day, including the time spent during after-school programs. School gardens can be used like living laboratories, and are a fun place to learn in a hands-on way. Gardens also provide opportunities to learn much more than just science. Our lessons include activities that incorporate science, engineering, math, music and art. We also include multiple learning modalities, which incorporate strengths from all eight of Howard Gardner's "intelligences" (including the most recently added naturalistic intelligence).

Throughout our lessons, we often invite students to use as many of their senses as possible. Expanding sensory awareness is one of the underpinning goals of our project. By tending to the garden over an extended period of time, and paying close attention to the changes that take place, we hope to teach patience and increased awareness of the natural cycle.

As teachers, we strive to practice an engaged pedagogy, which requires teachers to participate in the learning process as fully as they ask their students to. By participating alongside students, teachers allow themselves to be viewed as whole individuals on their own path to self-actualization. This holistic approach honors both students and teachers as complex individuals. To prepare ourselves to teach children in all the ways mentioned above, we practiced routines that strengthened our own relationships to the natural world. We sat for a time in nature, each in our own special spots, observing and tuning in to the natural cycles that occur both within us and around us. For ten weeks, we learned not only from books, but from ourselves, our peers, the world around us, and from individuals already practicing engaged pedagogy in environmental education. The effect that this teaching style had on us as students further reinforced our desire to teach in this manner ourselves. We felt the difference that having an engaged educator makes, and we have been inspired to do the same for others.

Background

The Cultivating Connections curricula shares a common theme of phenology. Not to worry! Just because it's a fancy science word, doesn't mean you should be intimidated to teach these lessons. They're actually quite fun! You're probably more familiar with phenology than you may realize. Have you ever seen mountain snowpack melt into a river in March and April? Have you ever smelled the fragrance of a late summer sunflower? Have you ever heard the wind blow the autumn-changed leaves off the branches of a maple tree? Have you felt the temperature drop during the winter? These are all common occurrences for each of the four seasons. We united these lessons by focusing on spring phenology.

Phenology is commonly known as nature's calendar. Merriam-Webster defines phenology as 1: a branch of science dealing with the relations between climate and periodic biological phenomena; 2: a periodic biological phenomena that are correlated with climatic conditions. Common examples of spring phenology are bird migration patterns, the sprouting growth of leaves and flowers, thawing of the frozen snow or frost covered surfaces, rising temperatures, increasingly longer daylight hours, balanced precipitation and sunlight cycles, the immersion of blooming flowers, the hatching of eggs, the birth of new generations, the nursing of young, and pollination by a variety of pollinators.

Although the following lesson plans focus on spring phenology, it is imperative to emphasize the seasons cyclically and holistically. The patterns in one season have direct consequences in the next season. For an example that is specific to the Pacific Northwest, a winter that experiences heavy snowfall and freezing temperatures will result in much more snowpack that defrosts into meltwater in the spring. A wetter winter will cause spring rivers to have higher water levels, which may delay the hot and dry season of the summer. However, it is important to teach phenology as a system that is cyclical and heavily interdependent on the entirety and wholeness of a system.

So what does phenology look like in the Pacific Northwest? This region is characterized by the Cascade Mountain Range that acts as a natural barrier between two climates. On the western side of the mountains along the Pacific coast is a temperate rainforest. The eastern side of the range is known as a high elevation, arid rangeland. Most of the region's climate zones range from coastal marine to high alpine to semi arid steppe. The region is dependent on snowpack and subsequent snowmelt for regional water supplies. Increased temperatures during the cold

season have caused snow to precipitate as rain and warmer temperatures have lead to earlier snowmelt. In the past the pacific northwest has experienced considerably dry winters causing spring to come earlier, which lead to more hot, dry and dangerous wildfires.

Sockeye salmon have also played a key role in the history of the region, specifically to the ecology, economy, and environment. Their migration through the Columbia River and its associated tributaries help replenish their spawning grounds with a new batch of eggs which will spawn into mature salmon, as well as provide a food source to a variety of wildlife, including humans. Due to warmer temperatures, however, the upstream migration survival rate has decreased.

In addition, warmer temperatures have also caused flowers such as lilacs and honeysuckles to bloom earlier, corresponding to the pulse of spring snowmelt. The water coming downstream carries large quantities of rich sediment that is beneficial for soils, and replenishes the fresh water supply. The soil absorbs as much water and nutrients as possible. In response, the plants consume this readily available supply of nutrients and water developing earlier. Bird breeding behavior has also witnessed some changes due to rising temperatures. Northern Flickers were studied to prove that they began to nest and lay eggs earlier in warmer temperatures.

Phenology is an incredibly interconnected system, and we observe these occurrences so we can better understand seasonal patterns and their consequences. Although warmer temperatures have been the trend in the last decade or so this past winter 2017 has proved the trend otherwise. This winter has been colder and has had more precipitation than the past two winters combined. As garden educators we will can help students become aware of these patterns and assist with them keeping track of these changes in their journals.

STE(A)M Journals

RATIONALE

The journals are a place for students to log and track data throughout the duration of the lesson sequence. With this structure, students engage in routine data collection, analysis, and graphing. The journals are a routine included in each lesson, ensuring students engage in hands-on experience with three of the five **STE(A)M** (Science, Technology, Engineering, Art, and Math) subjects within the garden.

Science: Students observe the effect weather has on our gardens, using their journals to log and and graph daily variances.
Technology: Students use thermometers, rain gauges, and rulers to measure temperature, rainfall and plant growth.
Math: Before we graph our data points we allow students to discuss their findings, as scientists do! Students will learn how to average the data in order to account for the varying data points.
Art: Students get to decorate their journals and create a visual bar graph.

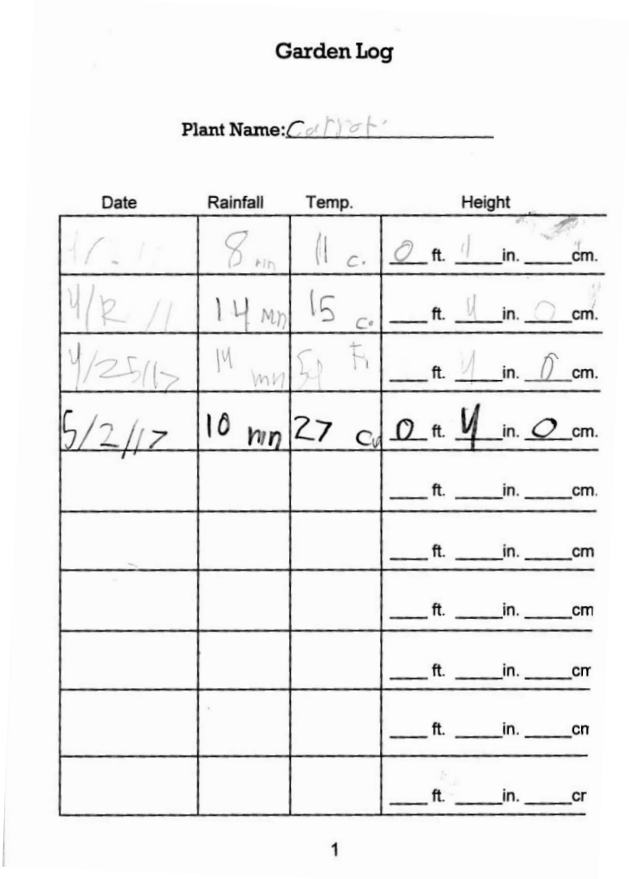
JOURNAL ACTIVITY OVERVIEW

The first day that you introduce journals will take the longest. To begin, give students context for the journals: they will be collecting data every garden session and graphing that data in order to make observations about the garden. Tailor this introduction to the age group you are working with. In general, the purpose of the journals is for students to practice being scientists.

Walk through the journals with your students, highlighting the parts of it you will be using. The first two pages contain the tables which they will use every session for recording data. Some pages have graphing grids which you may or may not use, depending on the abilities of your students. Some pages are blank, allowing room for answering prompts and making sketches.

If you have time, give your students approximately 10 minutes to decorate the covers of their journals. Personalizing their journals will give them a chance to be artistic, to feel ownership of their journals, and to build excitement for using their journals in the future.

Introduce the other tools to your students. You will be using rulers (with centimeters), a rain gauge, and a thermometer (one that displays both Celsius and Fahrenheit will add complexity). Clarify the units of measure for each of these tools.



Garden Log

Plant Name: Carrot

Date	Rainfall	Temp.	Height
4/18	8 mm	11 c.	0 ft. 1 in. ____ cm.
4/25/17	14 mm	15 c.	____ ft. 1 in. 0 cm.
4/25/17	14 mm	Fri	____ ft. 1 in. 0 cm.
5/2/17	10 mm	27 c	0 ft. 4 in. 0 cm.
			____ ft. ____ in. ____ cm.
			____ ft. ____ in. ____ cm
			____ ft. ____ in. ____ cm
			____ ft. ____ in. ____ cm
			____ ft. ____ in. ____ cm
			____ ft. ____ in. ____ cm

1

As a teacher, you should decide if your students will be choosing their own plants to measure, or if the class will choose two to measure together, or if you would prefer to select the plants yourself. When you have decided which plants to measure, help your students write the plant names on pages 1 and 2.

Now your students are ready to begin taking down data! The first thing students should always do is write down the date. Then, you can work together as a group or split into two (or four) teams, depending on the age of your students, the number of students you have, and the number of facilitators you have.

Help the students to collect data at each station. There will be a rain gauge station, a thermometer station, and two plant stations. (The rain gauge station will not have any rain in it today, and that is okay. Students can mark a zero or a dash to indicate that there is no data available.) Again, today's session will take the longest, as students learn the proper methods for collecting data at each station.

For accurate measurements: the rain gauge should remain in the ground, placed level so the reading is accurate. The thermometer should either be installed at child's eye-level, or held up straight and level with the eye. Students should not put their fingers over the temperature gauge to try and warm it up. To measure the plants, place one ruler straight and vertical, with the base touching the soil but not buried. The second ruler should be carefully held level and horizontal, touching but not bending the tallest part of the plant. Where this second ruler

meets the first gives a visual indication of how tall the plant is. (Rulers make a T shape.)

When students have all recorded all four data points, bring the class back together to review the findings and graph the data. For older students, you can use this opportunity to discuss ambiguity in data collection, and what scientists do when they disagree. If all the students recorded the same data, then chances are good that the data is trustworthy. If there is disagreement, discuss it. Minor differences in data are averaged (ex: half the class got 78 degrees and half got 80 degrees: the average of 79 degrees is recorded). When measurements are off by more than 1-2 points, this can be discussed further until the class reaches a consensus on what data to record on the graph. This discussion does not need to last more than 1-2 minutes per data piece.

When it is time to graph a data point, use a flip-chart and record the data. We strongly suggest making a bar graph. For example: temperature, degrees (Fahrenheit or Celsius) are on the Y-axis, and the dates of your garden session are on the X-axis. Depending on the ability of your students, you can either graph the data points for them, or have students do it by alternating roles or asking for volunteers. When you are done graphing the day's data, you are done with the journal activity for the day. To use the journals more, or to add complexity to your lesson, each lesson plan includes an optional prompt which pertains to that day's lesson.

On subsequent days, the journal activity will follow a pattern much like the first day. First you will pass out the journals, make sure that students are writing in the correct date and that they are on the correct page. Then, you can split your group into teams (if desired) and send them to any station to start. Each group will rotate stations to record data of all four things: rainfall, temperature, and the height of two different plants. When they are done at each station, bring your group back together to compare and discuss the data they collected. Graph the data on your flipchart graphs. You can also take a moment to notice significant trends or changes. Our lesson plans include time to analyze the data at the end of the sequence.

Spring Weather Brings Garden Treasures

Noticing Growth in the Garden

Day 1 of Cultivating Connections Spring Sequence

Bianca Flynn & Trisha Maxfield – UO Environmental Leadership Program – 2017

Target Grade Level
1st - 5th grade

Essential Question
What elements of spring weather make plants grow?

Objectives
By the end of this activity, students will be able to:

- Explain 3 elements of spring weather that influence plant growth
- List & describe 2 resources used to observe or track growth in the garden

STE(A)M Integration

Art: Decorating journals.

Science: Observation & data tracking

NGSS Performance Expectation
3-ESS2-1 Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Lesson Length
60 minutes

Offsite Prep
15-30 minutes

Onsite Prep
10 minutes

Summary

This activity introduces 1st - 5th grade students to weather patterns and their effect on local gardens, using interactive storytelling, an art project, and journaling. By teaching students how to identify spring weather patterns they will observe how sunlight, rainfall, and temperature influence plants in the garden. Students will use journals, thermometers, rain gauges, and rulers/measuring sticks to measure and track data. The journals are a place for students to log the data they gather through measuring plants, rainfall, and temperature. Students will get in the habit of routine data collection, analysis, and graphing.

Rationale

The activities in this lesson allow students to make connections to local spring weather conditions through observation and data tracking. Being knowledgeable of spring weather patterns will empower students to think critically about their local garden environment, and enhance their sense of place. Journaling is one method of inciting critical thinking and awareness of the environment. Whether students are tracking plant growth, or writing a reflections about what habitats students observed in the garden, they will develop a keen sense of awareness of patterns that occur in the natural world.

