



Curriculum Units by Fellows of the Yale-New Haven Teachers Institute
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Mr. McGregor's Garden, Peter Rabbit, & The Plant-tastic World of Photosynthesis

Curriculum Unit 00.06.05
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Science is a field of studies which all, both young and old, can enjoy. The experiences had from hand-on activities can lead to a life long love of the field of science. Young children especially benefit from activities that include both literary knowledge and hands-on experiments. When all the five senses are engaged in the learning process the results tend to be a more permanent type of learning. While those facts committed to memory through rote style learning may endure for a limited period of time, the experiences learned in the actual performance of a task seem to last for a more extended period of time. It is my own personal experience to recall the knowledge and activities in which I was an active participant more clearly and in more detail than the knowledge gained by rote. The seminar of photosynthesis therefore lends itself to be an excellent source for the active involvement of the children in the learning process.

The New Haven Public School system has made literacy its top priority to the exclusion of most other courses of study. Through the use of the balanced literacy program, the system plans to increase the reading competency of all its students. Balanced literacy involves more than just a student's ability to read the printed page. Balanced literacy incorporates the children's desire to learn to read and write, the development of language concepts, the ability to apply phonemic awareness as the child encounters unfamiliar words, to increase vocabulary and the understanding and usage of letters and letter sounds.

In this unit, I propose to integrate science into the literary component of the school curriculum while studying the importance of plants to most forms of life and the process of photosynthesis. The activities included in this unit are intended to incorporate reading, writing, math, social studies, and art/drama into the science activities. By capitalizing on the child's innate curiosity, I hope to motivate them to become actively involved in what they are learning. This unit is written for children in kindergarten but can easily be adapted for children in grades one through four. Through this involvement, it is hoped that they will have learning experiences that will not be soon forgotten.

The format of this unit is more of a story form jumpstarting with the children receiving a letter from a popular story character and working the unit from that point forward.

Getting Started

The children have just received a letter from Mr. McGregor. It has been sent special delivery and is marked urgent. It is earmarked to the children of your grade level and/or room number. The special effects of placing the letter in a special delivery envelope would really add to the children's excitement and curiosity.

Make arrangements in advance for someone to deliver the letter to the classroom just about the time you will be introducing the unit on plants. Collaborate with the person to emphasize the "importance" of the letter because it is a "special" delivery marked "urgent".

Display the letter so that the children can see that it is addressed to the class. (You may wish to take time to discuss the proper way to address an envelope.) Read the letter to the class. If time allows pause briefly after each question so that the children may give some initial responses.

Mr. McGregor's Letter

Dear Boys and Girls,

My name is Mr. McGregor. I understand that your class will be studying plants and gardening. I wondered if you would be so kind as to help me with my gardening skills? I know you may have heard a lot about me from Beatrix Potter in her book, *The Tale of Peter Rabbit*, but believe me; I really know nothing at all about gardening. Please, don't let the word get out that I needed your help. I'd be so embarrassed if I had to explain that it has really been Mrs. McGregor's garden all along. I really appreciate your help.

Now! There are some basic questions that have puzzled me for so long. Mrs. McGregor, who is so good with plants and gardening, asked me to take care of the garden while she was on vacation. She left a long list of instructions and even expected me to plant seeds and to set out seedlings. Well, I don't have to tell you how upset she was at the condition of the garden upon her return. Why she was so upset that she promised not to speak to me until I had taken a course on plants and gardening. Can you understand the fix I'm in? I am getting a little ahead of myself, so let me tell you the story and maybe you can help.

First, Mrs. McGregor gave me some seeds to plant. I wasn't thinking when I laid them on a tray next to my collection of tiny rocks and pebbles. I guess I accidentally planted the pebbles and rocks instead of the seeds. Well, you can imagine how disappointed she was when she arrived at home to find that there were no plants growing from the seeds. My first question is:

1. Why do seeds develop into plants while rocks and pebbles don't? I mean the Seeds look so much like rocks and pebbles and the rocks and pebbles look so much like seeds. What's the difference?

