Light Garden Activity Guide

AGRICULTURE IN THE CLASSROOM PEI

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ACKNOWLEDGEMENTS

The Learning Garden Activity Guide is an educational guide for teachers. This guide is designed for students from Kindergarten to Grade 8. The developers would like to thank Nutrients For Life for partnering on this project and the PEI Department of Agriculture and Vesey's Seeds for their generous contributions.

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TEACHER EVALUATION FORM

We would really appreciate any input or feedback regarding your experiences with the activities. Any suggestions will enable us to develop a better program.

Light Garden Educational Coordinator (EC): _____
Name: _____
School: _____
Email: _____
Telephone: _____
Grades & Classes/Subjects you used the Light Gardens with: _____

1. The EC was knowledgeable about the subject matter.
- o Strongly Agree
- o Agree
- o Disagree
- o Strongly Disagree

2. The EC explained things in a way the students could understand.
- o Strongly Agree
- o Agree
- o Disagree
- o Strongly Disagree

3. I (the teacher) understood the goals of the lessons.
- o Strongly Agree
- o Agree
- o Disagree
- o Strongly Disagree

4. I (the teacher) understood the goals and vision of the Light Gardens.
- o Strongly Agree
- o Agree
- o Disagree
- o Strongly Disagree

5. The course content was interesting and relevant.
- o Strongly Agree
- o Agree
- o Disagree
- o Strongly Disagree

6. The class activities and assignments helped students build skills and understand the content.
o Strongly Agree
o Agree
o Disagree
o Strongly Disagree

7. I (the teacher) would be interested in requesting the Light Garden again.
o Strongly Agree
o Agree
o Disagree
o Strongly Disagree

8. Did the students make the connection between growing the plants to where food comes from?

9. Would it be beneficial to have the EC return to your classroom? Please explain.

10. What would it be if you could change one thing about the lessons?

11. Additional comments.

YES/NO I would like to sign up to receive Nutrients for Life resources and curriculum by email.

Thank you for your participation.
Note: Your evaluation will be shared with the Agriculture In The Classroom PEI, the Director of Nutrients for Life Canada And the educational coordinator you evaluated.
Contacts: info@aitc-pei.ca and/or tsealy@nutrientsforlife.ca

You can also mail your completed forms to: **Agriculture In The Classroom PEI, 420 University Avenue, Farm Centre, Suite 113, Charlottetown PE C1A 7Z5**

LIGHT GARDEN CONTRACT

This confirms that _____ of _____School has taken responsibility for the AITC PEI Light Garden, effectively, _____ for agricultural education activities.

Not including soil, seeds and plants, all parts will be returned to the PEI AITC upon completion of the school term and agreed-upon duration. The Light Garden will be returned/picked up within 10-12 weeks. This Light Garden is for future use in other classrooms across Prince Edward Island.

If in the event of damages to the Light Garden, a financial settlement and agreement will be made. Please ensure the light garden is properly cared for and maintained to the best of your abilities.

If there are any questions or concerns with the Light Garden, please contact the PEI AITC anytime.

_____
Teacher Name

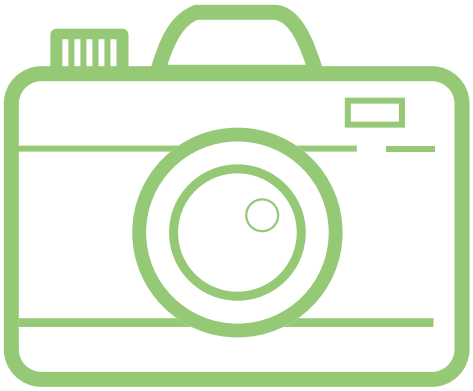
_____
Tamara Sealy
Educational Coordinator

_____
Teacher Signature

_____
Date

_____
Date

PERMISSION TO TAKE PICTURES



I, _____ at _____School, give permission to PEI AITC and Nutrients for Life to take pictures in my classroom of my students learning with the Light Gardens. I understand the pictures may be exhibited on their websites and/or publications.

_____ _____

Teacher Date

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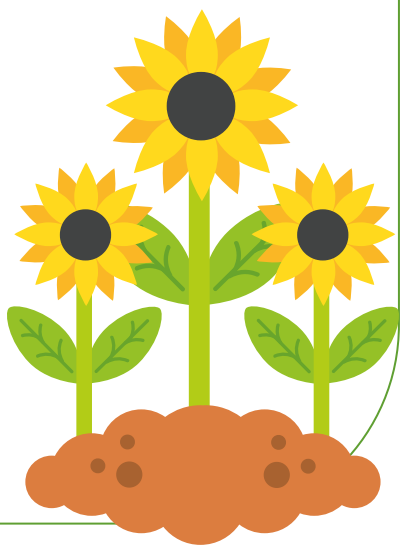
THINGS I LEARNED FROM THE LIGHT GARDEN!

Draw a picture or write a sentence!



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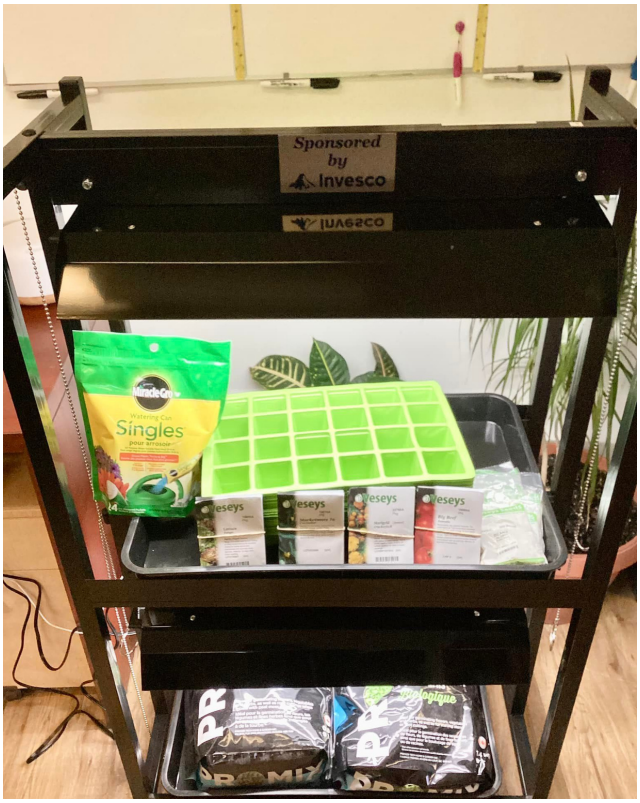
NUTRIENTS FOR LIFE | NUTRIMENTS POUR LA VIE

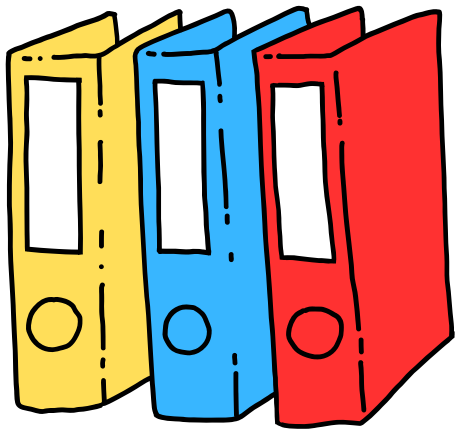
TO THE TEACHER

Thank you for using the Learning Garden Activity Guide. This guide has been designed for students attending Prince Edward Island schools using the light garden to grow different vegetation. Grade's activity is designed to meet specific curriculum outcomes designated by the Prince Edward Island Department of Education curriculum guides. We appreciate any feedback that you would like to share. If you have any stories, student writing pieces or artwork that you would like to share, please do so. This helps support our project and showcase the great things happening in PEI Schools.

YOUR LIGHT GARDEN PACKAGE INCLUDES THE FOLLOWING:

- Two Tier Light Garden (with black shelf trays)
- USB Stick(with Agriculture resources to use in the classroom) or Light Garden Binder
- Soil(s) for Light Garden
- Seeding Trays and/or Pots
- Water Soluble/Granular Fertilizer (depending on grade)
- Seeds for the lesson
- Timer
- Permission Form
- Light Garden Contract





THINGS TO RETURN TO THE PROGRAM:

- Two Tier Light Garden (with black shelf trays)
- Binder with the Light Garden Guide (if given)
- Timer
- Teacher Evaluation
- Permission Form signed
- Light Garden Contract

EACH ACTIVITY HAS THE FOLLOWING FORMAT:

Objective: States the goals of the activity

Curriculum Fit: This shows a list of all the specific subject curriculum outcomes that could be met

Materials: This shows a list of materials needed to complete the activity

Background Information: Provides some useful knowledge of why the activity is essential or how it could be applied to the real world

Introduction: Some topics that should be discussed before starting the experiment or activity

Activity/Procedure: Step by step on how to perform the experiment

Conclusion: What could be learned by completing the experiment and activities

In-Class Discussion: A list of topics to discuss after the activity has been completed

Activity Log: A list of all the activities to be completed for each grade level

This guide is designed to be a fun, interactive, and educational activity that teachers and students will enjoy. Some students will even be fortunate enough to take home their plants and grow them at home!

General Science Curriculum Outcomes

1. Students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology.
2. Students will develop the skills required for scientific and technological inquiry, solving problems, communicating scientific ideas and results, working collaboratively, and for making informed decisions
3. Students will construct knowledge and understandings of concepts in life science, physical science, and earth and space science and apply these understandings to interpret, integrate, and extend their knowledge
4. Students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge for the mutual benefit of self, society, and the environment

Growing Under Full-Spectrum Fluorescent Bulbs

With the advancement of today's technology, growing vegetation indoors has never had so many exciting options.

One of the most exciting advancements has been with the full spectrum fluorescent bulbs. These fluorescent bulbs replicate many of the conditions offered by the sun, including the temperature of the light in the bulb. The amount of replication of natural sunlight is higher than most normal bulbs. This allows the light from the bulbs to mimic natural conditions, and then the plants receive all their required light colours. The system is also more environmentally friendly than using shop lights because the system lights are brighter while also using less energy.

The height of the light fixtures is also adjustable. As the plants grow, the height of the lights can be raised to avoid burning the plants and to ensure that as much of the plant as possible receives light. **Unless otherwise stated, the average height distance for this experiment is 7.5cm (3 inches) above the tallest plant.** A bigger separation will be needed if the top plant feels warm from the lights.

The lights on the system need to be wiped clean every month. Also, lights should be wiped before beginning and at the activity's conclusion. Any dirt and dust build-up would reduce the amount of light that reaches the plants.

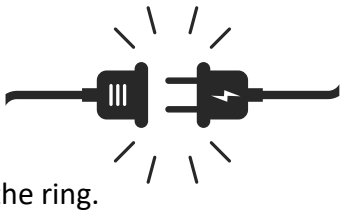
Plants should have their position on the light garden tray rotated every week. This is because the bulb's intensity is higher in the center than at the ends. If plants are not rotated, the experimental results will likely be biased towards the center plants.