Background

Gardens flourish under specific weather conditions. Rain, sunlight, and a temperate climate are beneficial for plant growth in the garden. Spring weather in the Pacific Northwest provides hospitable conditions for the garden. The warmer, wet weather and longer days encourage plants to start their journey to becoming fully grown plants. Tracking how the plants grow in relation to spring weather will allow students to see a connection between the garden and the climate in the

Preparation for Lesson

1. Print the journal double sided; 1 journal per student. Align pages and use construction paper as the outside cover. Fold journals in half, and staple.

2. Place rain gauge in a space that is open and allows for rain capture.

3. Place thermometer in accessible location.

4. Draw a graph outline on the flip-chart for rain, temperature and two-plants.

Materials

- Spring Weather Story (attached)
- 1 pencil per student
- Abundance of markers
- 4 rulers or yardsticks
- 1 journal per student (Attached)
- Graphing flip-chart
- Construction paper (1 per student)
- Thermometer
- Rain Gauge

Key Vocabulary

- Weather elements
- Hospitable

Evidence of Learning

- Datalog
- Data graph

Garden Connection

Plant Growth

Pacific Northwest.

This lesson compares rain, temperature and sunlight, and explores their role in the garden. The water that plants get from the rain helps transport vital nutrients through the plant. Pollination is a phenological stage that is greatly affected by extreme temperatures, and this can act as a major impediment to plant growth and production. Lastly, sunlight gives plants the energy that they need to grow.

Procedure

Introduction (5 minutes)

Ask students to come together in a circle. Go over the plan for the day, mentioning we will listen to an interactive story to learn about spring weather, we will introduce journals, flip-chart graphs, rulers, rain gauges, and thermometers, going over how to use them as a measuring tool and how to read the measurements. Explain to the students how we will be using these tools to make observations and log plant growth in the garden over the next 5 weeks. Then we will look at the thermometer, the rain gauge, and measure plant height, before entering the data in our journals using the datalog. After everyone has a chance to log the data we will circle-up and discuss our findings before graphing the data on our flip chart. Tell the students that as we log data about weather and garden growth, we are practicing being scientists, in order to have a better understanding of why the garden grows.

Interactive Storytelling (10 minutes)

Inspire students with *The Season of Life* story. It involves participation through a role-play activity that teaches participants how the specified weather elements influence plants in the garden. One facilitator will read the story, while the other facilitator will act out the sounds and motions students can mimic throughout the story. The facilitator may divide roles amongst the students (i.e. one student is the sun, one student can make rain sounds, and the rest can pretend to be plants). The lead instructor can also opt to use hand gestures to help students identify when students can act out part of the story. Both facilitators should maintain high energy levels and enthusiasm to keep the students engaged. There are no definitive motions to go with the story, facilitators should be animated and do what feels intuitive when acting out gestures. Facilitators can refer to the bolded words and phrases as a cue for hand gestures if guidance is needed.Use *The Season of Life* story (attached at the end) as a basis for the level of detail this lesson will explore.

1. Have students sit or stand in a circle on the ground and let them know they will hear a story about rain, temperature and sunlight in spring.
2. Inform students they should listen closely because their help is needed to tell the story. You can give a practice scenario, (ie. Rainfall is frequently mentioned throughout the story), and ask the kids to practice the sounds and hand motions for rain. You could also have the students demonstrate a hand motion for the sun. Various ways of interpreting sounds and motions during the story are acceptable.
3. Tell the students to listen closely and make observations, and ask the group if they have any questions
4. Let students know when you count down from 3,2,1 on your hands, at 1 they should plant both feet on the ground and remain silent until the next action.
5. Read *The Season of Life* and refer to one of the two stories provided, depending on the grade level of the students.

Art Activity (10 minutes)

Introduce the journal to students by explaining that they will use it as a tool to keep track of the temperature using a thermometer, rainfall using a rain gauge, and height using rulers. If the plant is really tall, they can use yard sticks.

1. Mention to students we will take the next 10 minutes to decorate the cover of their journal using markers, mentioning they will need to write their name on the front of their journals, as we will collect these after each lesson.
2. Ask if there are any questions
3. Have children select which markers they would like to use
4. Have them seek out a flat surface they can color on
5. Watch the time and give children a 1 minute warning
6. When the time is up, have students come back to the circle for the next set of instructions

Journal Activity (15-20 minutes)

Inform students we will track the growth of two pre-selected plants for the duration of the program. We will rotate between measuring stations, then come together to discuss our findings.

1. Have students open their journals to page 1.
2. Have them write down the names of the two pre-selected plants.
3. Have students write in the date on their data log.
4. Ask students if they have any questions.
5. Split the students into 4 groups, one group for each measuring station (2 groups can work as well, do what seems intuitive for the size of the class).

6. Give each group 2 rulers and assign each group to a station.
7. Have students document their findings at each station.
8. Once the groups have rotated through all of the stations, have students come back to the circle to discuss the data.
9. Ask for a volunteer with a quiet hand to share the data they got and open the discussion to the group.
10. Take a rough group average and either assign a role or ask for a volunteer to help graph the data on the flip-chart. Do this for all four graphs.
11. Mention to students we will be discussing the growth of our plants in relation to the weather during our last session.

TO SIMPLIFY

For younger age groups, consider making the measurements and recording results as a whole group, taking volunteers to perform each task.

TO ADD COMPLEXITY

Provide the following prompt for students to answer in a blank page in their journals: *What kind of weather do you think plants need to grow?*

Wrap-up (10 minutes)

Have students circle up for assessment activity. In order to assess understanding participants will use the thumbs up/thumbs down approach. Educators will ask questions meant to incite critical thinking (adapt for different age groups).

- *"What are you excited to see in the garden this spring? Are there specific things you want to look for?"* (i.e. evidence of pests, friends of the garden, plant growth, etc.)
- *"Based on the story, why do you think we need to look after the garden? Why can't we just leave the garden alone?*
- *"Based on the story, what do rain and sun do for plants?"*
- *"Why are we tracking the plant growth in the garden?"*

Have students find a partner and spend 3 minutes sharing what they have learned about ideal weather conditions for the garden. Give 1 minute warning as time lapses. Regain students attention using techniques such as "clap once if you can hear me, etc."

Explain to students the next questions are verbal response and your curious if anyone can make connections to other information they have learned, either through experience or in school.

- *"Can anyone tell me what else helps plants grow besides weather?"* (soil, worms, Co2)
- *"Can anyone tell me what happens to plants during winter?"* (dormant, unable to survive because of cold temp.)
- *"Who can tell me why spring is the optimal season for plant growth?"* (perfect mixture of rain, sun, and warmth)

- *"How can you observe and track plant growth in the garden?"* (measuring sticks, journals.)

Adaptations

To simplify:

- Only select one plant.

To add complexity:

- Have students calculate the average of all the data sets from the group.
- Have students pick their own two plants, have them graph the data in their journal on pages 3-6.
- Have students look up weekly weather patterns on the internet, have them create a log in the back of their journal.

Rainy Day:

Use the internet to look up weather for the day, have students estimate how much their plants have grown.

Adapted From

A Wild Seed Story: A Year in the Life of a Meadow

"How Much Sunlight is Needed to Grow Carrots?".*SF Gate.* Hearst Communications Inc. Web. 20 March. 2017

"Tips for Growing Dandelion." *Global Healing Center.* Web. 20 March. 2017

"How to Grow Arugula in the Pacific Northwest. *Northwest Edible Life.* 30 January. 2014 Web. 20 March. 2017

The Season of Life*: Adapted from *A Wild Seed Story

1. As winter comes to an end, each and every day, the sun rises a little higher into the sky. As the days grow longer plants and animals look forward to warmer and sunnier days.

2. As the temperature gets warmer, **plants take a peek out** from the blanket of soil and come to find a world bustling with life. Now, all the snow and frost have melted, animals come out of hibernation and seedlings embark on their journey into full grown plants.

3. The first day of spring marks the middle of the sun's journey in the sky, and the heat that the sun gives off is not as strong as in summer, or as weak as in winter. The sun gives energy for the **plants to soak up** and turn into food, and **springtime showers pour water** for the plants' roots to drink.

4. The life of plant, however, is not an easy one, and even though springtime creates healthy weather conditions for the plants to grow, different plants need different levels of sun and water, and spring weather patterns can be unpredictable.

5. Some days, the temperature is very cold, and **hale drops** on the plants below. The chilly weather can make the plants **wilted and bent** as they **hunch over to stay warm.**

6. Sometimes, **rain** does not come for days, and the plants and soil become **dry and thirsty.**

7. Some days, the weather is just right, and plants receive healthy amounts of food and water for the garden to flourish. When the **sun is out**, the plants' bright green leaves **face up towards the sky**, like **hands trying to catch the sun's rays.**
8. When it rains, the **roots spread deep into the ground**, and these roots slurp up the **water like little straws**. As the roots get deeper and stronger, they protect the plants from blowing away in the wind or washing away from too much rain.
9. Spring weather can be very unpredictable, and it does not always help the plants grow. But when it is too dry, we can water the plants, and when it is too rainy, we can cover the plants to protect them. As caretakers of the garden, we help the garden survive, just like the garden helps us.

Garden Log

Plant Name:_____

Date	Rainfall	Temp.	Height
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.

Garden Log

Plant Name:_____

Date	Rainfall	Temp.	Height
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
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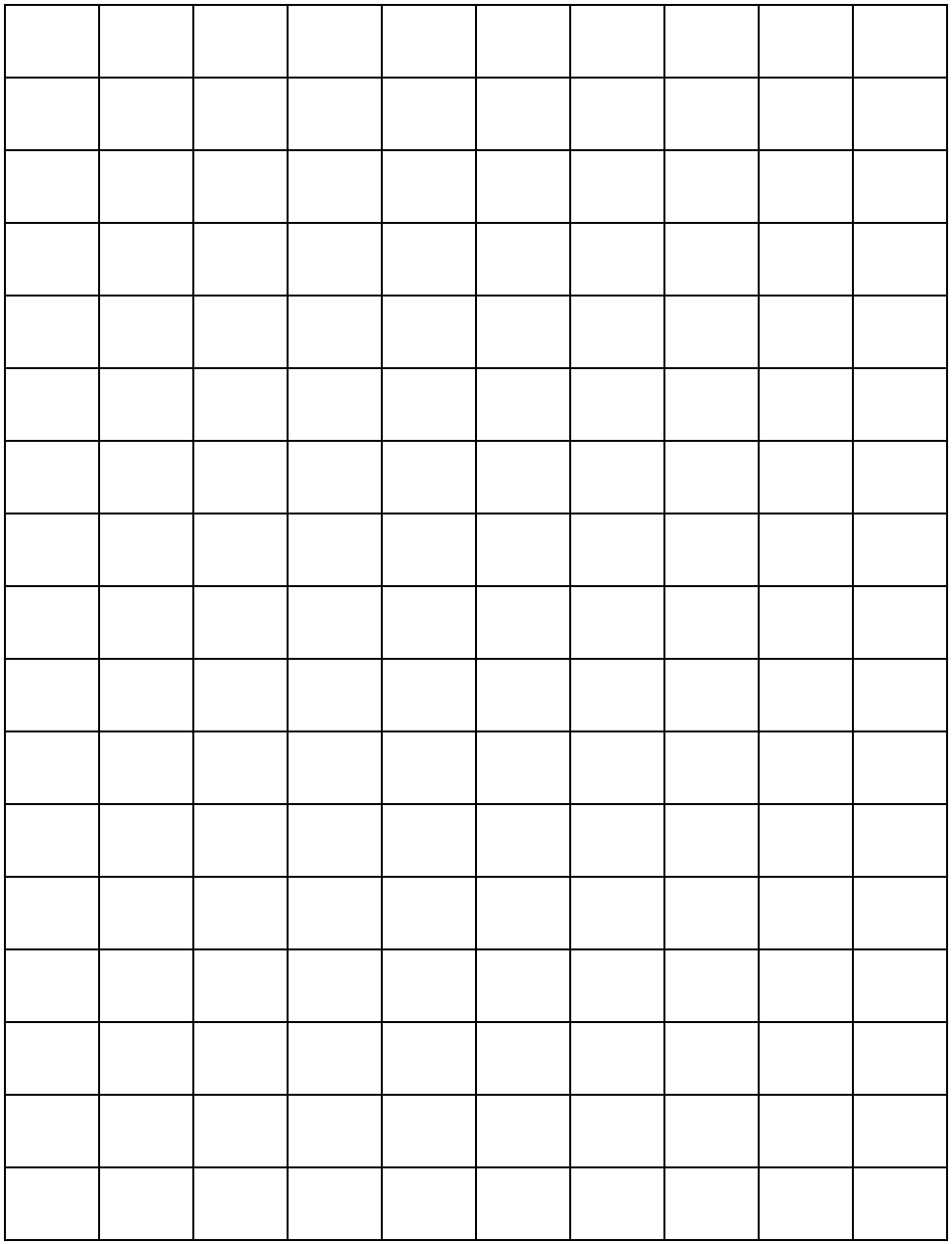
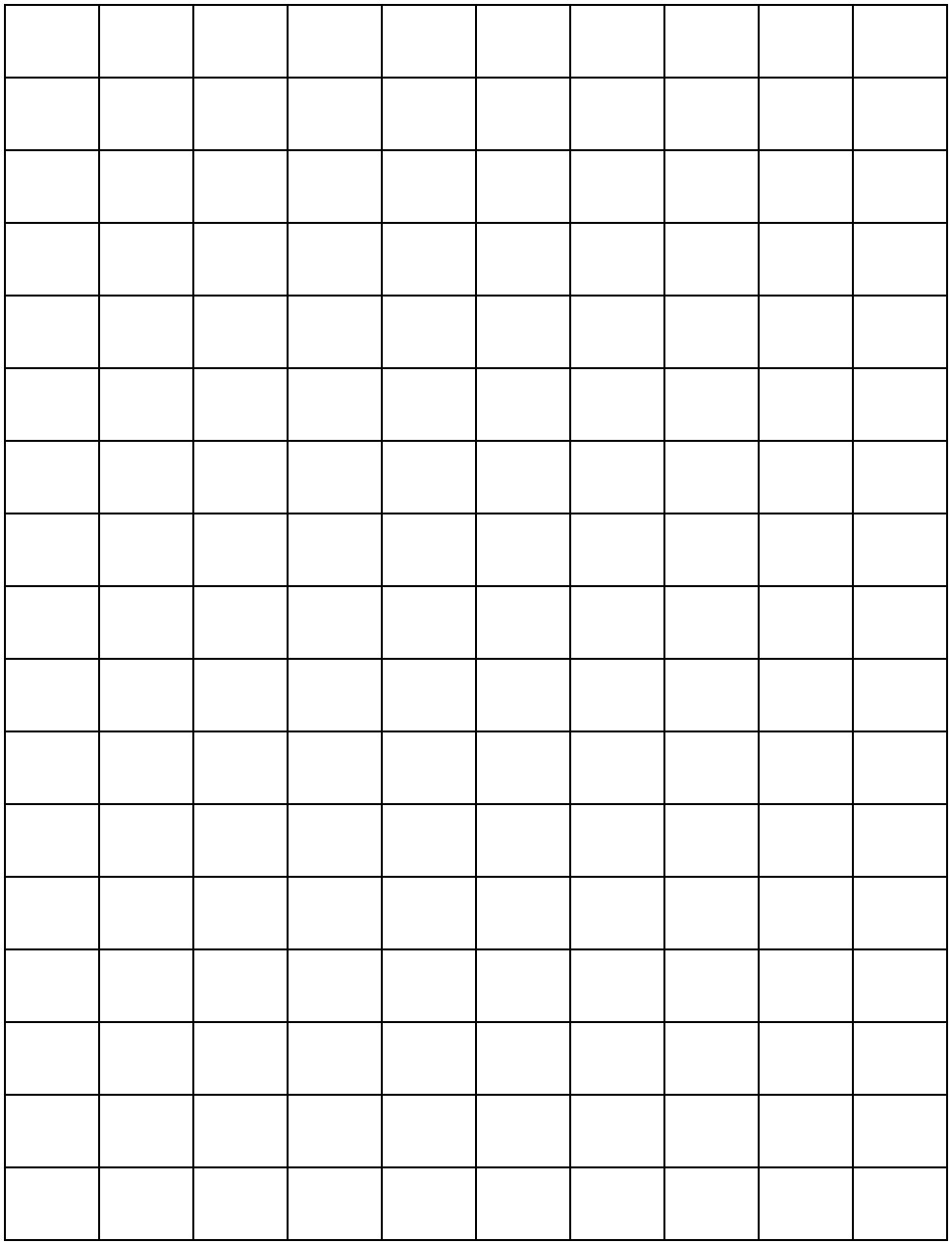
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.
			____ ft. _____in. _____cm.