Secondly, Mrs. McGregor asked me to set out some seedlings. They were about 2-4 inches tall. As I was

setting them out, I couldn't help but notice some stringy things hanging from the bottom. (Mrs. McGregor later told me they were called roots.) They looked very raggedly and untidy. Knowing Mrs. McGregor's love of neatness and order, I took my pruning shears and trimmed all that stringy stuff away. The sticks (or stems as I later learned they were called) were very neat and looked lovely. I was surprised to discover that some of the plants withered and turned brown, while the others wouldn't even stand up. They fell right over with the least little breeze. Question number two is:

2. What are these stringy things called roots and why are they so important to plants?

Thirdly, I noticed that some of the soil in the garden was too smooth. There wasn't a rock or a pebble in the soil anywhere! Now, you know how much I love rocks and pebbles. I thought the plants would love them too. So, I gathered several wheelbarrows full and dumped them in the rows of the garden. I earnestly mixed them into the soil and Presto! The place looked wonderful. (Or so I thought!) Then I saw some plants that looked rather tropical. (I later discovered that they were okra plants.) Well, they made me think of lying on some white sand under a beach umbrella on a tropical island. So, I purchased some sand and turned the okra patch into a tropical paradise. Mrs. McGregor was seething. She said her soil was "composted" (whatever that means) and rich in "organic" materials. She accused me of ruining her okra patch but on this one I held my ground. Rocks, I declared, are beautiful and decorative and they're a plus to any garden. Question number three is:

3. Do garden plants grow best in rocks, sand, or this so called "composted" soil that Mrs. McGregor loves so much? What is "organic" anyway?

My fourth dilemma is this. It was forecasted that the summer would be an extremely hot one. Temperatures would range in the high 80's and might possibly reach into the 90's. Now, one day as I was sitting in the shade of the porch and listening to the gentle hum of the air conditioner, I thought about the plants. I couldn't imagine them suffering in the withering heat. So, I attempted to "shade" them from the sun's hot rays. I erected a canopy of heavy tarp over as much of the garden as I could. The neighbors told me they heard Mrs. McGregor's scream over a mile away. She is very difficult to please. My next question is:

4. What would make Mrs. McGregor think that garden plants need light from the sun in order to grow?

My final question is about Peter Rabbit and gang! I saw that rabbit the other day and he was carrying off a head of lettuce and some string beans just like he owned them. To add insult to injury, he had some of his friends with him. There was a mouse illegally carting off some peas in his mouth. I thought I saw a large bird overhead looking rather hungrily at the mouse. A woodchuck was munching on the heads of some broccoli plants while a rather large cat sat near by on a rock, as still as a statue, except for his tail, which kept switching back and forth. He was studying the goldfish in the garden pond. My final question is this:

Why is Peter Rabbit and gang always invading the garden and why would that large bird be interested in a

mouse? Whose cat is that anyway and why is he always staring at the goldfish in the garden pond?

This is all so very confusing. Plants growing from seeds, stringy roots that are deemed to be valuable to plants! Plants that don't like the dark but that actually need the heat from the sun and that bothersome Peter Rabbit who refuses to work for a living.

Well, I think I've bothered you enough. I do hope you can help. I eagerly await your response. In the meantime, I think I'll pick some of those long stem roses I saw at the far end of the garden and give them to Mrs. McGregor. Maybe she'll change her mind and talk to me!

Thanks for your help,

Mr. McGregor

P.S. Now I've really done it! Those roses were for the Country Fair Rose Contest! I'm really beginning to

wonder if we really need plants at all. And all this talk about photosynthesis! What do you think? After reading the letter to the children, you may want to introduce or re-introduce them to Mr. McGregor and Peter Rabbit in Beatrix Potter's book, *The Tale of Peter Rabbit*.

Let's Meet Mr. McGregor

Read the children the story, *The Tale of Peter Rabbit* by Beatrix Potter. Allow the children to discuss the story and how it relates to the letter they received from Mr. McGregor. Review Mr. McGregor's letter. On large manuscript paper, copy each question that Mr. McGregor posed in large letters. You should have six questions, including the final question: are plants really important?

Tell the children that you will try to help the class answer Mr. McGregor's last question first. Explain that if Mr. McGregor understands why plants are important then he may be more interested in learning how to take care of them.

Plants

The P.S. Question First: Do people really need plants? Why are plants important to plants?

There are thousands of different kinds of plants on the earth. Plants are found in every place on earth. They are found in the desert, the jungles, polar ice caps, hot springs, the ocean, on high mountains, as well as in our backyards.

People admire plants for various reasons. Some admire their aesthetic beauty while some use plants for their medicinal benefits. The truth is that without plants, we would not be able to live. Whether directly or

indirectly, plants are the primary food source for all animals, including humans.

Plants not only provide food but they provide materials necessary for the building of homes and for the preparation of clothing. They also provide fuel such as oil and gasoline. Even some of the foods we love, like ice cream, could not exist without plants.

The environment in which we live is also dependent on plants. Plants provide oxygen, a gas, that most living things need in order to live. Without plants, the air we breathe would be deadly.