The lights should be used daily from whenever the teacher arrives in the classroom until the teacher leaves. **This should give each plant at least 7 hours of light daily.** Lights must be shut off as plants require a break period from the light, or development will suffer.

Care for the Indoor Light Garden

How to turn it on:

1. Ensure the rows that are being used are plugged in.
2. Each power cord has a rotating wheel surrounded by a black box on it. Turn the wheel to turn the lights on or off, do this for both rows of the garden.
3. Both rows of lights should have been illuminated. Check the link between the lights if only one row is lit up. The link is found in the same position where the power cord plugs into the lights; however, on the other end of the lights.



How to raise the light height:

1. Go to the side of the light garden.
2. Each row has a metal chain with a ring on the end. Grab the ring.
3. Pull the chain horizontally with the ground. This will pull up the side closest to you.
4. A chain grip is found on the metal chain. Push the chain grip up until it touches the frame of the machine. This will hold the chain, and light row, in place.
5. Repeat the procedure to adjust the other side of the indoor light garden.

How to lower the light height:

1. Go to the side of the light garden.
2. Grab the metal ring. Hold firmly so the row does not slip.
3. Open the chain grip by pushing on its side. Slowly allow the chain to slide through the chain grip.
4. This should lower one side of the light fixture. When a desirable height is found, let go of the chain grip. Do not let go of the chain until you are certain the grip is holding the chain securely.
5. The procedure should be repeated with the other side of the light row.

Cleaning:

Lights

1. The lights should be cleaned at least once a month. This is to prevent dirt and dust from building up.
2. To clean the lights, unplug all cords for the unit.
3. Find a soft, dry cloth. Rub lights with the cloth to clean.

Frame

1. The hoods and frame should be cleaned regularly as well.
2. Unplug all cords for the unit.
3. Gently wipe with a damp cloth.

Growing Trays

1. Each row on the light garden should hold two 37cm x 24 cm growing trays.
2. If one tray wears down, please use one of the replacement trays in its place.

Care for the Plants

Watering:

1. Plants should be watered as specified in the procedure.
2. Water should be fed directly onto the soil; avoid “showering” the plant, as this could cause disease.
3. Plants should be watered early in the morning.
4. Do not overwater the plants! This could be as bad as not watering the plants enough. (Sometimes, if you over water a white mildew will form on the soil)

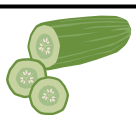
Lights:

1. Lights should be turned on daily (if no timer is present).
2. Remember to rotate the positions of the plants on the light garden tray. All plants need equal amounts of light to avoid an experimental bias.
3. Lights must also be turned off regularly, as too much light can kill plants. An ideal amount of light to receive, at most, would be between 6–8 hours daily.

Fertilizer:

1. In a watering jug, add one package of fertilizer (1 package will make enough for 8L of water)
2. Mix the fertilizer and water well.
3. Apply fertilizer mixture to the plants (fertilize on a weekly basis)
4. The mixture should be added to the soil. Do not pour the mixture onto the leaves of the plant.
5. Wash hands immediately after using fertilizer.

Planting Depth of Seeds

Type of Seed	**Planting Depth**
 Bean	3-4 cm
Cucumber 	3 cm
 Lettuce	0.6 cm
Marigold 	0.6 cm

KINDERGARTEN ACTIVITY

Exploring the Five Senses with Plants

Objective: To apply the five senses as a method to describe plants.

Curriculum Fit:

Science: Exploring the World Using Our Senses

1.1 – Become aware of our five senses

1.2 – Develop and use vocabulary associated with the five senses

Social Studies: I am Unique

1.3 – Demonstrate that cooperation is an important part of being a member of a group

Health and Physical Development: Personal Development

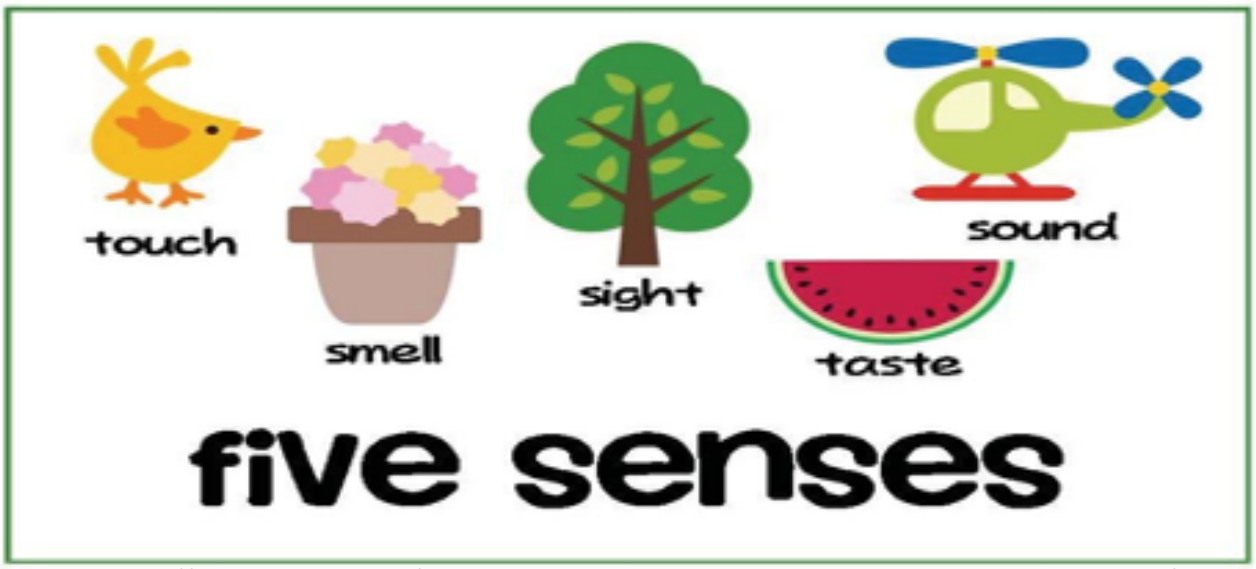
3.3 – Engage in and complete activities independently; and seek assistance as necessary

Materials:

- Indoor light garden
- Growing trays
- Fertilizer
- Potting soil
- Cucumber seeds
- Tomato seeds
- Marigold seeds
- Lettuce seeds
- Additional supplies that are needed but not supplied by the program– watering can, popsicle sticks to mark students' plants

Background Information:

The five human senses are taste, smell, sight, touch and hearing. Each of these five senses serves a different purpose. In humans, taste occurs in the mouth. It results from the interaction between the material and taste buds in the mouth. The taste buds send a message to the brain, creating taste sensations. Smell allows a person to detect any aromas in the air. Sight is the ability to see. Sight serves many purposes, including determining how far away an object is, reading, and watching television. Touch is the ability to feel where an object is by having physical contact. The last sense is hearing. Hearing is the ability to recognize a particular sound. As well, the person should recognize where that particular sound came from.



http://www.clipartkid.com/senses-clipart-clipart-panda-free-clipart-images-MbWY3O-clipart/

Introduction:

Briefly explain to students the following:

1. What the five senses are.
2. What each of the five senses means.

Activities/Procedures:

1. Each student will be assigned to one of three plants; marigolds, cucumbers, or tomatoes.
2. Each seed should be planted to an appropriate depth, and each tray should be labelled to know which plant is in which tray.
3. The planted seeds should be transferred to the light garden for the experiment.
4. Plants should receive light daily.
5. Marigolds should be watered every second day or every day if the soil is dry. Tomatoes should be watered twice a week, once at the start and once at the end (MondayƒThursday or Tuesday/Friday would be the two best combinations). Cucumbers should be watered enough to ensure the soil is constantly damp but not completely soaked. Use the water-soluble fertilizer weekly with regular watering.
6. On The first day of each school week, the plant tray's positions should be rotated to ensure all plants receive equal light intensity. Also, the rows should be checked to see if the height of the light fixtures needs to be adjusted.
7. The activities in the Activity Log should be completed at the end of the experiment.

Conclusion:

The student should have a stronger understanding of the five senses and be able to apply these senses to describe objects.

In-Class Discussion:

1. In what other situations would each of the senses be important?
2. Are any of the senses more important than others or are they all equal?

Kindergarten Activity Log: Exploring the Five Senses with Plants

Please Note: If writing skills are not yet developed, the questions in the Activity Log are allowed to be done as part of the in−class discussion.

Sense of Touch:
Feel the different parts of a plant, including roots, stem, and leaves. How do the different parts feel? Are they soft, hard, smooth, bumpy, etc?

Repeat the same exercise with two different types of plants. After feeling the third plant, students should be able to notice at least one major difference between each plant through touch.

Sense of Sight:
Look at each of the plants. Describe some of the major features of each plant, including, but not limited to, the colour, size, and height.

Sense of Smell:
Get students to smell each of their plants. Do any of the plants have a noticeable or unique odour? Do some of the plants have no odour at all?

Sense of Hearing:
One of the most noticeable sounds plants make is the rustling of their leaves in the wind. Listen to the sound difference between the plants when they are inside with no wind and outside when there is wind.

Sense of Taste:
(How did the lettuce taste?)
The sense of taste has many important functions for humans. The main sensations are sweet, salty, bitter, and sour. Can you think of any fruits or vegetables that would fall under these categories?

Kindergarten Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Participation in Growing/Sharing the Plants, and Class Discussions	Student actively participated in growing the plants, sharing the plants, and in class discussions	Student participated briefly in all of actions	Student participated in only two of the three actions	Student did not participate
Activity Log	Student successfully completed all activities	Student completed all activities, more detailed answers needed	Student left 1 or more questions blank	Student did not attempt to complete over half of the activities
The Five Senses	Student showed a strong understanding of all five senses	Student showed a strong understanding of at least three of the senses	Student showed a strong understanding of at least of the senses	Student did not show a strong understanding of any of the senses
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Kindergarten Activity Log Answer Key: Exploring the Five Senses with Plants

All questions are opinion based. It is at the teacher's discretion to decide what an acceptable answer is.

GRADE 1 ACTIVITY

The Structures of a Flower

Objective:

At the end of the plant's growth period, students should be able to label the different parts of a plant and know the observed difference between a flowering and a non−flowering plant. Students should be able to measure and record information about a plant.

Curriculum Fit:

Science: Characteristics of Living Things

201−5 − Make and record relevant observations and measurements about animals and plants using written language, pictures, and charts.