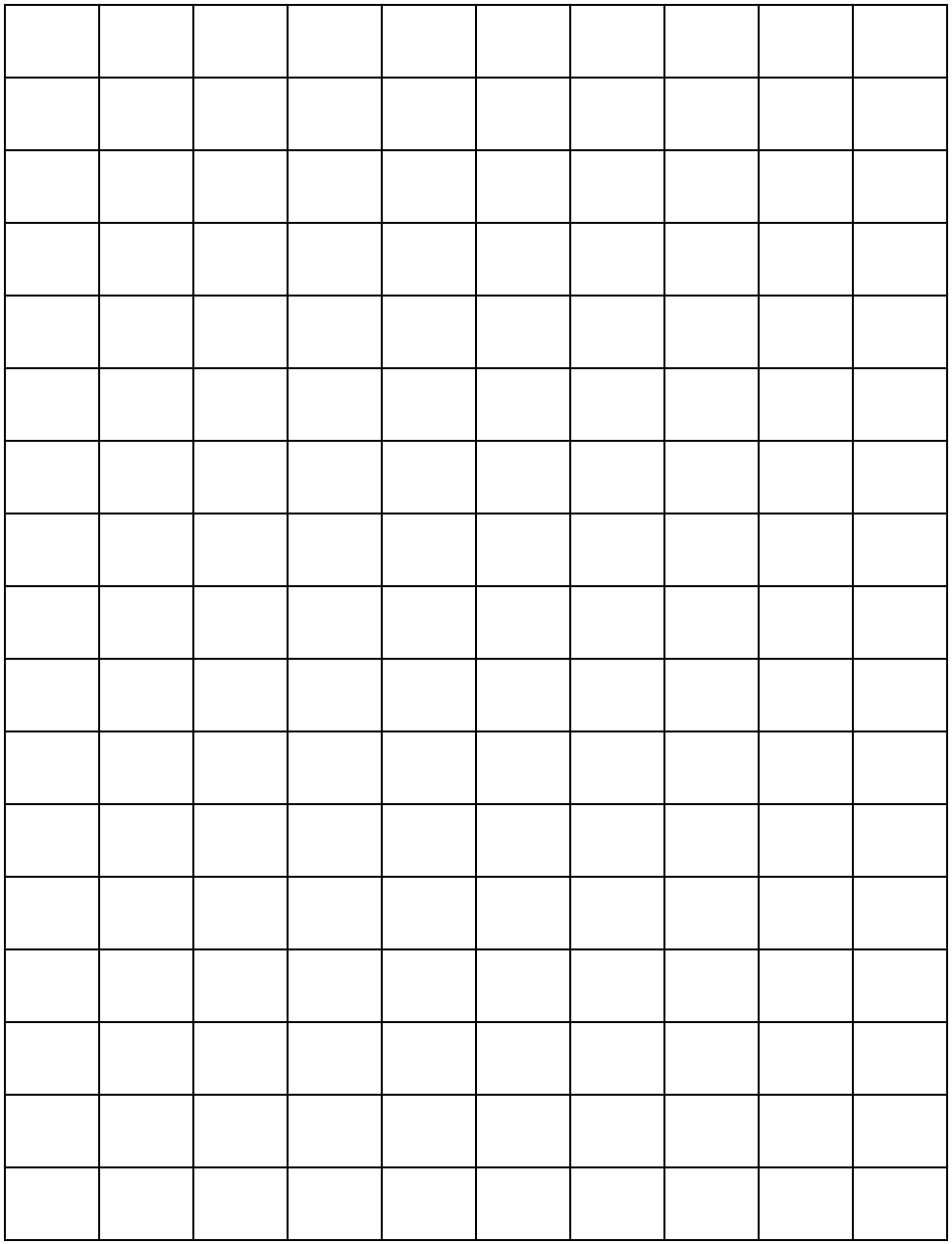
Rain Graph



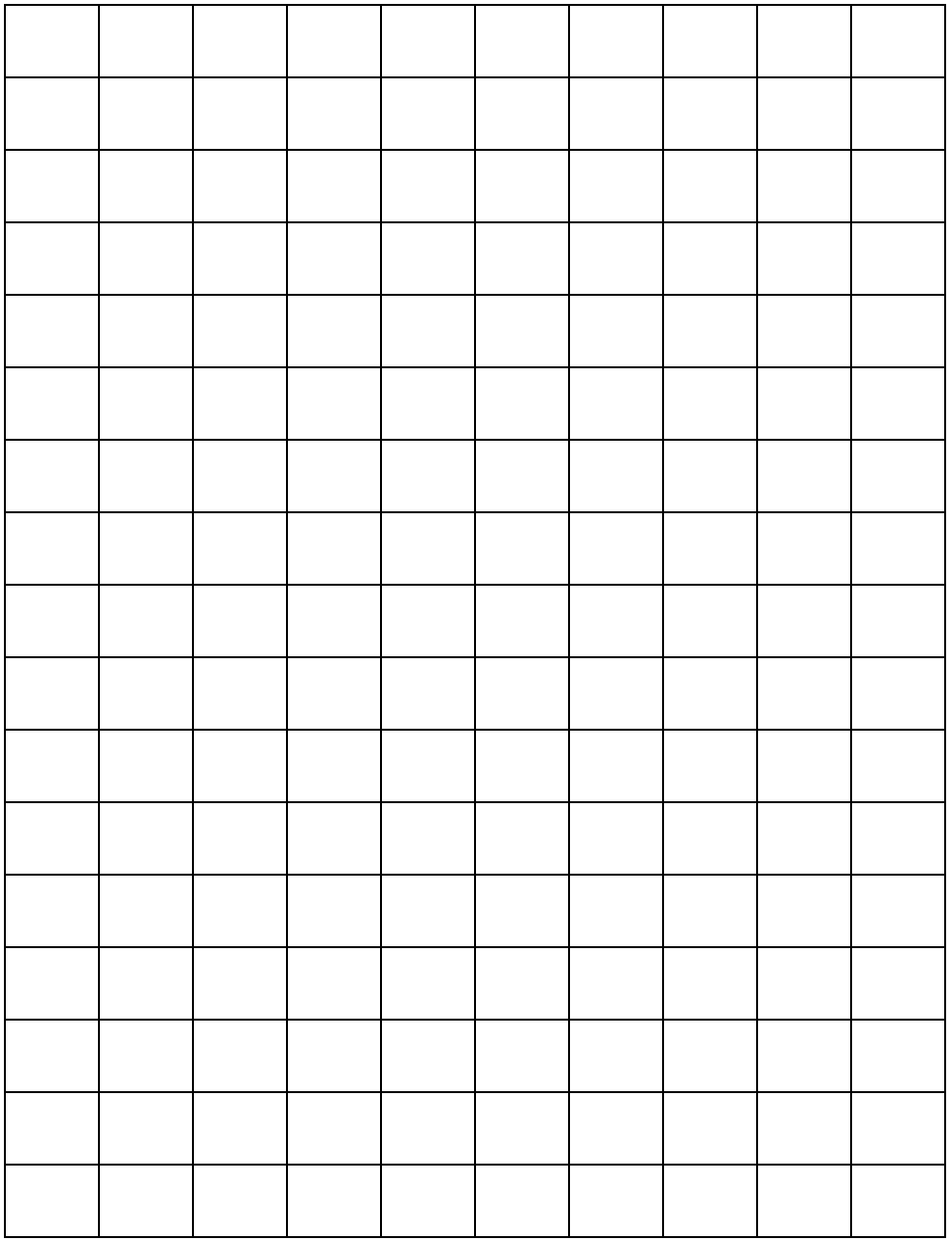
Temperature Graph



Plant #1



Plant #2



The Purpose of Pollen

Noticing Pollination in the Garden

Day 2 of Cultivating Connections Spring Sequence

Kaelin Oppedal - University of Oregon Environmental Leadership Program - 2017

Target Grade Level
1st - 5th grade

Objectives
By the end of this activity, students will be able to:

- Identify the stigma and anthers and explain their functions
- Define pollination and explain when it occurs
- Describe 2 methods of pollination

STE(A)M Integration

Art: journals, singing

Science: observation & data tracking, plant part identification, pollination song

NGSS Performance Expectation

2-LS2-2 Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

4LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction

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Lesson Length
60 minutes

Summary

This session introduces 1st - 5th grade students to pollination through a series of hands-on activities, addressing the essential question: *What is pollination?* During this lesson, students will learn about the reason why plants flower and how they are pollinated. Through four activities (singing, acting out wind pollination, pollination tag and flower dissection), students will come to understand and observe the amazing process of plant reproduction!

Rationale

The activities clarify the interdependence between plants and pollinators, and illustrate the ways in which flower structure functions to support reproduction. By engaging students' minds and bodies in learning, they develop a fuller, better-rounded understanding of pollination and how it connects to them in relation to the food grown in their school gardens, as well as the food they see in the grocery store. This fosters a deeper connection between the child and nature's processes, by illustrating human dependence on food and therefore pollination.