There are many different kinds of plants. Some are very simple, having no roots stems or leaves. The simplest forms of plants are called algae. Algae live in the water, both fresh and salt.

Other plants depend on leaves, stems, and a root system through which to gather water and minerals. These plants include roses, daisies, and many of the foods we eat. Many of the foods we eat such as ice cream, chocolate milk, tomatoes, grapes, etc. would not exist if there were no plants.

P.S. Question Part 1: Do people really need plants?

Think It Through

Ask the children to think of some ways that people use plants. Make a list of their response.

Looking For Clues

Take the children for a nature walk. Have them look for the many different ways that people in the neighborhood use plants. Compare what they found with the original list.

Lesson No. 1

Objective: To help the children understand the many ways people use plants.

Have the children take the following grid home and complete it with their parents. Have the children return the list to school the next day.

Dear Parents:

We are discussing the importance of plants in our class. Please list the types of plants you have in and around your home. List the name of the plant and its use. Include plants we eat, garden plants, yard plants, trees, etc. Include pictures of your plants if you can.

Name of Plant Type of Plant (house, garden, yard, etc.) Usage of Plant

Allow the children to share the various kinds of plants on their list with the class.

Setting Up A Science Journal:

Help the children to make a science journal. The children should include the date (very early grades the teacher may choose to provide a date stamp and ink pad) and the materials they needed. Include a picture drawn by the child or cut from a magazine, and have the child write a sentence or two about the project and their findings.

Recording the Results:

Have the children draw and write what they observed in their science journal.

P.S. Question Part 2: Why are plants important?

Dangerous chemicals fill our air, water, and soil. These pollutants come from chimneys, car exhausts and factories and pesticides. These poisons remain in our soil or get washed into rivers and streams changing clean water into poison.

In their book, Nature Quest, James and Priscilla Tucker share the following information. Our homes also contain poisons that threaten our health. Our draperies, carpets, and upholstery contain solvents such as trichloroethylene and chloroform. Benzene appears in the dyes found in these substances while formaldehyde is a component of plastics and insulation. The invisible vapors released by these items causes reactions ranging from allergies to cancer in our bodies.

The marvelous way in which plants were created helps them to serve as a natural combatant to some of these pollutants. Trees and plants absorb air storing carbon dioxide and these pollutants in their cells. They then release pure, clean oxygen into the atmosphere. This process is reproduced over and over again as these clean air machines do their part in helping to protect our environment.

In the home certain houseplants, such as aloe vera, philodendron, English ivy, peace lilies, and others help to cleanse the air of formaldehyde, benzene, and trichloroethylene. Not only do these plants help to clean the air but their aesthetic beauty is also rewarding.

Seeds

Question #1: Why do seeds develop into plants while rocks and pebbles do not?

Seeds come in different shapes and sizes. They are found in fruits, vegetables and flowers, and plants. All seeds have two things in common. Every seed contains an embryo, which is a little plant, and food that helps the little plant to grow.

Seeds are carried to different places in a variety of ways. Some are blown from place to place by the wind, others are carried by water, and some attach themselves to the fur of animals.

The purpose of all seeds is to germinate and grow thereby perpetuating the plant species.

Lesson No. 2

Objective: To share a story about seeds.

Getting Started

Display the book, *The Tiny Seed*, by Eric Carle

1. Allow the children to predict what the story might be about.
2. Read the story to the children.
3. Discuss with the children where seeds come from and what happens to the various seeds.
4. Review the story with the children listing what the seed needs in order to grow.

Take the children for a nature walk. Provide each child with a small bag in which to hold the seeds they collect. Have the children observe different types of plants and their seeds. Children may gather some seeds that have fallen from plants to the ground. You may want to discuss with the children some of the seeds animals use for food. Place the collected seeds in the science area. Provide a magnifying glass so that the children can observe the different type seeds collected.

Recording the results: Let the children draw and write about their nature walk in their science journals.

Lesson No. 3

Objective: To observe how seeds are alike and different.

Read the following poem by Else Holmelund Minarik to the children.

Little Seeds

Little seeds we grow in spring
growing while the robins sing
give us carrots, peas, and beans,
tomatoes, pumpkins, squash, and greens.

And we pick them,
one and all,

through the summer,
through the fall.

Winter comes, then spring, and then
Little seeds we sow again.

Follow Up

Discuss the poem with the children. Have the children brain storm fruits and vegetables containing seeds. Record their answers on chart paper.