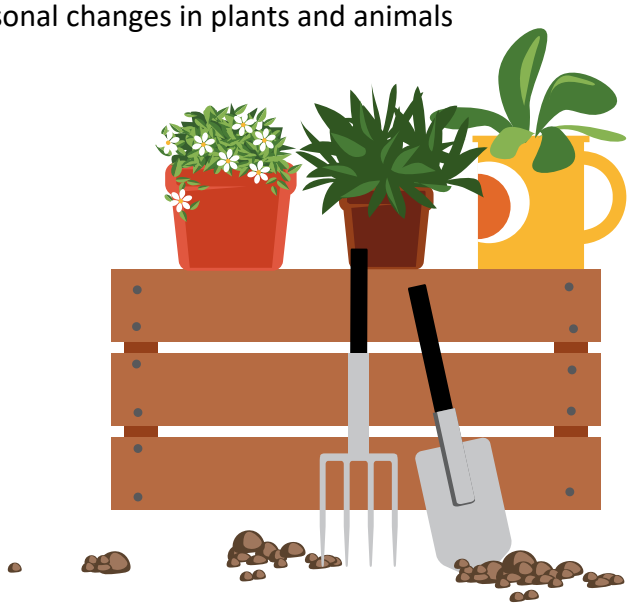
203−5 − Identify and use common terms for parts of humans, other animals, and plants

100−8 − Identify and describe common characteristics of humans, other animals, and plants, and identify variations that make each person, animal, and plant unique

203−4 − Listen and respond to another student's description of an animal or plant 202−2 − Place animals and plants in groups according to one or more characteristics 100−5 − Describe different ways that plants and animals meet their needs

103−2 − Recognize that humans and other living things depend on their environment, and identify personal actions that can contribute to a healthy environment

200−3 − Make predictions about seasonal changes in plants and animals

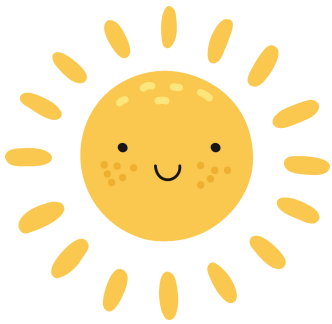


Materials:

− Indoor light garden
− Growing trays
− Water
− Fertilizer
− Potting soil
− Paper
− Marigold seeds
− Lettuce seeds
− Additional supplies that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plants

Background Information:

Agriculture is very important in today's world. Providing healthy food choices for individuals and supplying major companies with raw products for manufacturing. One major field of agriculture is growing plants. Plants supply humans with many nutrients and minerals required to live a healthy life. Most plants are generally composed of three main parts: the roots, the stem, and the leaves. The roots anchor the plant in the ground and absorb water and minerals (food). The stem can be considered a transport zone between the roots and the leaves. The leaves are where the water is expelled, and the sunlight is absorbed.



Introduction:

Explain to students the following before starting the experiment:

1. How to use the chart in the Activity Log.
2. Things a plant needs to grow and survive.
3. The major structures of a plant.

Activity/Procedure:

1. Each student in the classroom is to be assigned one seed from either a flowering or a non−flowering plant. Ensure that there is an equal number of flowering and non−flowering plants distributed.
2. The student will be assigned a specific tray cell for the indoor light garden and must fill it with soil.
3. The student must bury the seed at an appropriate depth to ensure growth will occur. Students should not remove the seed from the garden until the end of the experiment.
4. Plants should receive light daily. Lettuce should be watered daily as a seed. Once lettuce has germinated (is visible above the soil surface), lettuce only has to be watered enough to ensure the soil is kept damp. Marigolds should be watered every second day or every day if the soil is dry. Use the water-soluble fertilizer weekly with regular watering.
5. Each student should record the height of their plant in the activity log every Monday, Wednesday, and Friday. If a plant is not visible above the soil, a height of 0.0cm should be recorded. The measurement should be from the soil level to the highest point on the plant.
6. At the start of every week, the plant tray positions should be rotated to ensure that all plants receive equal light. Also, the rows should be checked to see if the height of the light fixtures needs to be adjusted.
7. At the conclusion of the allotted growth time frame, the Activity Log attached to the section must be completed.

Conclusion:

Students should be able to see the observed differences between flowering and non−flowering plants. Students should also have learned some of the different parts of a plant and how to make and record measurements of a plant.

In-Class Discussion:

1. Discuss some of the advantages of using an indoor growing system. How would this affect the seasonal growth of some plants?
2. What are some ways that plants meet their physical needs?
3. Humans have a heavy dependence on their environment. What are some ways that humans could contribute to a healthy environment?

Light Gardens

Grade 1 Activity Log: The Structures of a Flower

Please Note: If writing skills are not yet developed, the questions in the activity log can be answered as part of the in−class discussion.

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0 cm should be recorded if no plant is visible.

Date	Plant Height (cm)	Date	Plant Height (cm)

Did you have a flowering or non-flowering plant?_____

What do plants need to survive? _____

_____

_____

_____

Dig your plant out of the soil pot. Press the plant with a light book against the paper. Either pin the plant (if possible) to the paper or trace the outline of the plant on the paper. Correctly label the plant's roots, stem, and leaves on the paper.

Compare your plant with a classmate. Make sure both students have different plants. Each student should briefly describe their own plant to their classmate. Compare the two plants while making a list of multiple similarities and differences.

Similarities	**Differences**
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Grade 1 Activity Marking Rubric

Activity Objective	Level 4	Level 3	Level 2	Level 1
Recorded Measurements of Plant Height.	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Plant Essentials	Student thought of at least 3 things a plant needs to survive	Student thought of 2 things a plant needs to survive	Student thought of 1 thing a plant needs to survive	Student could not think of anything essential to plant survival
Common Parts of the Plant.	Plant traced or pinned correctly, all parts labeled correctly	Plant traced or pinned correctly, 2 parts labeled wrong	Plant not traced or pinned correctly, 2 parts labeledwrong	Plant not traced or pinned correctly, all parts labeled wrong
Plant Comparison	Students listened and presented well. Large list created	Students listened and presented well. Medium length list created	Students did not listen or present well. Small list created	Student would not present/listen to other students. No list created
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

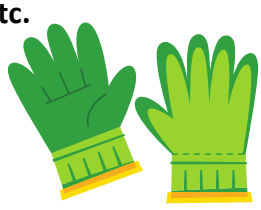
Grade 1 Activity Log Answer Key: The Structures of a Flower

Did you have a flowering or non-flowering plant? **This depends on which type of seed was assigned.**

What do plants need to survive? **A large list could include water, sunlight, air, soil, fertilizer, etc.**

Dig your plant out of the soil pot. Press the plant with a light book against the paper. Either pin the plant (if possible) to the paper or trace the outline of the plant on the paper. **Correctly label the plant's roots, stem, and leaves on the paper. Roots are the portion of the plant found mostly below ground, the stem is the long middle portion, and leaves grow out of the stem.**

Compare your plant with a classmate. Make sure both students have different plants. Each student should briefly describe their plant to their classmate. Compare the two plants while making a list of multiple similarities and differences. **A large list could be made. Some major differences include height, number of leaves, flowers, colour, root system, etc.**



GRADE 2 ACTIVITY

The Stages of Plant Development

Objective:

Students will have a chance to grow their plants. At the end of the growth period, students should be able to observe and describe plant changes and recognize when these changes occur.

Curriculum Fit:

Science: Investigating the Needs and Life Style of an Organism

101−7 − Observe and describe changes in the appearance and activity of an organism as it goes through its life cycle

201−5 − Record relevant observations of changes in the appearance and activity of an organism as it goes through its life cycle using written language, pictures, and/or charts

102−6 − Identify constant and changing traits in organisms as they grow and develop

203−5 −Respond to other students' ideas about an organism's needs and changes in growth pattern

203−2 − Recognize the stages of development of the organism using applicable terminology and language

202−7 − Propose suggestions for meeting the needs of the organism being investigated, and draw conclusions about its growth patterns or stages based on observations

203−3 − Communicate procedures and results of the investigation into the life cycle of an organism using drawings, demonstrations, and/or written and oral descriptions

Mathematics: Shape and Space

SS3 − Compare and order objects by length, height, the distance around and mass (weight) using nonstandard units, and make statements of comparison

Materials Needed:

− Indoor light garden
− Growing trays
− Water
− Fertilizer
− Potting soil
− Bean seeds
− Lettuce seeds
− Additional supplies that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plant tray cell

Background Information:

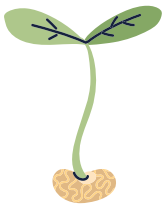
The ability to record, describe, and understand change are very important skills. In the experiment, each student should grow one bean plant and be able to observe and describe the change in a plant's life cycle and understand at what stage in development these changes occur. A plant is a great way to model the lifecycle of an organism. A plant follows a similar growth pattern to most animals. The major stages of growth in a bean plant in order are emergence and early growth, branching and rapid growth, flowering and pod formation, and pod fill and maturation (information was taken from http://www.colostate.edu/Orgs/Vegnet/vegnet/dbgs.html).

Bean Plant Lifecycle

Introduction:

The teacher should explain the following to students before starting the experiment:

1. How to use the recording chart in the Activity Log.
2. Briefly go over the different stages of development of the organism (seed, germination, seedling, full plant).



Activity/Procedure:

1. Students should each receive one seed.
2. Each seed should be buried in the soil to an appropriate depth.
3. Students should place their trays containing seeds on one of the light garden rows prior to the experiment.
4. Once seeds are planted, they should be transferred to the light garden. Plants should receive light daily. As well, beans should be watered at least every second day. Ensure that the soil is damp but not soaked after being watered. Use the water-soluble fertilizer weekly with regular watering.

5. Measurements of plant height and recording of observed changes will be taken on Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible. The measurement should occur from the soil to the highest point on the plant.
6. At the start of every week, the plant trays must be rotated to ensure that all plants receive equal light. As well, each row should be checked to see if the height of their fixtures needs to be adjusted.
7. Students should complete the activities in the Activity Log once the activity has finished. The Activity Log starts on the next page.

Conclusion:

Students should have been able to observe, describe, and record changes in the plant throughout its lifecycle. Students should also be able to say at what stage-specific changes occurred in the plant's lifecycle.

In-Class Discussion:

1. How are the life stages of a plant similar to that of a human?
2. Were changes immediate (i.e. occur overnight), or were many of the changes gradual?

Grade 2 Activity Log: The Stages of Plant Development

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible.

Date	Height (cm)	Observed Changes

What major changes does a plant experience throughout its life cycle?

_____

_____

What features of plants were consistent (not changing) over an extended period of time?

_____

_____

During periods of rapid and small growth, did the basic needs of the organism appear to change (eg did the soil appear dryer indicating higher water uptake)? What do these changes indicate?

_____

_____

Compare your findings with those of fellow students. Did they have any ideas that differed from yours? What were they?

_____

_____

Plant Knowledge:

What are some basic needs of most plants?

_____

_____

_____

Could you divide the life cycle of a plant into any distinct stages? What are these stages called?