Background

Materials

- Flowers (1 per student - one with obvious male and female parts. *ex*: rhododendron)
- Flower part sorting mats (1 per student) ***OR***
- Flower part coloring worksheets (1 per student)
- Cinnamon (about 1 tsp for each pair of students)
- Double sided-tape
- Fake flowers (1 per student - one with a prominent stigma)
- Pompoms (multicolored. Enough for each cup to have 5 of the same color)
- Cups (1 per student)
- Journals (from Day 1)
- Student measuring sticks (from Day 1)
- Rain guage
- Thermometer

Preparation for Lesson

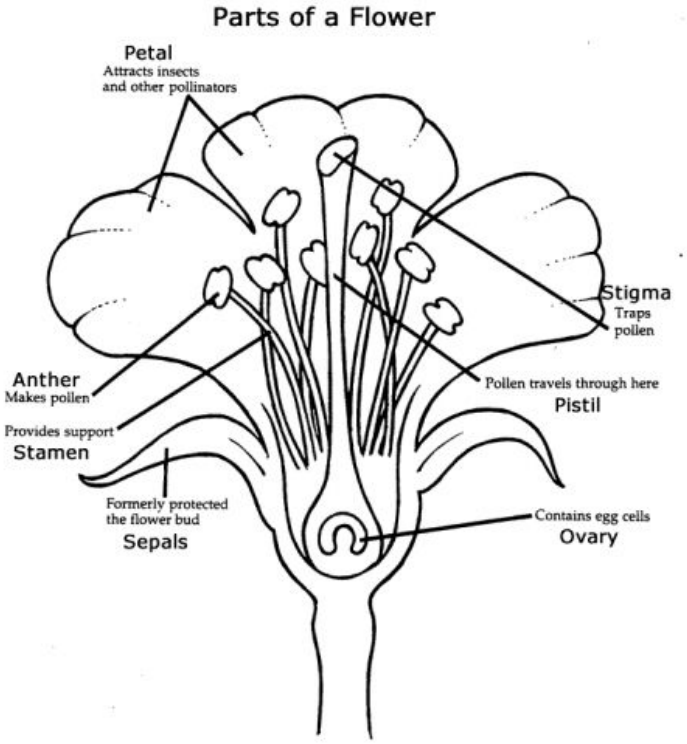
1. Wrap the stigmas of the fake flowers in double sided tape.

2. Draw a flower diagram on a board or a flip chart with labels. If drawing is not your strong suit, feel free to display the flower diagram on a projector screen before you go outside.

3. Prepare cups for pollination game: Put 5 pompoms in each cup. Within each cup the color of the pompoms should be the same, but each cup should contain a different color.

4. Print enough flower sorting mats or coloring activity sheets for each student (depending on which activity you choose to facilitate).

5. Write or display song lyrics



Pollination refers to the process in which pollen grains from the stamen of one flower are transferred to the stigma of the same or a different flower. This can happen with the assistance of wind, or more efficiently with the help of a variety of different pollinators, including insects such as bees, moths, butterflies, beetles and flies, as well as an array of birds and mammals.

Flowers and pollinators work together for mutual benefit. The flower attracts the pollinator with its bright colors and intricate patterns. This is how a flower communicates the presence of delicious nectar, in exchange for fertilization assistance. The bee, for example, is lured to the flower while seeking its food, and in the process of collecting the nectar, bumps into the male parts of the flower: the anthers that sit atop the stamen. Pollen from the anther sticks to the bee, and travels with it as it buzzes from flower to flower collecting food. The bee will rub up against the female part of another flower: the stigma, and deposit the pollen. The pollen grains then travel down through the pistil to the ovary at the base of the flower, where the eggs are stored. Once pollen and the egg meet, seeds form, and eventually end up inside of the plant's fruit, which is then eaten, digested and excreted by animals, distributing seeds so that they may grow into plants themselves.

Key Vocabulary

- Pollination
- Stigma
- Anther
- Pollen

Evidence of Learning

- Flower dissection (part identification)
- Articulate the pollination process

Garden Related Activities

- Pollinator song
- Pollination game
- Wind pollination activity
- Flower dissection/ coloring activity

Procedure

Introduction (5-10 minutes)

1. Welcome the group to the garden.
2. Have the students close their eyes and take a deep breath.
3. Have them take a moment of gratitude to think about what they are thankful for, and offer them the chance to share with the group.
4. To begin the lesson, ask the students what they learned last session about what happens in spring. Ask them to name signs of spring, and note the weather associated with the season.
5. Explain to the students that they will be learning about pollination and flower parts associated with this process.
6. Explain that the next task is to explore these concepts in their own garden.

Journal Activity (10 minutes)

Inform students we will be measuring plant growth, rainfall, and temperature for the day. We will rotate between measuring stations, then come together to discuss our findings.

1. Have students open their journals to page 1.
2. Have students write in the date on their data log.
3. Ask students if they have any questions.
4. Split the students into 4 groups, one group for each measuring station (2 groups can work as well, do what seems intuitive for the size of the class).
5. Give each group 2 rulers and assign each group to a station.
6. Have students document their findings at each station
7. Once the groups have rotated through all of the stations, have students come back to the circle to discuss the data.
8. Ask for a volunteer with a quiet hand to share the data they got and open the discussion to the group.
9. Take a rough group average and either assign a role or ask for a volunteer to help graph the data on the flip-chart. Do this for all four graphs.

TO SIMPLIFY

For younger age groups, consider making the measurements and recording results as a whole group, taking volunteers to perform each task.

TO ADD COMPLEXITY

Provide the following prompt for students to answer in a blank page in their journals: *How many different flowers do you see? Choose one and describe its parts and draw a picture of it. Write down other observations that might be important to the flowers such as temperature and weather.*

1. Transition into the lesson by asking the students if anyone knows the names of the parts of a flower.
2. Ask them if they know what pollination is and how it works.
3. Use your diagram of a cross cut flower to explain each of the parts and what they do. Use a real flower to make the connection.
4. Teach the following song (to the tune of The Itsy Bitsy Spider) pointing to the words as you go, to familiarize them with the vocabulary:

Pollinator Song:

Flowers must be fertilized in order to make seeds
They rely on pollinators to do this special deed
They attract the birds and bees with nectar and bright colors
Who transfer pollen from their anthers to the stigmas of the others.

From the stigma down the pistil and then to the ovary
Where the pollen meets an egg and then becomes a brand new seed!

Pollination Game (10 minutes)

1. Tell the students that you need their help setting up the game. Give each student a cup of pompoms and ask them to go place it in a grassy area within a set of boundaries determined by you, and return to you when they are finished.
2. Explain that they will be acting as bees and will be "pollinating" the flowers by taking a pompom from one flower and putting it in the cup of another flower. Encourage them to take on the animal form of the bee by flapping their wings and buzzing.
3. Have the honey bees all start in one place, and call it the hive. Tell them that once they have pollinated all of the flowers they must report back to you, the queen bee.
4. Release the honey bees to pollinate the flowers.
5. When all the bees have returned to the hive, collect the cups and ask the students what they notice about the pompoms. They should tell you that they have several different colors in their cups now. Explain that this shows how pollen moves from flower to flower with the help of pollinators like bees.

Optional:

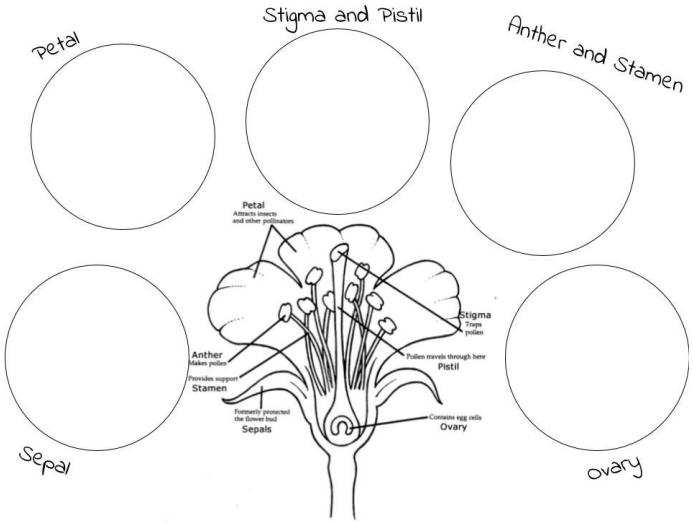
Incorporate the challenge of wind pollination by selecting a few students to act as wind, who will need to try to toss their pompoms into the cup from 3 large steps away. Use failed attempts as an opportunity to explain that while wind sometimes works, pollinators are much more efficient.

Assessing Understanding

(15-20 minutes)

In order to assess students' understanding of the reproductive flower parts, perform a flower dissection activity.

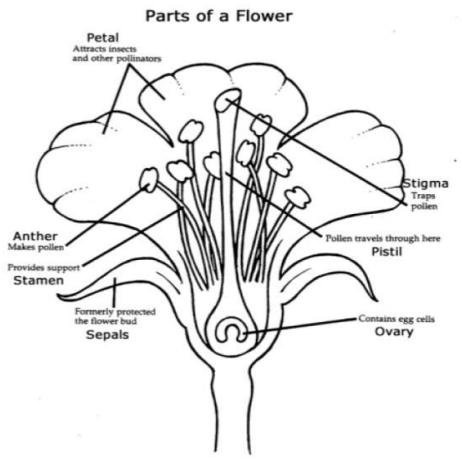
1. Supply each student with a real flower and a flower part sorting mat (attached):



2. Show the students how to gently separate each part of the flower. Then instruct the students to carefully take apart their own flowers and divide them into the parts they learned about at the beginning of the session.
3. Ask them to place each part in the respective circle on their mat. Encourage them to look for pollen on the anthers, and to break open the ovary to look for egg cells.
4. While they are working, help them dissect and identify, probing them with questions such as: *"What do you think this part is? What does it do? Does pollen come from this part (anther) or this part (stigma)?"*
5. Ask them to raise their hands when they are done so you can check their work. Take note of the number of successes/failures.
6. Come back together once everyone is finished to explain the correct identification.

TO SIMPLIFY:

If flowers are unavailable or students are having trouble staying on task, consider a coloring activity as an alternative assessment (see attachment).



PETAL
STIGMA
PISTIL
OVARY
ANTHER
STAMEN
SEPALS

1. Instruct the students to fill in the each part of the flower with a different color, and to shade the bubble word that matches the part with the same color. Be very clear about this, coloring with rules might be a new concept to them.
2. Walk around while they color and assist them where necessary. Ask them probing questions like: *"Can you show me where the _____ is? Do you know what part does ____?"*
3. When they are finished, allow them to wander and follow their curiosities, looking around the garden for plant parts and pollinators, carrying their colored diagrams with them.

Wrap-up (5 minutes)

1. Have the children gather around in a sharing circle, and ask them what they learned today. When they say pollination, ask them what that is. How many pollinators can they think of? Can they remember the two ways flowers are pollinated? How about which part of the flower pollen comes from? How do flowers and pollinators benefit each other? Record their responses in writing and use them to evaluate the success of your lesson. Were the learning outcomes met?
2. Ask them what their favorite part of the day was. Use their feedback to self-evaluate.
3. Invite the students to keep an eye out for pollinators like bees and hummingbirds in the garden and around the neighborhood, as they will be learning more about pollinators next week. Ask them to report back to you next time you meet to tell you what they saw the pollinators doing in order to smoothly transition into the next lesson.

Supplementary Materials

- On a rainy day, consider playing this short (2:40) stop-motion video that simply illustrates the symbiotic relationship between flowers and pollinators:

  Pollination Lesson with Stop Motion Science Animation for Kids. Dir. Lucas Miller. *Stop Motion Science*. YouTube, 30 Mar. 2012. Web. 16 Feb. 2017. https://www.youtube.com/watch?v=zy3r1zlC_IU

Outdoor Wind Pollination Activity (5-10 minutes)

1. Ask students to split into pairs. One student is the wind and the other gets to hold the flower.
2. Hand out pre-taped fake flowers, one per pair.
3. Ask them to stand 3 steps away from their partner.
4. Pour about a teaspoon of cinnamon (which will act as pollen) in the hands of the students who are being the wind, and ask them to hold it until every pair has some.
5. Ask the flower holders to hold their flower away from their body and stand off to the side so they don't get cinnamon on them.
6. Explain that on the count of three the wind partner is going to hold their cinnamon or "pollen" on their flat hand, and blow it into the direction of the flower. The flowers cannot move their legs, but they may swing their arms to 'catch' as much 'pollen' as possible on the sticky stigma of their fake flower.
7. Count to three and have the kids act out wind pollination.
8. Ask them what they noticed. *"How much pollen did they catch? Was it less than they expected? Did wind pollination do a very good job? Would another pollination method work better? Why?"*
9. With cinnamon in your own hand, pretend to be a pollinator (ask them to choose what kind you are, challenging them to come up with one you haven't talked about) and walk up to a flower holder and roll the sticky stigma in the cinnamon. Show them what it looks like. *"What differences do they see? What inferences can they make?"*

TO SIMPLIFY:

If students are having trouble staying focused, select a well behaved volunteer or another facilitator to assist you with a demonstration instead.

Adapted From:

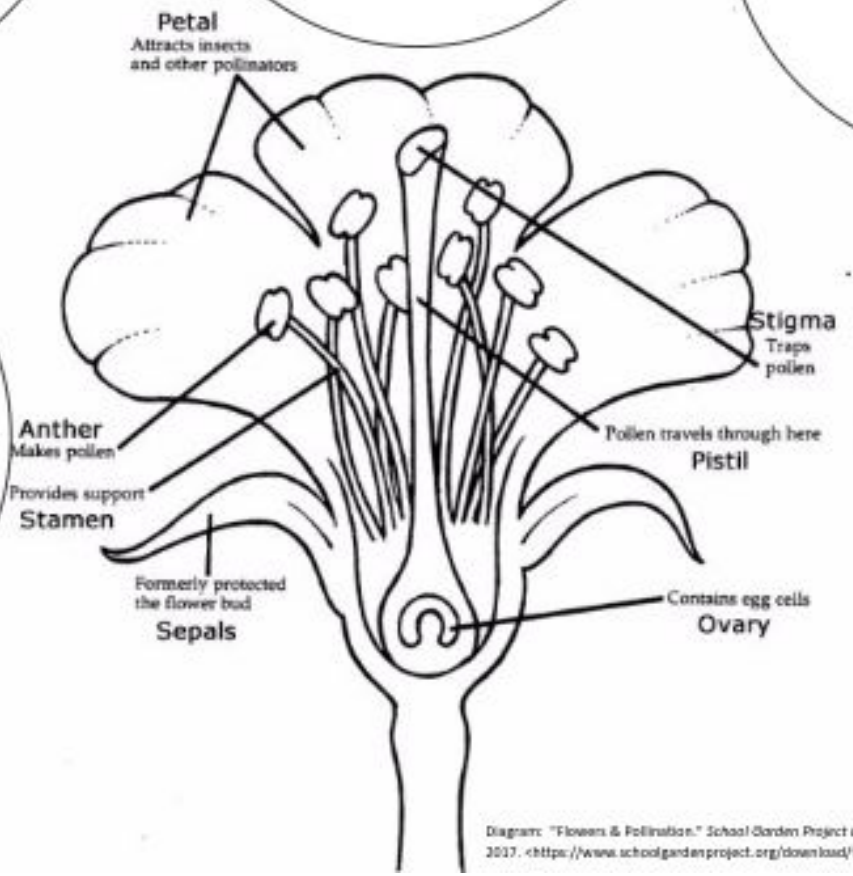
"Hands-on Interactive Activities (outdoor/indoor) | CPP: California Phenology Project." *California Phenology Project*. University of California, Santa Barbara, n.d. Web. 15 Feb. 2017.

Image: "Flowers & Pollination." *School Garden Project of Lane County*. N.p., n.d. Web. 25 Feb. 2017. <https://www.schoolgardenproject.org/download/flowers-pollination/>

Petal

Stigma and Pistil

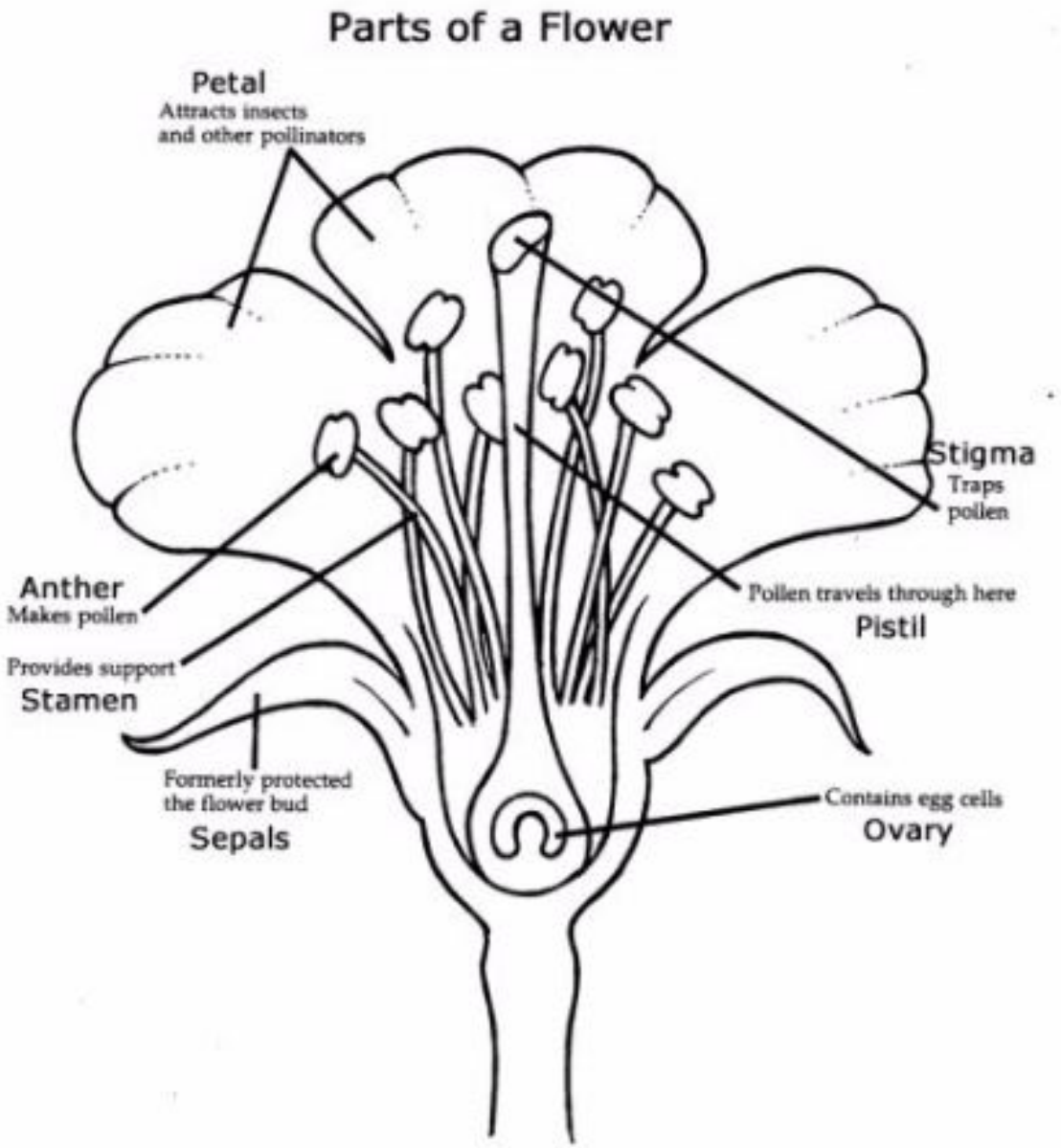
Anther and Stamen



Sepal

ovary

Diagram: "Flowers & Pollination." *School Garden Project of Lane County*. N.p., n.d. Web. 25 Feb. 2017. <https://www.schoolgardenproject.org/download/flowers-pollination/>.



PETAL

STIGMA

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ANTHER

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SEPALS

Diagram: "Flowers & Pollination." *School Garden Project of Lane County*. N.p., n.d. Web. 25 Feb. 2017. <https://www.schoolgardenproject.org/download/flowers-pollination/>.

Pollinators
Noticing Friends of the Garden
Day 3 of Cultivating Connections Spring Sequence

Justin Knowles – University of Oregon Environmental Leadership Program 2017

Target Grade Level
1st – 5th grade

Essential Questions
What do pollinators do? How do they do it? Why is it important?

Objectives
By the end of this lesson students will be able to:
- Identify three different pollinators
- Articulate the codependent relationship of plants and pollinators

STE(A)M Integration
Art: journals, mapping
Science: observations & data tracking, pollinator identification, mapping

NGSS Performance Expectation

2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Materials
- Pollinator cards
- Journals
- Writing utensils
- Clipboards
- Blank paper
- Hand lenses
- Thermometer
- Rain guage

Lesson Length
60 minutes

Summary

In the previous lesson about pollination students were introduced to the process of pollen transfer, plant parts, and seed generation. Friends of the Garden will introduce 1st-5th grade students to specific types of pollinators such as, bats, bees, beetles, birds, butterflies, flies, moths, and wind. Through activities such as identification, role playing, story mapping, and inquiry lead discussions, students will be able to identify pollinators and articulate their role in the garden.

Rationale

Spring is a vital time of year for new growth in our environment, especially the garden. With the help of pollinators, our gardens are able to grow plants that eventually become edible fruits and vegetables. Humans and animals depend on pollination as a mechanism of the growing process for flowers, fruits, and vegetables. Therefore, understanding the many types of pollinators and their role is not only a fun way to learn in the garden, it's also very important to understand the process.

Background

In the spring plants and animals are responding to the warmer temperatures and longer daylight hours by coming to life in search of food and reproduction for survival. Pollinators assist in the reproduction of plants by transporting pollen. Flowers that are not pollinated are not able to produce fruits and seeds. In return, flowering plants attract pollinators by producing nectar, a highly nutritious, sugar-based substance as a significant source of food. Plants have developed scents, colors, and shapes that make them attractive to pollinators who, in turn, have developed physical characteristics that allow them to gather and transport pollen as they seek food.
The most well-known pollinators are bees. In the U.S. there are nearly 4,000 native species of ground and twig nesting

Preparation for Lesson

- Print pollinator cards (laminated cards are recommended)
- For grades 1-2, create a story map
- Gather materials
- Create your own story map as an example for students

Key Vocabulary
Pollinators
Pollen
Nectar

Garden Related Activities
Ability to identify types of pollinators and their roles and relationships in the garden

bees. Some form colonies while others live and work a solitary life. Bees make great pollinators when their needs of nectar, pollen, and water are available. Although the varying tongue length of bees determines which flower they can obtain nectar and pollen from, they are generalists. Meaning they will pollinate a wide range of crops.

Honey bees are the most commonly known bees, but contrary to popular belief, not all bees belong to a honey making colony with a queen bee in a hive. For example, mason bees live in solitude, tending to their own brood (young). Although mason bees live alone, they prefer to nest near other mason bees. They make great pollinators, as they are among the first pollinators going to work in early spring from March to May, when other pollinators have yet to leave their nests/hives. Mason bees also make for great pollinators, as they are typically non aggressive bees since they live alone and have no need to protect a hive. They are also efficient, and they find food within a 300-foot radius of their nest, compared to that of four miles for the honey bee. Flying short distances in a zig zag pattern makes them especially efficient pollinators. Their primary source for nectar is from fruit trees, for example an apple tree. Mason bees collect nectar, bring it to their nests, knead it into a ball, mix it with saliva and save it in the holes of their nest. After enough food is stored mason bees lay eggs and close the holes sealed with mud.

Butterflies need sun to warm their bodies to fly. Therefore, they are attracted to the leaves, flowers, bare earth, and stones within a garden as resting sites to bask in the sun. They typically prefer open space to receive this warming effect but also prefer protection from the wind as they are easily affected by this force. Host plants are susceptible to damage as larvae feed on the leaves. They also like to be close to soil as a nutrient and water source.

Moths are distinguished from butterflies, as they have antennae that feather at the tip. Moths are also more active at night, but are still attracted to light. They may be less colorful, but are attracted to strong and sweet smelling flowers that open in late afternoon or night. Flowers that are white or pale colored are often most commonly associated with moths.

Beetles may be less attractive than birds and butterflies, but they do help with pollination. Although eating plant parts gives them a bad reputation, they are attracted to strong scented flowers with their sexual organs exposed. They pollinate magnolia, sweet shrub, paw paws, and yellow pond lilies.

Flies are generalist pollinators. They typically pollinate small flowers that bloom under the shade in seasonally moist habitats, and are attracted to annual and bulbous ornamental flowers. These include: paw paws, dead horse arum, skunk cabbage, goldenrod, and members of the carrot family such as Queen

Anne's lace.

Birds in general forage plants for fruit and seed. The primary bird pollinator is the hummingbird. With long beaks and tongues, they are capable of drawing nectar from tubular flowers. Pollen is carried by both the beak and feathers. Brightly colored flowers attract hummingbirds, as they are able to see the color red, whereas bees cannot.

Procedure

Journals (5 minutes)

Inform students we will be measuring plant growth, rainfall, and temperature for the day. We will rotate between measuring stations, then come together to discuss our findings.

1. Have students open their journals to page 1.
2. Have students write in the date on the data log.
3. Ask students if they have any questions.
4. Split the students into groups appropriate to your class size, one group for each measuring station.
5. Give each group 2 rulers and assign each group to a station.
6. Have students document their findings at each station.
7. Once the groups have rotated through all of the stations, have students come back to the circle to discuss the data.
8. Ask for a volunteer with a quiet hand to share the data they measured and open the discussion to the group.
9. Take a rough group average and either assign a role or ask for a volunteer to help graph the data on the flip-chart. Do this for all four graphs.

To Simplify

For younger age groups, consider making the measurements and recording results as a whole group, taking volunteers to perform each task.

To Add Complexity

Provide the following prompt for students to answer in a blank page in their journals.

- *"Can you see/hear any friends of the garden (pollinators)? What types of plants are they interacting with? Where in the garden are they?"*

Introduction (5 minutes)

Begin by opening awareness of the group. Lead by example, having feet firmly on the garden floor to feel rooted, engage their senses encouraging them to listen, see, touch, and smell, but not taste. Cycle through a few deep breaths.

Share the energy in the garden and use this moment to allow students to get present in the space. While breathing, encourage each student to express gratitude by thinking to themselves about what they are thankful for; if anyone is willing, offer them a chance to share with the group.