_____

_____

Grade 2 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Recorded Observations of Plants	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Identified Consistent Features and Changes on a Regular Basis	Student could identify several consistencies and changes in a plant'slife cycle	Student could identify a few consistencies and changes in a plant'slife cycle	Student could identify only a few consistencies or a few changes in aplant's life cycle	Student could not identify any consistencies or changes in a plant'slife cycle
Plant Life Cycle Comparison	Student compared findings with at least three other students	Student compared findings with two other students	Student compared findings with one other student	Student did not compare findings with other students
Plant Knowledge	Student was ableto think of 3 basic needs, and correctly identify stages	Student was ableto think of 2 basic needs, and correctly identify stages	Student was able to think of 1 basic need, and incorrectly identified some stages	Student was not able to think of basic needs, incorrectly identified most stages
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 2 Activity Log Answer Key: The Stages of Plant Development

What major changes does a plant experience throughout its life cycle? **The seed grows roots and a stem. Stem can grow leaves or flowers. Size and potentially colour changes as well. What features of plants were consistent (not changing) over an extended period?**
Refer to experiment results that students found.

During periods of rapid and small growth, did the organism's basic needs appear to change (e.g., did the soil appear dryer indicating higher water uptake)? What do these changes indicate?
Again, this is a question that students answer based on their results. A logical answer should support what those changes indicate.

Compare your findings with those of fellow students. Did they have any ideas that differed from yours? What were they? **This answer will vary depending on what students have thought of.**

Knowledge:
What are some basic needs of most plants?
A large list could include water, sunlight, air, soil, fertilizer, etc.

Could you divide the life cycle of a plant into any distinct stages? What are these stages called?
The life cycle could be divided into seed, seedling, plant, and flower.

GRADE 3 ACTIVITY

Testing Growing Conditions for Plants

Objective:

To determine what conditions are best for growing certain types of plants. Students will also learn about the importance of plants to the environment and animals.

Curriculum Fit:

Science: Investigating Germination and Growing Conditions for Plants

202−2 − Place seeds in groups according to one or more attributes

200−1 − Ask questions to investigate related to growing conditions for plants 200−3 − Make predictions about which conditions will be best for plant growth

201−5 − Make and record relevant observations and measurements of plant growth during their investigation

202−4 − Construct and label bar graphs that show plant growth under different conditions

100−29 − Draw inferences that identify and investigate the life needs of plants and describe how plants are affected by the conditions in which they grow

100−29/203−2 − Identify and describe parts of plants and their general function

202−5 − Identify and suggest explanations for patterns and discrepancies in the growth rate of similar plants grown in varying conditions

Science: The Life Cycle of a Plant

201−6 − Estimate measurements of the plant as it grows

100−30/201−5 − Observe and describe changes, using written language, pictures, and charts, that occur through the life cycle of a flowering plant

Science: Uses for Plants

102−12 − Describe ways in which plants are essential to living things and the environment

102−13 − Identify parts of different plants that provide humans with useful products, and describe the preparation that is required to obtain these products and how our supply of useful plants is replenished

203−5 − Respond to the ideas and actions of others and acknowledge their ideas about the uses and replenishing of plants

Science: Interactions of Living Things and Soils

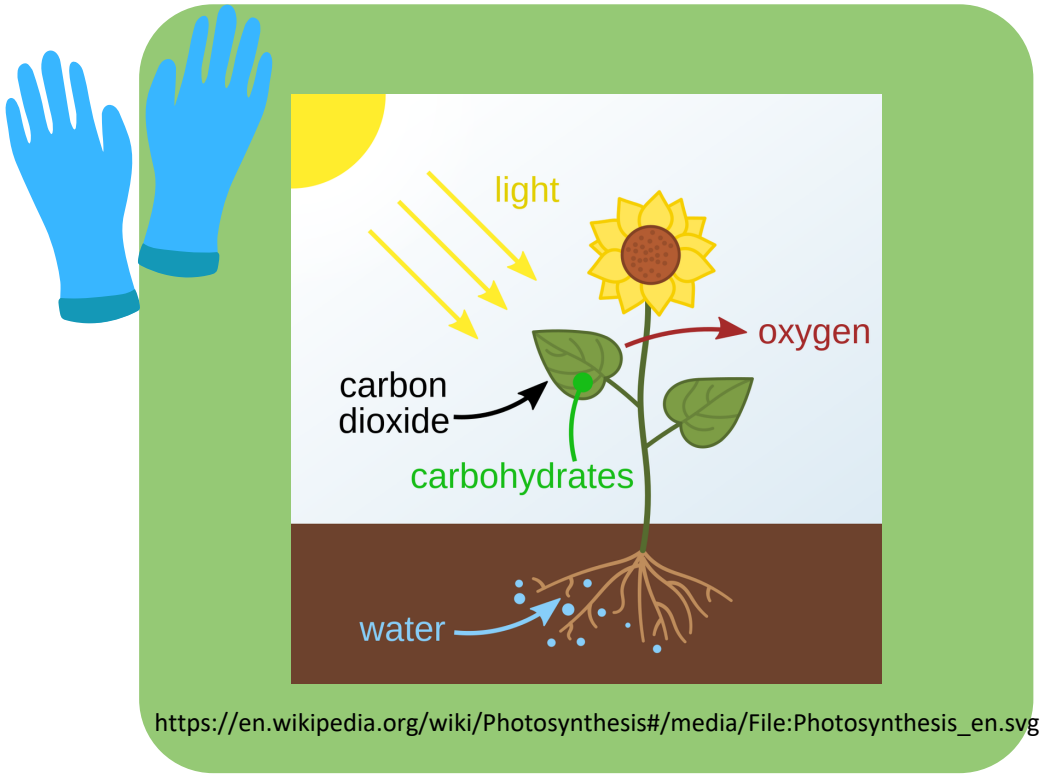
100−35 − Investigate and describe how living things affect and are affected by soils

Materials Needed:

- Indoor light garden
- Growing trays
- Water
- Potting soil
- Paper
- Bean seeds
- Marigold seeds
- Lettuce seeds
- Fertilizer
- Additional supplies that are needed but not supplied by the program– watering can, popsicle sticks to mark students' plants

Background Information:

Plants are essential for the survival of humans and every animal on the planet. Plants are usually at the bottom of most food chains. Plants also provide many of the essential nutrients required in a healthy diet. Growing plants can be very dependent on the conditions in which they live. The amount of sunlight and water received are two of the most important conditions. In the experiment, optimum light levels are to be researched. One row of the Light Garden will be watered (soil to be kept moist but not wet), and the lights will be turned on daily Monday–Friday. The second row will be watered (soil to be kept moist but not wet); only have its lights turned on Monday and Friday. Controlling the light variably, the importance of light will allow the students to observe how light can affect its growth.



https://en.wikipedia.org/wiki/Photosynthesis#/media/File:Photosynthesis_en.svg

Introduction:

Explain to the students the following before the experiment.

1. What condition will each row of the Light Garden represent?
2. On what days have the lights on for each row?
3. If multiple seed types are used, ensure each plant has a unique bar graph.

Activity/Procedure:

1. Students will be divided into groups of two
2. Each student in the group will pick up one seed.
3. Label the rows as follows:
    a. TOP ROW−water as needed, lights on daily
    b. BOTTOM ROW: water as needed, lights on Monday and Friday only
4. Each group member must bury their seed in a different environment than their partners. Ensure that seeds are buried to an appropriate depth. Use water-soluble fertilizer weekly with regular watering.
5. Students should read the Activity Log to complete any pre−experiment activities. The Activity Log is found after the in−class discussion.
6. Plants need to be measured regularly. All height measurements will be taken on Monday, Wednesday, and Friday. A height of 0.0cm indicates that the plant is not yet visible. The measurement should be taken from the soil level to the top of the plant.
7. At the start of every week, the plant trays should be rotated. This is to ensure that all plants receive an equal amount of light for growth. Also, each row should be checked to see if the height of each light fixture needs to be adjusted.
8. Once the final day of the experimental period has occurred, one final measurement should be taken for the heights and recorded.
9. All remaining activities in the activity log should be completed.

Conclusion:

Students should be able to report which light conditions were best for each plant. These results can be through displaying the data in a bar graph. Students should also have a basic understanding of the importance of plants to the environment and humans.

In-Class Discussion:

1. What are some ways that plants could be replenished?
2. Ignoring height as the only factor, what was the quality of each grown plant? Were some plants shorter but appeared healthier?

Grade 3 Activity Log: Testing Growing Conditions for Plants

Complete Before Growing:

Compare the different types of seeds being used. What is similar in the seeds? What is different?

Knowing the plants' conditions, predict what will happen to the plants under each light condition.

Complete During the Experiment:

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible.

Date	Height (cm) Light and Water as Needed	Height (cm) Light M and F, Water as Needed

Complete After the Experiment:

Construct a bar graph showing the average height of all plants (the same type as yours) in your class. Only use the final height of each plant when calculating the average height. Using these results, identify the needs of plants, and identify how conditions affect these needs.

How well would the different plants have grown if a third row had been available that only received water and no lights on Monday and Friday? Use the results from your experiment to answer the question.

There are many different parts of plants. Identify some of the parts of your plant and describe the function of that part.

Part	Plant Function

Importance of Plants:

How are plants important to living things and to the environment in general?

Plants are essential for human health. What parts of plants are important for humans?

Compare your answers with those of a classmate for the last two questions. Did you have any different ideas or different results that occurred during the experiment? If so, what were the differences?