After the quick awareness exercise, gain a sense of pre-lesson knowledge by asking students if they know anything about pollinators. The essential questions to answer by the end of the lesson are: what do pollinators do? How do they do it? Why is it important? Students should have a basic understanding of pollination from the previous lesson "Purpose of Pollen". Define vocabulary words.

> **Pollinator**- an animal that transfers pollen from the male anther of a flower to the female stigma of a flower
> **Pollen**- powder grains of flower that are used for reproduction
> **Nectar**- sugary fluid secreted by plants to encourage pollinators

Connect the vocabulary words to the process of pollination. Using the matching cards show the different type of pollinators and briefly explain their unique role in the garden. To enhance this learning moment show the picture side of the matching card, ask: does anyone know what this is? Why is this animal a friend of the garden? Reinforce the mutual benefiting coexistence of pollinators in and around the garden. Ask if anyone has any questions before moving on to the activities.

Matching (10 minutes)

Pair students together. Have the pairs face each other. If you have an odd number of students, have a group of three. Pollinator cards are part of a pollination set. For this activity you will only need the 8 pollinator cards. The remaining cards are available and encouraged for creative adaptations as they are all very relevant.

For grades 1st-2nd

1) Pass out pollinator cards face up. Be sure to give them at least two different types of pollinator cards
2) Allow each group to look at the pollinator and make observations of the image on the card
3) Give them a chance to read the characteristics and develop questions about their pollinator
4) Ask: "what is similar/different about your pollinators?" Allow everyone to share.

For grades 3rd-5th

1) Pass out pollinator flash cards. Identify which student will be the reader and which student will be the guesser. Make it clear that students will switch roles. Each student will have a turn to read and each student will

have a turn to guess.

2) Have the cards organized so that the reader has the description in a readable position, but does not show the pollinator picture to the guesser.
3) The student with the characteristic side will read the characteristics to the guesser. If needed, the guesser is allowed to ask 1-3 hinting questions that are yes and no answers only. The reader can only answer yes or no.
4) After reading the characteristics and, several questions have been asked the guesser must take his/her guess.
5) The guesser is allowed up to three guesses. If the guess is not right after three guesses the reader must tell the guesser which pollinator has those characteristics
6) Switch roles and repeat. Make sure each student has a chance to guess a pollinator. Make sure each pair receives at least two different types of pollinators.

Mason Bee Story Mapping (20 minutes)

1) Begin by role playing as mason bees. Decide a location in the garden that will act as our mason bee nests. Choose a place where all mason bees can gather to listen and understand the instructions, are safe from predators such as robins, crows, starlings, and woodpeckers, and are building an appetite for sweet nectar.
   a) Although mason bees live alone, which is known as living in solitude, they tend to nest near each other for safety reasons.
2) Begin the pollinator story mapping exercise in the nest. Before handing out clipboards, maps, and hand lenses explain the task:
   a) "*You* (the student) *are going to pretend to be a mason bee and are currently in your nest"*
   b) "Our mission is to collect as much nectar as possible and store it in our nest"
   c) "*To accomplish the task, bees must peek our eyes out of our nests, check for predators, make sure it is safe to leave and then fly away"*
   d) "After we are done 'collecting' we will gather as a group to share our flying journey"
3) Hand out materials: clipboards, map, pencils (hand lenses if needed).
   a) For grades **1st-2nd** , clipboards with an outlined map that show them where to go and how to get there
   b) For grades **3rd-5th** , clipboards with blank paper for them to draw their own map and story. On the blank sheet of paper students will create a map, marking the location of the nest, orientation of the sun, north arrow, locations in the garden that they stopped at, paths taken to arrive at each location.
4) Once students have their materials ready, send the bees from their nest and encourage students to use the hand lenses to find detail in the plants/garden beds.
5) Write observations on a separate sheet of paper behind the map. Guiding questions: was there nectar, pollen, both, neither?
   a) To encourage observations, students should engage sensory awareness

(see, hear, smell, feel, not taste.)
   b) Make sure students are not destroying plants/flowers, if they need to touch do so delicately and leave plants carefully as they were in place
   c) Make observations on the type of the flower, where it was, how it was oriented, what it's neighbor was, were there any other pollinators, or friends of the garden (i.e. earthworms, beetles, etc.)?
6) When time is nearing completion give students a 5-minute warning, 1-minute warning, and when time is up all pollinators will return to their nests
7) Once all have returned, circle up and allow students to share where they went, why they went there, what observations were made, and if anyone has questions
8) Use this time for students to reflect on their experience

Wrap (10 minutes)

To assess understanding
1) Remain in a circle
2) Ask for a quiet hand to name a pollinator. Repeat at least three times or as many times until all pollinators have been identified.
3) Ask for a quiet hand, how do pollinators work? Why is it important? (Seek answers from students that haven't had a chance to share/answer)

To wrap the lesson briefly review the different types of pollinators, their role in the springtime and their relationship to the garden/plants. Allow students to ask questions and reflect on what they are grateful for in terms of pollinators.

Adapted From

Ley, E. L., Buchmann, S., McGuire, K., & Holmes, R. (2008). *Selecting plants for pollinators: a regional guide for farmers, land managers, and gardeners: in the pacific lowland mixed forest province including the states of Oregon and Washington*. San Francisco, CA: Pollinator Partnership/North American Pollinator Protection Campaign.

Moisset, B., Wojcik, V., & Pollinator Partnership. Blue Orchard Mason Bee (Osmia lignaria). Retrieved March 22, 2017, from https://www.fs.fed.us/wildflowers/pollinators/pollinator-of-the-month/mason_bees.shtml

Image: "Flowers & Pollination." *School Garden Project of Lane County*. N.p., n.d. Web. 22 Mar. 2017. <https://www.schoolgardenproject.org/download/pollinator-matching-cards//>.

Materials: Pollinator Cards

		
borage	sunflower	tomato
		
squash	nasturtium	calendula
		
strawberry	potato	onion

		
corn	evening primrose	cactus
		
kale	honeysuckle	wheat
		
lettuce	carrot	pea

		
bee	butterfly	moth
		
fly	beetle	bat
		
hummingbird	wind	

- Bright blue flower
- Has lots of nectar
- A favorite of many pollinators

- Brightly colored flower
- Large, flat topped cluster of flowers
- A favorite of many pollinators

- Smells spicy
- Dull, pale flowers
- Small flower

- Large flower
- Smells spicy
- Dull colored
- Smells fruity

- Brightly colored
- Tubular shaped flower
- Has lots of nectar

- Bright orange, yellow, or pink
- Large, flat topped flower

- Bowl shaped petals
- Has lots of nectar
- Small, white flower

- Pale colored flower
- Smells unpleasant to humans

- Smells strong!
- A ball made of many tiny flowers
- Green and white flowers

- Not much color or smell
- Has two kinds of flowers,
  - a male and female type
- Tiny flowers

- Opens in the evening
- Strong floral scent

- Opens at night
- Smells strong and fruity
- Large flower

- Smells sweet
- Petals in landing pad formation
- Small flower

- Very brightly colored flower
- Smells very strong (sweet)
- Tubular shaped flower
- Has lots of nectar

- Cluster of tiny flowers
- Tiny flowers are colorless
- Tiny flowers are odorless

- Dull or pale flowers
- Not much smell
- Small flower

- Cream or white colored clusters of tiny flowers
- A favorite of many pollinators
- Humans may find the scent unpleasant

- Smells sweet
- Flower has nice landing pad
- Flower explodes pollen when opened!

Created by School Garden Project of Lane County: www.schoolgardenproject.org

- Attracted to sweet smelling flowers
- Prefer petals to be a "landing pad"
- There are 20,000 bee species in the world and each are attracted to different flowers. Thus, many flowers are popular with bees.

- Attracted to sweet smelling flowers
- Likes orange, yellow, pink, and blue flowers
- Prefers flat-topped clusters of flowers because butterflies need to land before feeding

- Prefers light colored flowers because they only fly at night
- Attracted to strong floral scents
- Look for flowers that open in the evening

- Prefers flowers that are green, white, or cream colored
- Often likes bowl shaped flowers or clusters of small flowers
- Enjoys smells that humans may find unpleasant

- Cannot see colors
- Attracted to spicy or fruity smelling flowers
  - Often these flowers are dull or pale colored

- Flies at night
- Attracted to flowers with a strong and fruity scent
- Prefers large flowers

- Prefers red, orange, and purple flowers
- Likes tubular flowers with a lot of nectar
- Not great sense of smell, so attracted to bright, showy, flowers.

- Helps pollinate the flowers that animals aren't attracted to:
  - Odorless flowers
  - Colorless flowers
  - Small flowers

What Makes a Habitat A Home?

Noticing the Elements of Habitats

Day 4 of Cultivating Connections Spring Sequence

Chelsea Ingram & Abbey Leonardi - UO Environmental Leadership Program - 2017

Target Grade Level
1st– 5th grades

Essential Question
What are the essential things needed to make a place a suitable habitat?

Objectives
By the end of this lesson, students will be able to:

- Name the 4 components of a habitat
- Identify 1-3 actions that students can do to improve habitats in the garden

STE(A)M Integration
Art: Journals, singing

Engineering: Constructing mason bee shelters

Science: Observations & data tracking, habitat song

NGSS Performance Expectation
Crosscutting concept(s): Stability and Change Systems and Systems Models

Lesson Length
One 80-85 minute session

Summary

This lesson introduces 1st – 5th grade students to the four key components of a habitat through inquiry and a song. Additionally, a mason bee shelter building activity will allow students to actively engage in the creation of bee habitat. This will also encourage students to be mindful of their behavior in the garden.

Rationale

This lesson will raise awareness about the garden as a habitat and cultivate empathy for the species that live there. The activities in this lesson provide knowledge about what makes a place a good habitat and empower students to take responsibility for their garden habitat.

Background

Essentially, a habitat is a scaled down ecosystem. It is a community in which organisms interact with their environment. A habitat has four essential elements: food, water, shelter, and space. Habitats come in many forms (swamp, forest, meadow, city, etc.). Gardens provide a habitat for many plants and animals, and are especially important in areas that have limited green space.

Gardens typically have enough food for the organisms to eat, but sometimes there is not enough water or shelter for organisms to stay and live there. Adding some of these elements can encourage organisms to make the garden their home. Creating a mason bee shelter is one example of how students can positively impact the availability of the four components of a habitat within the garden.

Mason bees are different from European honey bees. Instead of living in hives, they make homes in individual units within small groups, with no particular hierarchy. Because of this they are called *solitary* bees. Mason bees don't have stingers. This makes them a great pollinator to invite into a school garden. Mason bees are also very efficient pollinators!

Materials

- Journals (from Day 1)
- Student measurnig sticks (from Day 1)
- Rain guage
- Thermometer
- Scissors (for teacher's prep)
- Non-toxic water based paint (for teacher can prep)
- Non-toxic water based paint pens

For every 4 students in your class, you will need:

- 1 large can (2-3 lb. size)
- 4 toilet paper rolls
- 16 cut pieces of newspaper (1/2 pages)
- 16 pieces of parchment paper (~8½ x 11" each)
- Dry moss
- Scotch tape

Preparation for Lesson

- Prepare a visual of the lyrics to the habitat song
- Pre-cut newspaper
- Paint and label each can

Key Vocabulary

- Habitat
- Food
- Water
- Shelter
- Space

Evidence of Learning

Construct a Mason Bee Home
Journal Entries

Mason bees typically make their homes in naturally occurring gaps and crevices, such as cracks in stones, hollow stems (such as dead raspberry canes), or holes in wood made by wood-boring insects. Inside of these holes, mason bees fill the back with mud and create a bed of pollen and nectar, called the 'golden nugget', to lay their eggs on in the spring. The bees fill the front of the holes with more mud to protect the egg inside. When the egg hatches, the larvae eats the golden nugget for food. However, the bee can remain in hibernation until next spring!

Think about your garden space. These types of habitat may not be readily available, or maybe there is not enough of these types of spaces in close proximity to the garden. You might already have some mason bees in your garden, but we want to encourage even more to make their home there. The mason bee shelters you make today will help.

Procedure

Introduction (5-10 minutes)

Ask if any of the students can define the word habitat. Can the students come up with some examples? What are characteristics that distinguish the different habitats? What organisms live there? For example, could a toucan live in a cold climate? Why not? Ask the students if the school is a habitat. Ask the students to identify the key elements of a habitat. What are some things that people, plants, or animals *need* to have in order to survive and thrive? Explain to the students that today's lesson will focus on the four *essential* elements of a habitat: food, water, shelter, space.

Habitat Song (10 minutes)

It is useful to have the lyrics to this song written where the students can see them: on a flip chart, projector, white board, or on a hand-out.

The song is meant to include ASL signs for the keywords: food, shelter, water, and space.

As the facilitator, you can use the following link to learn the ASL signs:
https://www.signingsavvy.com
This website provides a search engine to look up the following signs, and provides a short video that shows how they are performed.

1. Gather the students in a wide circle, with enough room to hold their hands out at their sides. This song will help students to remember what the four essential habitat elements are.