Grade 3 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Pre-Experiment Questions	Pre−experiment questions completed. Lots of thought put into answers	Pre−experiment questions completed. Not much thought put into answers	Only 1 pre− experiment question completed	Did not complete either of the pre−experiment questions
Recorded Observations of Plants	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Bar Graph: Creation and Analysis	Bar graph completed. Able to formulate ideas on how both water and light affectgrowth	Bar graph completed. Commented only on how just light or just water affected conditions	Bar graph completed. Did not think of any ideas on how conditions effect growth	Bar graph was not completed.
Plant Parts	Student listed at least 5 plant parts and functions	Student listed at least 3 plant parts and functions	Student listed at least 1 plant part and function	Student did not list any plant parts
Importance of Plants	Student finished all sections and compared ideas with fellow classmate	Student finished all sections. Did not compare answers	Student attempted some of the questions	Student did not attempt section
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 3 Activity Log Answer Key: Testing Growing Conditions for Plants

Complete Before Growing:

Compare the different types of seeds being used. What is similar in the seeds? What is different? **This is an opinion question, but some examples of what could be compared include color, texture, size, and depth of planting.**

Knowing the conditions the plants will be grown in, make a prediction on what will happen to the plants under each condition. **This is an opinion based question so most answers should be acceptable.**

Complete After the Experiment:

Construct a bar graph showing the average height of all plants (the same type as yours) in your class. Only use the final height of each plant during the calculation of the average height. Using these results, identify the needs of plants, and identify how conditions affect these needs. **Students should create a bar graph. The bar graph should show a difference in plant height, and students should be able to predict which set of conditions was best for plant growth.**

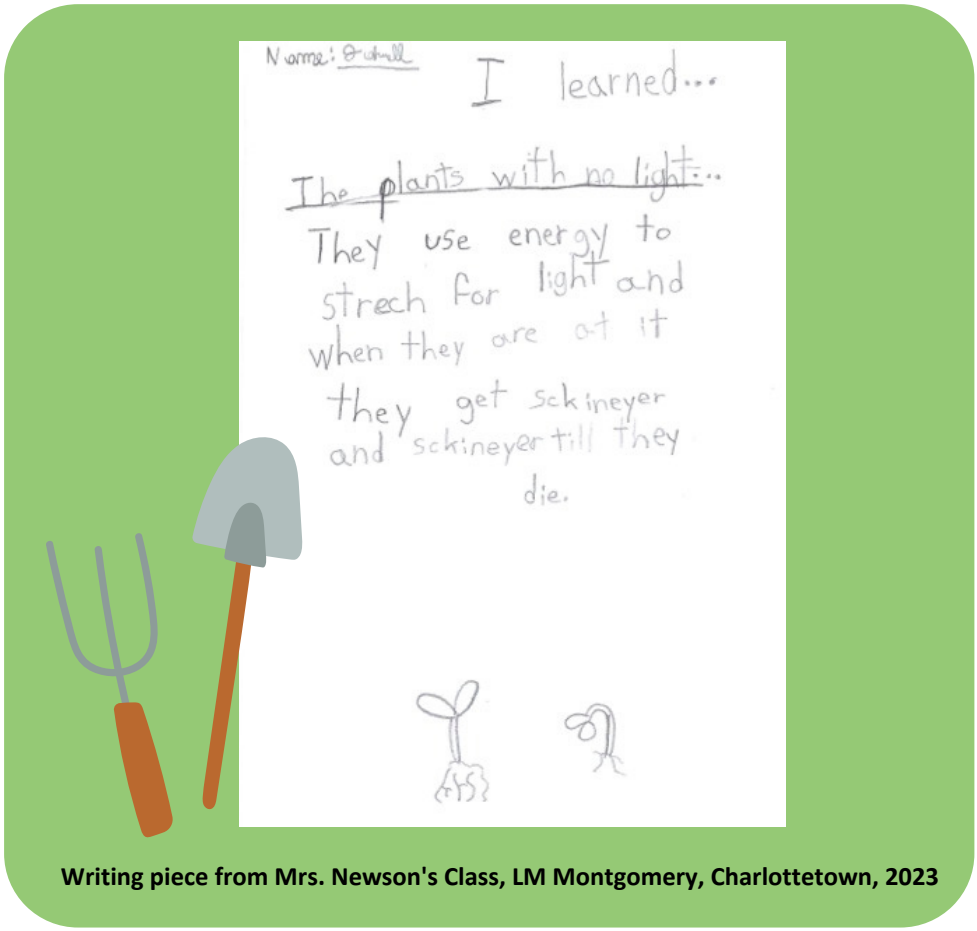
How well would the different plants have grown if a fourth row had been available that only received water and light on Monday, Wednesday, and Friday? Use the results from your experiment to answer the question. **Students should be able to see how less sunlight and water affect plant growth by looking at their bar graphs. Students should be able to make a prediction about how a lack of both sunlight and water would affect plant growth.**

There are many different parts of plants. Identify some of the parts of your plant and describe the function of that part. **Many different parts could be chosen. Only focus on the ones students have learned in class.**

<u>Importance of Plants:</u>
How are plants important to living things and to the environment in general? **Multiple answers are acceptable, including creating oxygen, providing food, protection, etc Plants are essential for human health.**

What parts of plants are important for humans? **All parts of plants can be useful depending on their origin. For example, the root of carrots, celery stems, and lettuce leaves can all be eaten.**

Compare your answers with those of a classmate for the last two questions. Did you have any different ideas or different results that occurred during the experiment? If so, what were the differences? **The answers to this question depend on how the students answered the previous questions.**



Writing piece from Mrs. Newson's Class, LM Montgomery, Charlottetown, 2023

GRADE 4 ACTIVITY

Adaptive Structures of Plants

Objective:

To observe the structural features that allow plants to survive in various conditions and to understand which conditions are best for the growth of certain plants.

Curriculum Fit:

Science: Habitats and Populations

204−1 − Identify questions to investigate about the types of plants and/or animals at a local habitat, and the conditions under which they live

206−2 − Compile and display the data collected in the habitat study using tallies, tables, and/or bar graphs

205−5/302−1 − Make observations and collect information related to local habitats and their associated population of plants and animals

104−4/206−3 − Present the procedures and results of their habitat studies, compare their results with those of other class members, recognizing that results may vary, and suggest reasons for these discrepancies

Science: Structural Features of Plants that Enable Them to Survive in Their Habitat

302−2/104−6 − Using appropriate terminology, compare the structural features of plants that enable them to survive in different kinds of places

106−4 − Describe how scientists knowledge of plant growth has led to agricultural innovations and techniques 105−1 − Describe current investigations into local or regional habitat issues Sources of Light

107−4 − Provide examples of how human−made sources of light have been designed to solve problems in the home and at school

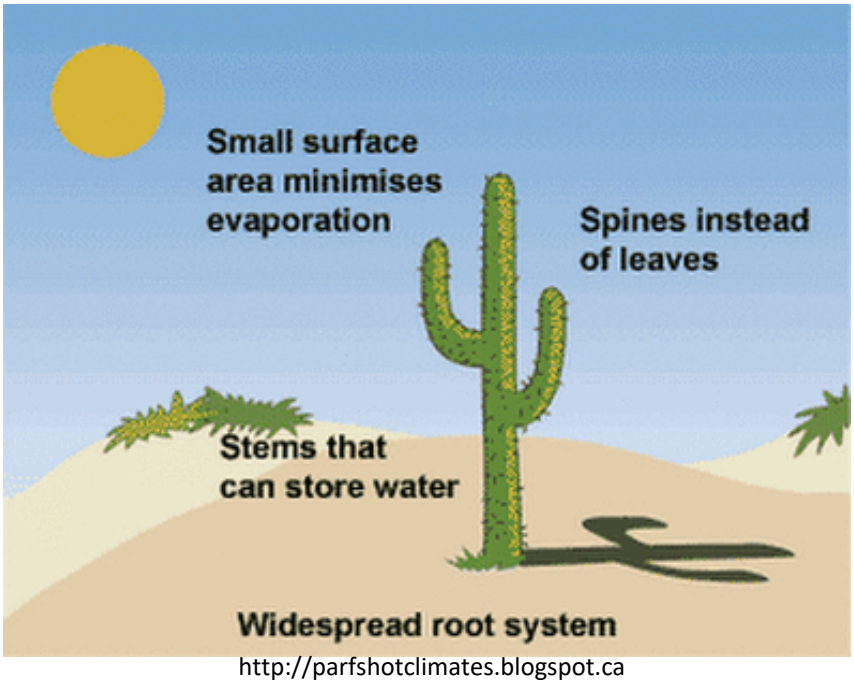
108−1 − Identify positive and negative effects of exposure to light

Mathematics: Patterns and Relations

PR3 − Represent and describe patterns and relationships using charts and tables to solve problems

Materials Needed:

− Indoor light garden
− Growing trays
− Water
− Fertilizer
− Potting soil
− Vermiculite
− Bean seeds
- Marigold seed
- Lettuce seeds
- **Additional supplies** that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plants



http://parfshotclimates.blogspot.ca

Background Information:

Different structural adaptations have enabled plants to survive in a number of different types of environments. Adaptations include the cactus leaf, the marigold's fibrous root system, the carrot's taproot, and bright colours to attract pollinators. In the experiment, different adaptations will be tested to see what adaptations are good for different environments. The experiment will test the plant's ability to grow in various soils.

Introduction:

Explain to students the following:

1. Different forms of adaptation plants use for different environments.
2. The nutritional value of the different soils.
3. Explain what kinds of vegetation regularly live in these habitats (where the soil types are found).

Activity/Procedure:

1. Assign students into groups of four.
2. Each group should receive four seeds: two of each type of plant being used.
3. Two different types of soil should be used to grow the plants in. Fill two trays with one type of soil and two with the other type (vermiculite).
4. The class should now have four different trays. Each tray represents a different seedʃsoil combination. Be sure to label the seedʃsoil combination on the side of the tray. Use water-soluble fertilizer weekly with regular watering.
5. Each group should plant the appropriate seed in the appropriate tray. Be sure to label which slot in each tray belongs to whom for identification purposes when switching the garden.
6. All trays should then be transferred to the light garden.
7. Lighting should take place every school day. Beans should be watered at least every second day. Ensure that the soil is damp but not soaked after being watered. Marigolds should be watered every second day or every day if the soil is dry.
8. Plant height should be recorded every Monday, Wednesday, and Friday in the activity log. If a plant is not yet visible, a height of 0.0cm should be recorded. Plants should be measured from the soil to the highest point of the plant. During the weeks the plants are located with students in the 4th grade, the numbers for those weeks can be taken from the 4th-grade students.
9. At the start of each week, the position of the trays should be rotated. This is to ensure all plants receive a relatively equal amount of sunlight. As well, each row should be checked to see if the height of the light fixtures needs to be adjusted.
10. At the end of the activity, plants should be examined. Height, quality of the plants (green or yellow in colour), and, if applicable, flowers are examples of what should be examined.
11. Activities in the Activity Log should then be completed.

Conclusion:

Students should have witnessed plants' growth (or non-growth) under different conditions. Students should be able to guess what features of certain plants allow for adaptation to certain environments.

In-Class Discussion:

1. The classroom should discuss which plants could survive in different conditions. Students should also be able to explain why certain plants could survive in these conditions while others could not.
2. Can students think of any new adaptations not mentioned during the introduction?
3. What are some advantages and disadvantages of using human-made light compared to sunlight?

Grade 4 Activity Log: Adaptive Structures of Plants

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible.

Date	Bean Height in Potting Soil (cm)	Bean Height in Vermiculite (cm)	Marigold Height in Potting Soil (cm)	Marigold Height in Vermiculite (cm)

Look at the results of the table. Were the plant heights always consistent (e.g. plant one was always tallest, plant two always shortest), or was there no set growth pattern for the plants?

Create a bar graph showing the height of each plant as compared to its soil. Use the final average height of all of the plant/soil combinations.
Which conditions were found to be best for each of the plants? Did any particular result(s) stand out?

In what type of environment are the plants regularly found in the wild? Is this consistent with what the results of the experiment would indicate?

The Real World:
Students should be able to hypothesize why plants have specific characteristics. Some possible adaptations include the shape of the roots and leaves. Were there any adaptations present in the plants used for the experiment?

Many scientists dedicate hundreds of hours to studying the optimal conditions for plant growth. How could the results of their findings affect the agriculture industry?

Today's world has many issues that are destroying habitats. Some examples include logging, urbanization, and natural disaster. How does this affect the plant habitat?

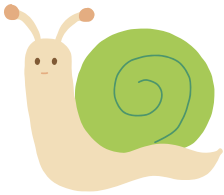
Grade 4 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Recorded Heights of Plants	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Bar Graph	Bar graph was created. Axis and titles labeled.Correct final heights used.	Bar graph was created. One of axis or title was not labeled. Correct final heights used.	Bar graph was created. Axis and title not labeled. Incorrect finalheight used	Bar graph was not created
Plant Living Conditions	Student reported best growing conditions from the experiment.Student also looked up where the plant is found in the wild. Good thought put into questions.	Student report best growing conditions and looked up where the plant is found in the wild.Not much thought put into questions.	Student only answered one of the two questions.	Student did not report results or look up the plant's conditions in the wild.
The Real World	All three questions were answered with a logical response	Only two of the three questions were answered with a logical response	Only one of the three questions was answered with a logical response	None of the questions were attempted or answered with a logical response
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 4 Activity Log Answer Key: Adaptive Structures of Plants

Create a bar graph showing the average height of each plant as compared to their soil. Use the final average height of all of the plant/soil combinations.
Which conditions were found to be best for each of the plants? Did any particular result(s) stand out? **The answers depend on the results of the experiment.**

In what type of environment are the plants regularly found in the wild? Is this consistent with what the results of the experiment would indicate? **Students will have to do a quick background check to find out where the plants live in the wild. Students must then decide if those conditions would be similar to the soil in the experiment.**



The Real World:

Students should be able to hypothesize why plants have certain characteristics. Some possible adaptations include the shape of the roots and leaves. Were there any adaptations present in the plants used for the experiment? **The roots of some differ depending on the need for water. A plant with all equal size roots requires more water than one with one large root and others branching off. Leaves also control the amount of sunlight the plant wants and water loss.**

Many scientists dedicate hundreds of hours to studying the optimal conditions for plant growth. How could the results of their findings affect the agriculture industry? **These results would allow the agriculture industry to grow crops in the best conditions possible to maximize plant yield.**

Today's world has many issues that are destroying habitats. Some examples include logging, urbanization, and natural disaster. How does this affect the plant habitat? **A change in habitat conditions could allow plants with certain adaptations to thrive and may kill off other species present.**

GRADE 5 ACTIVITY

Ozone Depletion, Global Warming, and the Water Cycle

Objective:

To investigate the possible effects of ozone depletion and global warming on the growth of plants. Students could also learn some of the different stages of the water cycle.

Curriculum Fit:

Science: Movement of Air and Water

301−13 − Relate the constant circulation of water on Earth to the processes of evaporation, condensation, and precipitation

Science: Environmental Issues

108−1 − Identify positive and negative effects of technologies that affect weather and the environment

106−4 − Describe how studies of the depletion of the ozone layer, global warming and the increase in acid rain have led to new inventions and stricter regulations on emissions from cars, factories, and other polluting technologies

Materials:

- Indoor light garden
- Growing trays
- Water
- Fertilizer
- Potting soil
- Bean seeds
- Lettuce seeds
- Additional supplies that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plants

Background Information:

Two of the most significant environmental issues over the past couple of decades have been the hole in the ozone layer and global warming. The effects are being felt all over the world. At the two poles, melting ice caps have caused ocean levels to rise and cause a change in the environment for animals living at the poles. Droughts and heat waves are being felt all over the world. Warmer ocean temperatures in the Gulf of Mexico have led to more powerful hurricanes. The effects of global warming also affect plants. Some plants thrive in the increasing heat, whereas others try adapting to a new environment. The experiment also mimics the three main stages of the water cycle: precipitation, evaporation, and condensation. Precipitation is mimicked by the watering of the plants, evaporation by the drying out of soil and leaves of bean plants, and condensation by retrieving water from a tap.

In the experiment, the rows in the light garden will have a different light height from the plants. The top row will be set 1 inch above the tallest plant, and the bottom row 3 inches above the tallest plant. The bottom row is set to the recommended height so it represents normal conditions. The top row is very close to the plants. This represents global warming conditions as the lights will make the plants warmer, and the more intense light represents a hole in the ozone layer.

Introduction:

Explain to students the following:

1. What the hole in the ozone layer is.
2. The causes of global warming.

Activity/Procedure:

1. Divide the students into groups of 3 or 4. Each group will receive two seeds.
2. Each seed should be planted to an appropriate depth in the soil. Ensure that each seed is planted on a separate tray so they may be placed on different rows.
3. The trays used should be transferred to the light garden. Ensure each tray is placed on a separate row.
4. Adjust the heights of the light rows to the following:
    a. The top row should be adjusted to 1 inch over the soil.
    b. The bottom row should be adjusted to 3 inches over the soil.
5. Plants should receive light on a daily basis. Lights should be left on during the entire school day for as long as possible.
6. Beans should be watered at least every second day. Ensure that the soil is damp, but not soaked, after being watered. Use water soluble fertilizer on a weekly basis with regular watering.
7. At the start of every week, the plant trays should be rotated. This is to ensure that all plants receive an equal amount of light for growth. As well, each row should be checked to see if the height of each light fixture needs to be adjusted.
8. Observations should be recorded every Monday, Wednesday, and Friday.
9. All activities in the attached activity log must be completed at the end of the allotted growing time.

Conclusion:

Students will have observed the effects that global warming could have on plants, specifically beans. Students also should have gained an understanding of the water cycle as it relates to plants.

In-Class Discussion:

1. What are some additional effects caused by global warming?
2. What are some ways that humans are trying to counteract the effects of global warming?

Grade 5 Activity Log: Ozone Depletion, Global Warming, and the Water Cycle

Make observations about the plants on each row as they grow throughout the activity. Observations may include colour, height, and overall health of the plant.

Date	Observations of Bean in Top Row	Observations of Bean in Bottom Row

Global Warming

Under which conditions did the bean plant best survive? Using the observations, would a bean plant survive a continuous increase in global temperature?

_____

_____

_____

Would the experiment results have been the same if a different plant species had been used? Why or why not?

_____

_____

_____

How has the industry changed with the discovery of global warming and the hole in the ozone layer? What new regulations have been implemented?

Water Cycle

Define the three steps of the water cycle in your own words:

Precipitation:

Evaporation:

Condensation:

Where do these processes occur on Earth? Where are they mimicked in the experiment?

Grade 5 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Recorded Observations of Plants	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Global Warming	Student answered all three questions correctly with thorough answers	Student only answered two questions correctly, small explanation included	Student only answered one question correctly, no thorough explanations	Student did not answer any questions correctly
Water Cycle	Student answered both questions correctly and provided thorough explanations	Student answered both questions correctly but did not provide thorough explanations	Student only answered one question correctly, did not provide explanations	Student did not answer either question correctly
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

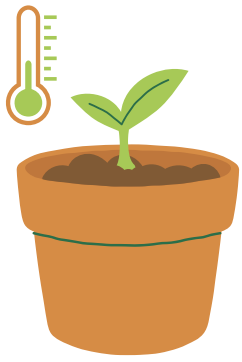
Grade 5 Activity Log Answer Key: Ozone Depletion, Global Warming, and the Water Cycle

<u>Global Warming</u>

Under which conditions did the bean plant best survive? Using the observations, would a bean plant survive a continuous increase in global temperature? **The best survival conditions will be determined from the results of the experiment.**

Would the experiment results have been the same if a different plant species had been used? Why or why not? **Different plants are best adapted to survive in different environments, so the results would likely differ depending on which replacement plant type is chosen.**

How has the industry changed with the discovery of global warming and the hole in the ozone layer? What new regulations have been implemented? **Many companies are trying to make more energy-efficient products. Some examples of new products include hybrid cars, refrigerators, and light bulbs. New regulations include reducing greenhouse gases, pollution, etc.**



Water Cycle

Define the three steps of the water cycle in your own words:

Precipitation: When water falls from the sky in the form of rain, snow, ice, or sleet

Evaporation: When water on earth changes to vapour and rises into the atmosphere

Condensation: When evaporated water changes to a liquid state

Where do these processes occur on Earth? Where are they mimicked in the experiment?
Precipitation occurs from a cloud and travels to the ground. In the experiment, this occurs when the water travels from the watering cup into the soil.

Evaporation occurs on the ground, and the vapour rises to the atmosphere. In the experiment, water evaporates from the soil or the plant.

Condensation occurs in the atmosphere on Earth. It does not occur precisely the same way in the experiment; however, it would best be mimicked when water travels from a tap into the watering cup. The watering cup could be thought of as a cloud in this circumstance.

Great Artwork from Mrs. Lynch, West Kent Elementary, Charlottetown, 2016

GRADE 6 ACTIVITY

Applying Plant Adaptations to Understanding Data Collection

Objective:

To develop science skills and develop skills on how to record information and how to apply it to a real-world situation.
Students should also observe some of the adaptive features of plants.

Curriculum Fit:

Science: Life Adaptations and Natural Selection

204−1/205−8 − Propose questions about the relationship between the structural features of organisms and their environment and uses a variety of sources to gather information about this relationship

Mathematics: Patterns and Relations

PR1 − Demonstrating an understanding of the relationships within the table of values to solve problems PR2 − Represent and describe patterns and relationships using graphs and tables

Mathematics: Statistics and Probability

SP2 − Select, justify and use appropriate methods of collecting data, including questionnaires, experiments, databases, and electronic media

SP3 − Graph and collect data and analyze the graph to solve problems

Mathematics: Shape and Space

SS8 − Identify and plot points in the first quadrant of a Cartesian plane using whole number ordered pairs

Materials:

− Indoor light garden
− Growing trays
− Water
− Fertilizer
− Potting soil
− Vermiculite
− Bean seeds
− Marigold seeds
− Lettuce seeds
− Graph paper
− Additional supplies that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plants

Background Information:

Plants have a variety of adaptations that allow them not only to survive but to thrive in their environments. Roots, leaves, and flowers come in different shapes and sizes. Each feature is generally adapted over centuries to be as effective as possible in its natural environment.

Graphing and reading graphs are very important skills in the world. A handful of jobs requiring these abilities include scientists, teachers, chemists, and business owners. Graphs provide a visual means to see and interpret data. In many cases, the researched information could only be interpreted with graphs.