2. Teach the following hand movements:
    a. "food" (fingers pinched together, bring to mouth)
    b. "water" (fingers make a W and tap chin)
    c. "shelter" (use the ASL sign for "home": start with the sign for food and then move your hand, in the same position, to your cheek close to your ear)
    d. "space" (right hand with fingers spread makes a horizontal circle out from chest)

3. Sing to the tune of "Twinkle Twinkle Little Star":
    Food, water, shelter, space (Do each sign as you sing the word)
    Makes a happy living place.
    I live in my habitat,
    Eating bits of this and that. (Sign for food with both hands, bring each to your mouth in turn)
    Food, water, shelter, space
    Makes a happy living place.

To enhance the activity, this song can be repeated with different lines to tell about different species. A few examples below replace the italicized lines above:

I live on a silken bed,
Eating insects in my web. (spider)

I live inside my shell,
Leaves and grasses serve me well. (snail)

I live high up in a tree,
Fruit and bugs can't hide from me. (bird)

Mason Bee Shelter Building Activity (45 minutes)

If it is nice weather outside, and not windy, this activity can take place in the garden. It is helpful to have a table, but a flat surface like a bench or sidewalk could work as well.

Introduce mason bees to the students. Have visuals of a mason bee and a European honey bee (attached).

1. Discuss some of the similarities and differences between these two species. Some guiding topics for discussion could include:
    a. Consider the differences in behavior between hive bees and solitary bees.
    b. How is a mason bee habitat different from other bees? Consider the purpose the crevices serve for the mason bee.
    c. Which is a more efficient pollinator, the European honey bee or the mason bee?
    d. Discuss the life cycle of the mason bee, from egg to adult.
    e. Only female mason bees have stingers. They will only sting if they are squeezed or trapped. Consider this compared to European honey bees.

2. When you are ready to get started, have one facilitator pass out materials. Alternatively, you can have a few students help you pass out materials, or line up the materials and have students collect what they need themselves.

3. As you build the shelter, keep the students engaged on the task at hand by asking inquisitive questions about what they are building. Keep in mind that younger students may not be able to focus on both the questions you have and the instructions. It might work best to ask these questions after the task is done, particularly with grades 1-3. Two critical thinking questions you can ask are:

1. *"How do you think the bees use these tubes?"* Explain how mason bees use mud and the 'golden nugget' to fill the tubes and lay their eggs in the spring.
2. *"Why do you think the mason bees might live in tubes like this instead of a hive? How is it different than living in a hive? What is similar?"* Tell the students that mason bees are solitary. They don't have a hive they share with a colony, and they don't have a queen. Instead, they lay eggs on their own. It is different than a hive because they don't share the space with other bees. It also doesn't involve making honey. It is similar to a hive in the way they protect their eggs in individual "nests".

To make the mason bee shelters:

1. Take out pre-painted can(s) and permanent markers
2. Have the students decorate the can to personalize the nest and foster a connection with the bee home
3. Each student needs:
    a. 1 toilet paper roll
    b. 4 pieces of newspaper
    c. 4 pieces of parchment paper
    d. pencil
    e. 8 pieces of tape
4. Have students lay one piece of newspaper on top of one piece of parchment paper so that the corners meet.
5. Next have students roll the newspaper and parchment paper tightly

together to make a tube. (It might help to roll the newspaper around a wooden pencil. Just make sure that the end of the pencil sticks out from the roll of paper, so you can pull it out when you are done.)

6. Once the newspaper and parchment paper are rolled tightly, fold the tube in half. The two open ends will now be at the same end.
7. Tape the tube together so that it stays in the bent position.
8. Place the tube into one of the toilet paper rolls. It's okay if the ends stick out from the tube.
9. Continue steps 4-8 until you have 4 bent tubes in each toilet paper roll. The tubes should fit in the toilet paper roll without falling out.
10. Place a handful of moss in the bottom of the can. The moss must be dry. The moss will help insulate the bees, and will keep the toilet paper rolls from knocking around inside the can.
11. Fill the can with your toilet paper rolls, with moss in between. The moss does not need to be stuffed tightly, but the tubes should stay in place.
12. Clean up materials with your students and get ready to go into the garden (if you're not already there). You will need to also bring the students' journals from Day 1, for the next activity.

Now that your mason bee shelters are done, it's time for them to be placed in the garden! Have the students help you find a place to put them. The homes should be in a safe spot on the ground, where they are not likely to be stepped on, kicked, or removed. They can also be placed in trees, if it is sure that they will not be knocked down or blown out by the wind.

This is a good opportunity to ask your students where a good place for the habitats are and why. *"Should they go up high in a tree?"* That *might* work! Mason bees make their homes in any space available, in walls, trees, or near the ground. (Depending on what is available at your site, you could choose to put the habitat in a tree. However, your mason bee home may be safer on the ground.) *"Should they go in the middle of the path?"* No, because they might get stepped on. Ask: *"What do the mason bees need for their habitat?"* The answer should be flowers for food (pollen and nectar), and mud to provide protection in their nests.

You should also ask the students: *When we come back to visit the mason bee habitats, how should we treat them? Should we pick them up, shake them, or move them?* No, because that would make the bees that use the habitat unhappy. The baby bees nesting inside might get hurt if we move their home. Instead, we can look inside carefully, to see if there are nests.

Once you have found a good place for your mason bee shelters, circle up and transition into the journal activity.

Journal Activity (15 minutes)

Inform students we will be measuring plant growth, rainfall, and temperature for the day. We will rotate between measuring stations, then come together to discuss our findings.

1. Have students open their journals to page 1.
2. Help students write in today's date.
3. Ask students if they have any questions.
4. Split the students into 4 groups, one group for each measuring station (2 groups can work as well, do what seems intuitive for the size of the class).
5. Give each group 2 rulers and assign each group to a station.
6. Have students document their findings at each station.
7. Once the groups have rotated through all of the stations, have students come back to the circle to discuss the data.
8. Ask for a volunteer with a quiet hand to share the data they got and open the discussion to the group.
9. Take a rough group average and either assign a role or ask for a volunteer to help graph the data on the flip-chart. Do this for all four graphs.

To Simplify:

For younger age groups, consider making the measurements and recording results as a whole group, taking volunteers to perform each task.

To Add Complexity:

Provide the following prompt for students to answer in a blank page in their journals: *Pick a species in the garden (plant or animal). Draw a picture of it. Find the four elements of habitat it relies on, then draw and label them in your picture.*

Wrap-up (5 minutes)

- Circle up and ask the students to name the four components of a habitat. Can they remember the ASL signs for each? Sing the song again if there is good energy for it.
- Congratulate the students on doing something helpful to make the garden a better habitat for bees! Ask what other things they can do to improve habitat conditions in the garden.
- Ask if they can name any other species that we would like to have in the garden. What can they do to help those species make their homes here?
- Suggest that the students can come back next class time to see if any mason bees have "moved in".

If you are evaluating this lesson and whether students have achieved the learning outcomes, take notes on the responses to each of the first three prompts. Keep track of how many students can answer each of your questions accurately. For more rigorous evaluation, consider printing a "quiz" with these questions that each student can complete individually, or ask them to write the answers on a blank page of their journals. (This will increase the time needed for the Wrap to 10-15 minutes.)

Adapted From:

ʻŌhiʻa Project. (1989). A happy place to live. An environmental education guidebook for Hawaiʻi (pp. 48-51). Honolulu, HI: Bernice Pauahi Bishop Museum and Moanalua Gardens Foundation.

Goward, E. (Ed.). (n.d.). Habitats and Ecosystems. Retrieved February 12, 2017, from https://www.schoolgardenproject.org/download/habitats-and-ecosystems/

"Mason Bees: How to Build a Bee Nest Using Recycled Materials." *Bukisa*.http://www.bukisa.com/articles/474795_mason-bees-how-to-build-a-bee-nest-using-recycled-items.

Mason Bee (*Osmia lignaria***)**
https://www.parentmap.com/article/keeping-mason-bees-10-expert-tips-for-families

Wasp (*Hymenoptera***)**
http://animals.nationalgeographic.com/animals/bugs/wasp/

European honey bee (*Apis mellifera***)**
http://rvcoutdoors.com/10-things-didnt-know-honey-bees/

The Giving Garden

Noticing Reciprocity in the Garden

Day 5 of Cultivating Connections Spring Sequence

Emily Jenkins – UO Environmental Leadership Program – 2017

Target Grade Level
1st-5th grade

Essential Question
Why is it important to take care of the garden?

Objectives
By the end of this lesson students will be able to:

- List 2 acts of how you take care of the garden.
- Describe the connection to how the nutrients in vegetables provide nutrients for our bodies and health.

STE(A)M Integration
Art: journals, cooking, coloring
Science: nutrition facts, plant life cycle, observation & data tracking

NGSS Performance Expectation

Primary Standard
K-LS1-1.
Use observations to describe patterns of what plants need to survive.
Disciplinary Core Idea(s)
LS1.C:
All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.

Lesson Length
60 minutes

Summary

This activity introduces 1st-5th grade students to the reciprocal nature of gardening, meaning we care for the garden and in return, the garden cares for us nutritionally. This is accomplished through the use of a garden based cooking lesson, discussion of nutritional elements provided within foods from the garden, and a discussion of how we take care of the garden.

Rationale

This lesson provides a hands-on interactive learning experience where students have the opportunity to gain nutritional knowledge, develop sensory awareness, and connect with their food from right where it starts. Beginning to understand the concept of food growing in the garden can be used to make a meal that provides the students the ability to recognize that their food grows from the ground; it does not just come from the store.

Further, this lesson starts fostering a connection to nature through the garden, instilling a sense of responsibility toward the environment, and contributes to identifying sense of place.

Background

Beet Nutrition

A beet is a **root vegetable**, meaning it grows underground. Beets helps keep our blood flowing smoothly, which results in an energy boost. Beets are also loaded with Vitamin C, which keeps our heart, skin, and eyes healthy and helps to prevent and cure the common cold. Beets also contain folate which also contributes to a healthy heart.

Preparation for Lesson

1. Set up should go as follows: Spread one large sheet of paper over table(s) in the garden and put down one cutting board and one grater on the table(s) for each student.

2. Separate station for mixing bowl, serving bowls/forks, tablespoon, mixing/serving spoon, ACV, OO, lemon juice, optional ingredients, salt & pepper, knifes

3. Food preparation: beets, carrots, and apples peeled and cut into easy-to-handle pieces for each student to have one to grate

Key Vocabulary

- Beta Carotene
- Root vegetable
- Healthy diet

Materials

(see materials section)

- Recipe card & worksheet printout
- Colored pencils
- Rain gage
- Thermometer
- Journals (from Day 1)
- Student measuring sticks (from Day 1)
- Ingredients for ABC Salad
- Cooking Supplies

Carrot Nutrition

A carrot is a root vegetable as well. Carrots are full of **beta carotene** which strengthens your eyes and is also what makes the carrot orange. Carrots also contain Vitamin k, which is good for your heart, builds strong bones, and keeps your blood flowing smoothly

Apple Nutrition

Apples are fruits that are filled with potassium and vitamin C, which helps our heart, skin and eyes. Apples are also loaded with carbohydrates which gives us energy. These all keep our bodies safe and healthy.

The term health or 'being healthy' means that you are free from illness or injury, mentally and physically. Having a **healthy diet** means eating foods that contain nutrients that are beneficial to our bodies and help keep us healthy. Empty foods are those that do not have beneficial nutrients for our bodies in them. Examples of these would be, cake, cookies, and soda. These are all empty calories.

There are many ways in which we help to **care for the garden**. A few of these activities include: watering plants, weeding, taking care of the soil (not walking on the beds), planting, harvesting, and planting in an area with access to sunlight. In the **Spring**, plants have the ideal conditions that they need to begin growing. These conditions are water, sunlight, soil, and warmth. The rainy weather of the spring provides water for the plants and as the days begin to get longer, more sunlight is available to the plants. The sunlight heats up the soil, giving the plant the warmth it needs.

Materials

- Recipe/worksheet printout (attached) (one for each student)
- Colored pencils (enough for students to share)
- Student made measuring sticks (from Day 1)
- Journals (from Day 1)
- Rain gauge
- Thermometer
- Ingredients (Feeds 6) {adapt for number of students in class}
    - 1 beet, peeled
    - 2 carrots, peeled
    - 1 apple, diced (prepped before lesson by teacher)
    - 1 tablespoon of lemon juice
    - 1 tablespoon of apple cider vinegar
    - 1 tablespoon olive oil
    - Optional: special toppings: raisins, salt & pepper, and others
- Cooking supplies
    - Hand graters (1 per student)
    - Cutting boards (1 per student)
    - Large bowl for mixing (1)
    - Tablespoon (1)
    - Mixing/Serving spoons (1)
    - Serving bowls (1 per student)
    - Paper for covering table (1 large sheet per table)
    - Forks (1 per student)
    - Knife (1-2) for adult supervisor(s)

Procedure

Journals (5 minutes)

This time will be used to analyze the data that the students have collected over the past weeks.

1. Take out the data collection charts for plant growth, rain, and temperature.
2. Display the charts and ask "*What do you notice about the data we have been collecting?*"
    - The students should make a correlation between how the rain and temperature affects the plant's growth.

TO ADD COMPLEXITY

Have the students answer the following prompt in their journal.