Introduction:

The teacher should explain the following to students before the start of the experiment:

1. How to plot in Cartesian coordinates.
2. How to mark coordinate pairs on the Cartesian graph.

Activity/Procedure:

1. Assign students into groups of four.
2. Each group should receive four seeds: two of each type of plant being used.
3. Two different types of soil should be used to grow the plants in. Fill two trays with one type of soil and fill two other trays with the other type (vermiculite).
4. The class should now have four different trays. Each tray represents a different seedfsoil combination. Be sure to label the seedfsoil combination on the side of the tray.
5. Each group should plant the appropriate seed in the appropriate tray. Be sure to label which slot in each tray belongs to who for identification purposes when switching the garden.
6. All trays should then be transferred to the light garden.
7. Lighting should take place every school day. Beans should be watered at least every second day. Ensure that the soil is damp, but not soaked, after being watered. Marigolds should be watered every second day, or every day if the soil is dry. Use water soluble fertilizer weekly as part of regular watering.
8. Plant height should be recorded every Monday, Wednesday, and Friday in the activity log. If a plant is not yet visible, a height of 0.0cm should be recorded. Plants should be measured from the soil to the highest point of the plant. During the weeks the plants are located with students in the 4th grade, the numbers for those weeks can be taken from the 4th grade students.
9. At the start of each week, the position of the trays should be rotated. This is to ensure all plants receive a relatively equal amount of sunlight. As well, each row should be checked to see if the height of the light fixtures needs to be adjusted.
10. At the end of the activity, plants should be examined. Height, quality of the plants (green or yellow in color), and if applicable, flowers are examples of what should be examined.
11. Activities in the Activity Log should then be completed.

Conclusion:

Students should have viewed some of the adaptive features of different plants. Students also should have learned one way to apply scientific skills to the real world by collecting, recording, and graphing data from an experiment.

In-Class Discussion:

1. Was it easier to view the data in table or graph format?
2. Do all the graphs for the same plantfsoil combinations look similar, or do they all look different? What could this mean?

Grade 6 Activity Log: Applying Plant Adaptations to Understanding Data Collection

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible.

Date	Bean Height in Potting Soil (cm)	Bean Height in Vermiculite (cm)	Marigold Height in Potting Soil (cm)	Marigold Height in Vermiculite (cm)

Plot the recorded heights on graph paper with a Cartesian plane format. The y-axis will represent the height of the plant in centimetres. The x-axis will represent how many days have elapsed since the start of the experiment. For example, if the experiment was started on March 5, then the x-axis value for March 8 would be 3. Don't forget to label each axis and title the chart. Looking at your chart of recorded points and your graph, how did your plant grow? Was there one period of rapid growth and then slower growth, or was it constant?

Looking at your chart of recorded points and your graph, how did your plant grow? Was there one period of rapid growth and then slower growth, or was it constant?

_____

_____

_____

Compare your graphs with some classmates. Do they all follow the same basic growth pattern, or did many have different periods of growth?

Using height as the basis for adaptation to a specific environment, which plants were best adapted to which soils? Can you hypothesize on which adaptive features allow for the adaptation?

Were there any soils in which no plants would grow? Can you think of any plants that would grow in those soils in the wild?

Grade 6 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Table	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Graph	Graph is neat. Axes are labeled, title is given, and points are plottedcorrectly	Graph is neat. Only one of title, axes, or points are incorrect	Graph is messy. Only one of title, axes, or points is labeled correctly	Graph is messy. Axes, title, and points are either missing or incorrect
Activity Questions	All questions completed with a thorough answer	Only three questions completed	Only two questions completed, answers were not detailed	At most one question completed, answers have littleto no details
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 6 Activity Log Answer Key: Applying Plant Adaptations to Understand Data Collection

Plot the recorded heights on graph paper with a Cartesian plane format. The y-axis will represent the height of the plant in centimetres. The x axis will represent how many days have elapsed since the start of the experiment. For example, if the experiment was started on March 5, then the x-axis value for March 8 would be 3. Don't forget to label each axis and title the chart. **The instructor will judge how well done the graph was.**

Looking at your chart of recorded points and your graph, how did your plant grow? Was there one period of rapid growth and then slower growth, or was it constant? **This question can be answered by looking at the graph.**

Compare your graphs with some classmates. Do they all follow the same basic growth pattern, or did many have different periods of growth? **The answer will be formed by comparing results.**

Using height as the basis for adaptation to a specific environment, which plants were best adapted to which soils? Can you hypothesize on which adaptive features allow for the adaptation? **The answer will depend on the results of the experiment.**

Were there any soils in which no plants would grow? Can you think of any plants that would grow in those soils in the wild? **The answer will depend on the results of the experiment.**

GRADE 7 ACTIVITY

The Role of Decomposers in the Environment

Objective:

Attempt to grow plants in various soil conditions (with and without decomposing material) and attempt to understand the roles of decomposers and producers in the ecosystem.

Curriculum Fit:

Science: Components of an Ecosystem

304−2 − Identify the roles of producers, consumers, and decomposers in a local ecosystem and describe both their diversity and their interaction

210−1 − Identify organisms as producers, consumers, and decomposers

304−1 − Explain how biological classification takes into account the diversity of life on Earth, using the terms producer, consumer, and decomposer

306−2 − Describe how matter is recycled through interactions among plants, animals, fungi, and microorganisms 306−3 − Describe interactions between biotic and abiotic factors in an ecosystem Decomposers

304−3 − Describe conditions essential to the growth and reproduction of plants and microorganisms in an ecosystem and relate these conditions to various aspects of the human food supply: air, temperature, light, and moisture

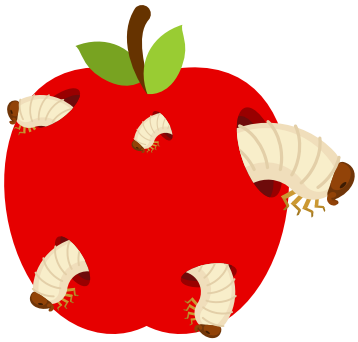
Science: Soil

310−3 − Classify various types of soil according to their characteristics and investigate ways to enrich soils

Mathematics:

SP1 − Demonstrate an understanding of central tendency and range by: determining the measures of central tendency (mean, median, and mode) and range and determining the most appropriate measures to report findings

PR2 − Create a table of values from linear relation, graph the table of values, and analyze the graph to draw conclusions and solve problems

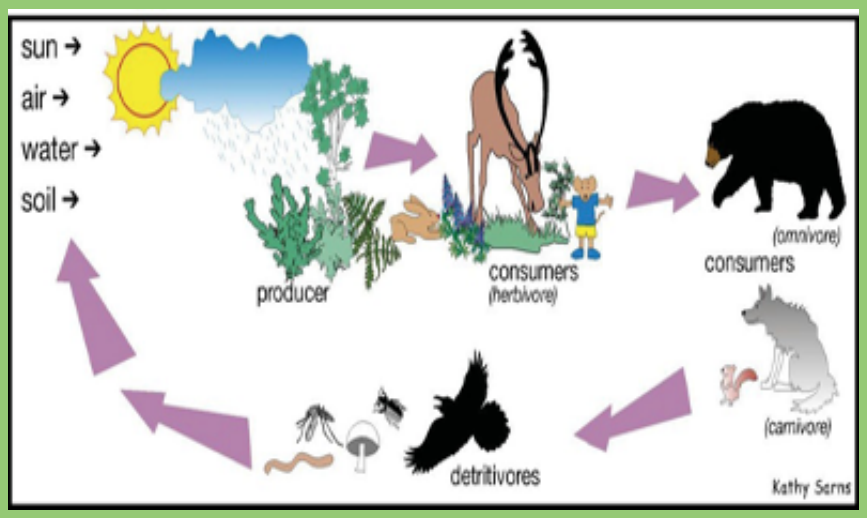


Materials:

− Indoor light garden
− Growing trays
− Water
− Fertilizer (Granular)
− Potting soil
− Bean seeds
− Marigold seeds
− Lettuce seeds
− Earth Worms (can pick up from the schoolyard or students' homes)
− Additional supplies that are needed but not supplied by the program− shredded newspaper, granulated sugar, watering can, and popsicle sticks to mark students' plants

Background Information:

Decomposers play a vital role in the recycling of matter through an ecosystem. Without decomposers, many elements would remain encrusted in the earth without returning to the surface. Decomposers function by breaking down materials into a form that can be engulfed by plants (producers). Producers will use this recycled matter to help them grow and return the matter to the surface. A consumer will generally eat a producer and gain the recycled matter. Consumers then eat consumers until the final consumer in the food chain has passed away. The cycle then restarts.

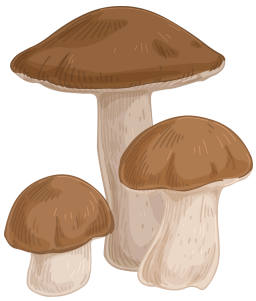


http://huckleberryfinnclc.weebly.com/decomposers.html

Preparation:

Small newspaper strips should be mixed into soil for plants on the bottom row. A tablespoon of sugar should be thoroughly mixed in as well.

Introduction:



Explain to students the following:

1. The main differences between a consumer, producer, and decomposer.
2. The different types of decomposers (e.g. worms and mushrooms).

Activities/Procedure:

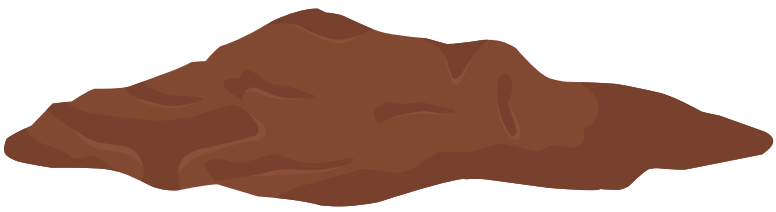
1. Students are divided into groups of 3−5.
2. Each tray on the lighting system is to be labelled. One tray should say “Fertilizer,” the next tray should say “soil”, and the last tray should be labelled “newspaper/sugar.” These will be the three different soil compositions for the experiment.
3. Each group must plant one seed in each of the three conditions. One tray should contain granular fertilizer mixed into the soil, the second tray should have just soil, and the third tray should have strips of newspaper and one tablespoon of sugar mixed into the soil. Students must plant each seed to an appropriate depth. Students should have a few Earthworms with the newspaper and sugar in the tray.
4. Plants should receive light daily. Beans should be watered at least every second day. Ensure that the soil is damp but not soaked after being watered. Marigolds should be watered every second day or every day if the soil is dry.
5. Plant height measurement should occur every Monday, Wednesday, and Friday. If no plant is visible, a height of 0.0cm should be recorded. The measurement should occur from the soil to the highest point on the plant.
6. At the start of each week, the position of the plant trays needs to be rotated. This is to ensure all plants receive equal amounts of light intensity. Also, each row should be checked to see if the height of the light fixtures needs to be adjusted.
7. At the end of the experiment, one final height measurement should be taken.
8. All activities in the Activity Log should be completed after the experiment.

Conclusion:

Students should be able to see how important decomposing materials, and thus decomposers, are to the environment.