- *"Look at the plants we have been measuring. Draw a comparison from how small the plants were at Day 1 to today. How have the plants changed over time? Are they taller? More flowers? List or draw: What garden care activities have helped the plants grow?"*

Introduction (2 minutes)

During this time the plan for the day should be laid out. Give an overview of the activities by saying *"First we are going to be cooking, and then we're going to color and talk about the vegetables we have been eating"*.

Activities (37 minutes)

Cooking Lesson

Introduction and Preparation (7 minutes)

1. Ask the students *"How do you take care of the garden?"*. Emphasize planting in the garden.
2. Ask the students *"When do you think is a good time of year to plant seeds?"*. Review the elements that make Spring the ideal time to begin planting. These elements being: rain, sunlight, temperature, pollination, and pollinators.
3. Ask *"As we take care of plants and watch them grow bigger, what do we end up with when they are fully grown?"*. Talk about how caring for plants leads us to delicious foods that we can eat and make meals out of!
4. Hand out the recipe cards and explain that the recipe we are going make is an ABC (apple, beet, carrot) salad.
5. Explain how everyone is going to have a different role in helping to put the salad together. The students pick their role. Ask for:
    - 1 student to be the Apple Cider Vinegar measurer and pourer
    - 1 student to be the olive oil measurer and pourer
    - 1 student to be the lemon juice measurer and pourer
    - 1 student to be the mixer
    - Every student will help grate

Cooking and Serving Table Preparation (20 Minutes)

6. First have the students wash their hands and make sure hands stay clean. Say "We need to make sure our hands stay clean, so if we sneeze or cough make sure to turn away, and not into our hands".
7. Talk about how to safely use the graters.
8. Hand out pre-prepped easy to handle pieces of carrots, and beets and have students begin to grate.
9. When a student finishes grating have them bring the cutting board full of grated pieces to the serving station and put shredded ingredients into the large mixing bowl.
10. When all shredded ingredients are added to the large mixing bowl, add the diced apples and have the students pour apple cider vinegar, olive oil, and lemon. Ask the students to come up to the serving station and measure and pour their ingredient into the large mixing bowl.
11. Lastly, have the student mixer come up and toss all of the ingredients together with the mixing spoon.

As the students are grating and preparing the salad ask sensory awareness questions:

- *"What do the veggies feel like?"*
- *"Do they have a smell?"*
- *"What do they look like?"*

Eating Time (10 minutes)

Portion out the salad into bowls and hand out utensils. Ask the students questions and talk about the nutritional value in beets and carrots. Start by asking *"What can you taste?"* and follow up with *"What makes a food healthy?"*. Discuss that the nutrients in foods are what make them healthy. Then explain the specific nutritional value in beets and carrots and how these nutrients fill our bodies and help us stay healthy and keeps us from getting sick. Empty foods, such as candy, cookies, and soda, do not contain nutrients that benefit our bodies in a positive way.

Assessing Understanding (10 minutes)

This activity will be using the bottom portion of the recipe card/worksheet handout to assess if the learning outcomes were achieved.

Adaptations

For students who are in **1st-3rd Grade**, use the attached recipe card/coloring nutrition worksheet. The students color the beet, carrot, and apple and read the nutritional facts. As they are coloring ask the students:

- *"What do you provide for the garden?"*
  - Students should respond with general garden care tasks (i.e. watering, weeding, ect.)
- *"What does the garden provide for you?"*
  - Students should respond with nutritional elements provided by garden (i.e. about beets, carrots, apples)

For students who are in **4th-5th Grade**, use the attached recipe card/fill in the blank/coloring worksheet. Ask the students to fill in the boxes with answers to the questions:

- *"What do you provide for the garden?"*
  - Students should respond with general garden care tasks (i.e. watering, weeding, ect.)
- *"What does the garden provide for you?"*
  - Students should respond with nutritional elements provided by garden (i.e. about beets, carrots, apples)

The students can then color the beet and carrot drawings.

Wrap-up (6 minutes)

Now we will connect the dots. Reiterate how we care for the garden and in doing so, nutritional foods that are beneficial for our bodies and health result. Do this by asking:

- *"Why/how should we take care of the garden?"*
- *"How is the garden taking care of us?*
- *"Was there something in the garden that you are grateful for?"*

- *“What did you like or learn about the salad?”*

Adapted From:

Fuller, Nancy. "Shredded Beet and Carrot Salad." *Food Network*. Food Network, 24 Aug. 2015. Web. 14 Feb. 2017.

Mercola. "10 Important Facts About Vitamin K That You Need to Know." *Mercola.com*. Mercola, 24 Mar. 2004. Web. 24 Feb. 2017.

"School Garden Project ." *School Garden Project of Lane County*. School Garden Project , 2016. Web. 07 Mar. 2017.

"Topmarks - Primary Resources, Interactive Whiteboard Resources, and Maths and Literacy Games." *Topmarks - Primary Resources, Interactive Whiteboard Resources and Learning Games*. TopMarks, 2017. Web. 07 Mar. 2017.

ABC Salad

(Apples, Beets, Carrots)

Ingredients:

- 1 beet, peeled and shredded
- 2 carrots, peeled and shredded
- 1 apple, diced
- 1 tablespoon of lemon juice
- 1 tablespoon of apple cider vinegar
- 1 tablespoon olive oil
- Special toppings: raisins, salt & pepper, nuts, etc.

Directions:

- Peel and shred beet, carrots
- Dice apple
- Mix together in a bowl
- Add apple cider vinegar, olive oil, and lemon juice
- **Optional: add salt & pepper, raisins, nuts, etc.

Makes 6 servings

I am a root vegetable (I grow underground!)

I am red and round
I keep your blood moving and give you energy!

I am orange and long and yummy to munch,
I give you my beta carotene which help your eyes a bunch!

I grow high up in a tree, I give you energy, and help you heart, eyes, and skin!

ABC Salad

(Apples, Beets, Carrots)

Ingredients:

- 1 beet, peeled and shredded
- 2 carrots, peeled and shredded
- 1 apple, diced
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- 1 tablespoon of apple cider vinegar
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- Special toppings: raisins, salt & pepper, nuts, etc.

Directions:

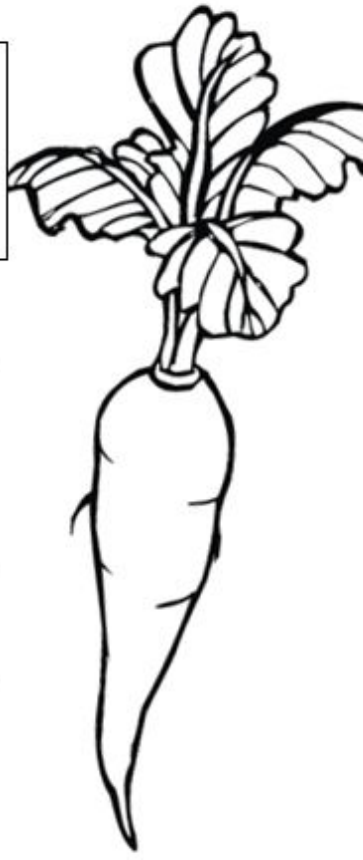
- Peel and shred beet, carrots
- Dice apple
- Mix together in a bowl
- Add apple cider vinegar, olive oil, and lemon juice
- **Optional: add salt & pepper, raisins, nuts, etc.

Makes 6 servings

How do you take care of the garden?

What does the garden give to you?

Fun Nutrition Fact!



Learning Assessment

Cultivating Connections Spring Sequence

University of Oregon Environmental Leadership Program 2017

Rationale

Assessments are important to determine whether or not the learning outcomes are met. Did we, as teachers, actually teach what we aimed to teach? Learning objectives are used to shape the lesson around the knowledge and skills students should obtain by the end of the lesson. The learning outcomes capture the main points of the lesson. The questions on this assessment are based directly on the learning outcomes of the lesson plans.

Procedure

1. Create a list of the lesson plans we've covered over the session on a flipchart or whiteboard.
2. Briefly review lesson plan activities with students to help them recollect the topics we covered.
3. Brief the students on your expectations for the evaluation.
4. Mention we will read through each question together, but we won't discuss answers during the evaluation.
5. Hand out the assessment.
6. Remind students to write their name on the top.
7. Read through each question, allowing time for students to answer.
8. Ensure students are listening to each question and not working ahead.
9. If students finish with a question early they can draw a picture on the side of the assessment.
10. Collect assessments from students.

TO SIMPLIFY

Have students discuss their answer with a partner.

TO ADD COMPLEXITY

Have students work individually without reading questions out loud.

Student Name: _____

Learning Assessment

Weather

1. What are three weather elements that influence plant growth in the garden?

2. Name two resources we've used to observe and track plant growth in the garden. Why might we use these resources?

Pollination

3. Which of the following is NOT a part of a flower?
    a. Stigma
    b. Anther
    c. Stem
    d. Petal

4. What are TWO ways flowers are pollinated?

Pollinators

5. Name/identify three different types of pollinators.

6. How do pollinators work? Why is it important?

Student Name: _____

Habitat

7. What are the four essential components of a habitat?

8. Draw a picture of a bee in its habitat. Include as many of the habitat components you can.

Reciprocal Garden

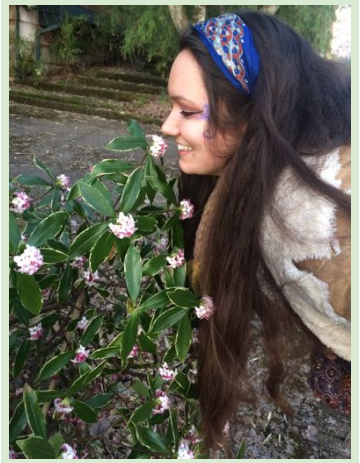
9. List TWO ways that we take care of the garden.

10. What does the garden provide for you?

Draw a picture to tell us the story of your favorite moment during garden class.

Meet the Team

Bianca Flynn



Bianca studies environmental history at the University of Oregon. When she was a child, her affinity for nature developed from building fairy houses in the forest, climbing banyan trees and going on family adventures. Her interest in gardening stems from her passion for health and nutrition, and a longtime hobby of digging in the dirt. She was ecstatic to continue working with the School Garden Project, and help cultivate students' sense of personal responsibility to local food and the environment.

Kassandra Hishida

Kassandra Hishida is a master's student in the University of Oregon's Environmental Studies master's program. Throughout her two years in Eugene she has enjoyed learning about food and environmental justice, as well as culturally responsive education. She loved volunteering with the School Garden Project (SGP) and was thrilled to have the opportunity to continue to support their work as the project manager for the ELP Cultivating Connections team. Kassandra loved spending time in the garden this spring and watching her team members inspire students to have fun while learning about STEM.

Chelsea Ingram

Chelsea was born in Vermont, but has lived most of her life in Eugene, Oregon. Her childhood and adolescence were spent wandering the bike paths along the Willamette River, picking blackberries and looking for fairies. Today, Chelsea studies and considers the environment from many social and political perspectives. She has a particular fondness for weeding and looking for worms in the garden. Now and then she still keeps an eye out for fairies.

Abbey Leonardi

Abbey is an Environmental Studies major at University of Oregon. Her passion for nature developed through exploring the outdoors as an athlete, specifically through trail running and skiing. Her interest in gardening stems from her passion for cooking and integrative holistic nutrition. Abbey plans on studying Alternative Medicine upon graduation. She grew up in Massachusetts and Maine.

Emily Jenkins

Emily has always had a love for nature. Her passion for the environment stems from her childhood growing up on the Oregon Coast. The natural beauty of the coast brought about an inherent appreciation for the environment. She is now a senior at the University of Oregon graduating with a degree in Environmental Studies and a minor in Food Studies. After she graduates she hopes to spread her love of food and the environment by working in the field of sustainable agriculture.

Justin Knowles

Justin is a Chicago born, New England raised, and Oregon educated outdoor enthusiast. A Geography major and Food Studies minor has helped him discover that his mission will be to bridge the gap between people and their food. He hopes to do this by inspiring young students to take an interest in localizing their food sources. His passion for the outdoors is rooted in a family tradition and a passionate connection to the ocean through the great sport of surfing. Since living in Oregon Justin has developed a new passion for growing and sharing food as well as hiking, waterfalls, and whitewater kayaking.

Trisha Maxfield

Trisha is an Environmental Studies major at the University of Oregon. She grew up in the foothills of the Cascade Mountain Range in Oakridge, OR; of which she insists is the Outdoor Recreation Capital of the PNW. Her earliest and fondest memories are of times spent outdoors with her grandparents catching night crawlers, pruning the garden, and patiently waiting for the bats take flight at dusk. By virtue, her love for nature and getting her hands dirty ensues! Time spent with her elders has allowed her to recognize the importance of fostering multi-generational communities.

Kaelin Oppedal

Kaelin was born and raised in Beaverton, Oregon, and now attends the University of Oregon where she is working toward a Bachelor of Science in Environmental Studies and two minors in Food Studies and Spanish. Her motivation to participate in the Environmental Leadership Program stemmed from her passion of protecting the environment and its people through the common language of food. Through agriculture, Kaelin aimed to make a difference in elementary students' early experiences with nature by helping to foster intimate relationships with the garden environment.

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