In-Class Discussion:

1. Comparing the effects of sugar and newspaper on the soil with Fertilizer, was there any difference in the quality of the plants?
2. Comparing the plain soil to the soils with added matter, was there any noticeable differences in the plants?
3. Most Fertilizer is broken down by decomposers to be used by plants. What would happen if there were no decomposers on Earth?



Grade 7 Activity Log: The Role of Decomposers in the Environment

Create a chart showing the height of each plant every Monday, Wednesday, and Friday. A height of 0.0cm should be recorded if no plant is visible.

Date	Plant Height (cm) With Fertilizer	Plant Height (cm) With no Added Material	Plant Height (cm) With Newspaper , Sugar andEarthworms

What is the effect of adding fertilizer on the growth of the plants?

Sugar is essential for growth. How did the plants grown with added sugar grow compared with the plants with fertilizer?

Define a decomposer, consumer, and producer. How do these three things interact?

What conditions enhanced plant growth? What conditions did not enhance plant growth? Hypothesize some ideas as to what makes these conditions different.

Classify the different types of soils according to their characteristics (eg texture).

Find the mean final height value for each plant and soil combination in the classroom (can be completed with in−class discussion at the end). Were all plants relatively similar in average size or did the extra matter create a difference?

Grade 7 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Recorded Heights of Plants	Chart is neat, containing at most 2 missed days	Chart is fairly neat, containing at most 4 missed days	Chart is not neat, containing at most 6 missed days	Chart is messy, over half of the days are not recorded
Growing Conditions	All three questions regarding growing conditions were answered with lots of thought.	Only two questions regarding growing conditions were answered. Some thought put into answers.	Only one question was answered. Not much thought put into answers.	No questions were answered.
Decomposers	Student answered all questions about decomposers correctly	Student completed one question about decomposers and attempted the second	Student attempted but did not complete either question on decomposers	Student did not attempt to complete either question on decomposers
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 7 Activity Log Answer Key: The Role of Decomposers in the Environment

What is the effect of adding fertilizer on the growth of the plants? **This should allow for better growth than in the row with no added materials. The experiment should confirm this.**

Sugar is essential for growth. How did the plants grown with added sugar grow compared to those with fertilizer? **This question can be answered with the results of the experiment.**

Define a decomposer, consumer, and producer. How do these three things interact?
Consumer: A consumer eats living things to obtain energy.
Decomposer: A decomposer breaks down dead organisms to obtain energy.
Producer: A producer can create their own energy.
These interact by recycling matter in the environment. Decomposers break down dead consumers and producers into a form that some producers can absorb. This keeps matter in the ecosystem.

What conditions enhanced plant growth? What conditions did not enhance plant growth? Hypothesize some ideas as to what makes these conditions different. **The effects of the different conditions can be found in the experimental results. The hypothesis should mention the difference in matter present.**

Classify the different types of soils according to their characteristics (e.g. texture). **Answers will vary.**

Find the mean final height value for each plant and soil combination in the classroom (can be completed with an in−class discussion at the end). Were all plants relatively similar in average size, or did the extra matter create a difference? **Answers will depend on the results of the experiment.**

GRADE 8 ACTIVITY

A Practical Use for Light Reflection

Objective:

To understand the light patterns of the light garden, as well as to compare ratios and rates of growth of different plants.

Curriculum Fit:

Science: Reflection

308−09 − Describe the laws of reflection of visible light and their application in everyday life: regular versus diffuse reflection, angle of incidence = angle of reflection

208−7 − Formulate operational definitions for incidence, reflection, and the normal

209−2 − Estimate angles of incidence and reflection

210−14 − Identify and correct practical problems in the way a constructed optical device functions

Science: Electromagnetic Radiation

109−13 − Explain the importance of using the words frequency and wavelength correctly

113−2 − Describe possible negative and positive effects of technologies associated with electromagnetic radiation

Mathematics: Patterns and Relations

PR1 − Graph and analyze two−variable linear relations

Mathematics: Number

N3 − Demonstrate an understanding of percents greater than or equal to 0% N4 − Demonstrate an understanding of ratio and rate

N5 − Solve problems that involve rates, ratios, and proportional reasoning

Mathematics: Shape and Space

SS3 − Determine the surface area of a right cylinder to solve problems

Materials:

− Indoor light garden
− Peat Pots
− Seed Tray
− Water
− Fertilizer
− Potting soil
− Bean seeds
− Lettuce seeds
− Additional supplies that are needed but not supplied by the program− watering can, popsicle sticks to mark students' plants

Background Information:

Light is essential for life on Earth to exist. Without light, plants would not be able to grow, and food would run out. Light obeys many physics laws. One set of laws deals with reflecting light off of a surface. Three main definitions of light reflection are vital to understanding how it works: the normal, angle of incidence, and angle of reflection. The normal is an imaginary line drawn perpendicular to the surface at which reflection occurs. It intersects the surface precisely when the light hits the surface. The angle of incidence and the angle of reflection are very similar.

Light is an example of electromagnetic radiation. This means that it is composed of an electrical and magnetic wave. Electromagnetic waves are extremely important in today's society. Cell phones, x−rays, and the radio are just a few examples of electromagnetic wave technology.

Introduction:

Explain to students the following:

1. How light reflects off a surface.
2. How light refracts when changing mediums.
3. How to compare rates, ratios, and percentages.

Activity/Procedure:

1. Students are to be placed in groups of at least two.
2. Each student should be assigned one seed and one cup. Students should fill their cups with potting soil and bury their seeds to an appropriate depth.
3. Partners will bury their seeds in different trays. This ensures that one seed for each group will be in different lighting.
4. Have one tray of plants at the middle of the light garden row and one at the very end of the row. These tray positions are not to have their positions changed at any point during the experiment.
5. The plants should receive light daily. Lights should be left on during the entire school day for as long as possible.
6. Beans should be watered at least every second day. Ensure that the soil is damp but not soaked after being watered. Use water-soluble fertilizer weekly as part of regular watering.

7. Height measurements should be taken on the first day of every week to compare growth rates. The heights of both plants should be recorded. As well, the height of each light fixture should be checked to see if an adjustment is needed.
8. One final height measurement should be taken at the end of the activity.
9. After the activity, all activities in the Activity Log should be completed.

Conclusion:

Students should understand the light reflection patterns of the Light Garden. Students should also have learned how to compare rates and ratios by comparing the two different trays.

In-Class Discussion:

1. The light garden says that plants left at the tray's center generally grow faster than those left on end due to higher light intensity. Was this observed in the experiment? Why is the light more intense in the middle than at the ends of the tray?
2. Share with the class your ideas on the best design for light reflection. Which design seemed most efficient and why?

Grade 8 Activity Log: A Practical Use for Light Reflection

Fill out the table below with the recorded plant heights. Calculate how much each plant grew over the course of one week.

Date	Center Plant		Plant on Edge	
	Overall Height	Weekly Growth	Overall Height	Weekly Growth

Ratios:

Create a list of height ratios of each of the two plants. Create a second list with a ratio of the growth rates. These ratios should be based upon a weekly basis.

Height Ratios	Growth Rate Ratios

Were the two ratios somewhat similar or different? What does this mean?

Try to calculate the surface area of each plant stem. Since the plant will likely be skinnier at the top and thicker at the bottom, choose a circumference from the middle of the plant to use in the calculations. Compare the two as a ratio. Was this ratio similar to the other two?

Properties of Light:

Describe the following terms:

The Angle of Incidence: _____

The Angle of Reflection: _____

Normal: _____

What is the difference between the frequency and wavelength of light? How are they related?

_____

_____

_____

_____

Light is an electromagnetic wave. What are the positive and negative effects of technology that is associated with electromagnetic waves?

_____

_____

_____

Do you think the mirrors' angles are at an appropriate position? Could you suggest any changes that would reflect more light onto the plants?

_____

_____

_____

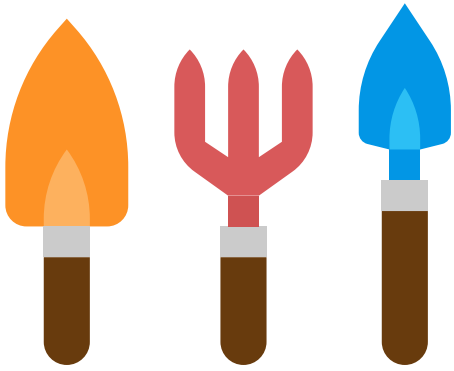
Grade 8 Activity Marking Rubric

	Level 4	Level 3	Level 2	Level 1
Recorded Heights of Plants	Chart is neat, containing at most one missed week	Chart is neat, containing at most two missed weeks	Chart is messy, containing multiple missed weeks	Chart was not attempted
Ratios	Ratio section is fully completed and correct	Ratio section is fully completed, some ratios are incorrect	Ratio section was¾ completed, multiple incorrect ratios	Less than half of the ratio section was completed, most ratios wrong
Properties of Light	All questions are full completed and correct	All questions are completed, some incorrect answers	Two questions not completed, multiple incorrect answers	Three or more questions not completed
Overall Effort	Student completed every activity	Student attempted most activities	Student attempted half of the activities	Student did not attempt over half of the activities

Grade 8 Activity Log Answer Key: A Practical Use for Light Reflection

Were the two ratios somewhat similar or different? What does this mean? **The closer the ratios are to each other, then the more similar the growth rate of the plants are. A large separation between ratios indicates that one rate was much faster than another.**

Try to calculate the surface area of each plant stem. Since the plant will likely be skinnier at the top and thicker at the bottom, choose a circumference from the middle of the plant to use in the calculations. Compare the two as a ratio. Was this ratio similar to the other two? **The answer will be the circumference at the middle of the stem multiplied by the plant height. The similarity in ratios is dependent on the experiment.**



Properties of Light:

Describe the following terms:

The Angle of Incidence: **The angle at which light approaches a point, measured from the normal to the path of light.**

The Angle of Reflection: **The angle at which light leaves a point, measured from the normal to the path of light.**

Normal: **An imaginary line perpendicular to where light travels to/through. It separates the angle of incidence and the angle of reflection.**

What is the difference between the frequency and wavelength of light? How are they related? **The wavelength is how long one single unit of light is. The frequency is how often the wavelength repeats itself. They are related because frequency multiplied by wavelength equals the speed of light.**

Light is an electromagnetic wave. What are the positive and negative effects of technology associated with electromagnetic waves? **There are many sources of both positive and negative effects of technology using electromagnetic waves. For example, cell phones, x–rays, and the radio all use electromagnetic waves to function. A downside is that overexposure to electromagnetic waves may cause illness.**

Do you think that the angles of the mirrors are at an appropriate position? Could you suggest any changes that would reflect more light onto the plants? **This is an opinion-based question.**

Sunflower plants at Westwood Primary, Cornwall, 2016