Connecting School and Home Send home a note to parents asking them to send in some type of fruit or vegetable that contains seeds. Explain that the children are studying seeds and that you would like to collect a variety of different seeds. Examples of the fruits or vegetables they might send could be kiwi, corn, peas (in the pod), squash, lemons, apples, oranges, etc. Cut in half the fruits and vegetables the children brought to school and show them the seeds inside.

Divide the children into small groups. Show the groups how to use toothpicks to carefully remove the seeds from the fruits/vegetables. Use the following grid to help the children record the data about the seeds they've collected.

Name of fruit

Color of seed

Size of seed

Shape of seed

Number of seeds

Recording the Results

Let the children draw and write about the different seeds they collected. They may want to glue some of their seeds in their journals.

An Inside Look

There are two parts to a seed, the embryo or little plant and the seed or outer covering of the seed. The outer covering protects the little plant inside the seed. The food inside a plant is stored in the cotyledon. Cotyledons are the leaves which are attached to the little plant or embryo inside the seed. When the seed starts to grow, one part of the embryo becomes the root while the other becomes the shoot or upper part of the stem and leaves.

Lesson No. 4

Objective: To study the parts of a seed and sprout.

Vocabulary

Seen coat

Embryo

cotyledon

What to do...

Soak some lima beans over night. Place one seed in each finger of a clear plastic glove. Hang the plastic gloves in a bright, sunny window. After the seeds have sprouted, remove several from the gloves. Display the diagram of the inside of a seed. Label the parts of the diagram and discuss with the children. Divide the children into small groups. Slice the beans in half and allow each group to examine the bean halves using a magnifying glass. As you point to each part of the seed and sprout have the children see if they can locate those parts.

Recording the results

Let the children draw and write about what they observed in their science journals.

Question No. 3 What are those stringy things called roots and why are they important to plants?

Plants are held in place in the ground and receive their water and minerals through their root system. These two actions complement each other in the fact that the roots can only hold the plant in place if they are alive and the only way they continue to live is if they feed the part of the plant that is above the ground. The plant therefore produces leaves that produce food in order to feed the plant. The food produced by the leaves in turn sends nutrients to the cells in the roots. This endless process of interdependence guarantees the life and health of the plant.

As the roots penetrate deeper and deeper into the soil, they become smaller and smaller. This might explain Mr. McGregor's description of the roots as straggly and unkempt. The roots on an average plant produce many hair-like rootlets. These roots grip the soil therefore keeping the plant in place. The stronger the root system and the more deeply embedded the roots are in the soil, the more secure the plant.

Rooted and Grounded

Lesson 5

Objective: This activity will show how roots work for the plant.

What to do...

Cut the ends off two stalks of celery. Place each stalk into a clear plastic glass of water colored with food dye. Place the glasses in a bright, sunny spot or under a plant light overnight.

The next days have the children cut across the celery to see how far up the colored water has moved. Explain to the children that the plant is made of many tiny tubes that bring water to the plant through its roots system.

Recording the results

Have the children draw and write what they observed in their science journal.

Social Development: Family Roots

Objective: To understand that the root system of a tree supports and sustains the life of the tree just as family unit supports and sustains the family members.

What to do...

Provide the children with a copy of the family tree. Tell them that just like plants have roots that accomplish important functions for the plant, so people have family roots or ancestors who are important to the well being of the family. Ask the children to take home a copy of the family tree and to have their parents help them fill it out.

Recording the Results

Have the children draw and write about their families.

Question No. 3: Do garden plants grow best in rocks, sand, or this so called "composted" soil that Mrs. McGregor loves? What is "organic" anyway?

Organic Gardening

Most of the foods we purchase in grocery stores have been grown using synthetic fertilizers or pesticides. Some farmers, however, grow their crops without the use of these synthetic fertilizers or pesticides. This method of growing food is called "organic farming."

Organic farmers, to condition the soil and nourish the crops, use composted materials. They rely on worms, fungi, bacteria, and other organisms to help decompose these organic materials and to turn this mixture into a rich fertilizer. Organic farmers may also use other natural forms of chemicals to fertilize the crops. Nitrogen, which is produced in a compost, limestone powder, bone meal, seaweed meal, and fish emulsion are some of the natural fertilizers used by organic farmers. Insects, such as ladybugs and praying mantis, are used as deterrents for bugs along with certain types of plants such as marigolds and chrysanthemums.

There are several different ways of gardening. The typical way used by most people is that of planting seeds or seedlings in the soil. Another way of gardening is the hydroponics or tank garden. The plant beds in this garden are filled with pebbles, sand, or some other inorganic materials. These beds are repeatedly flooded with a recyclable water/nutrient solution. The roots hang in this solution and receive their oxygen between the flooding. They receive their energy from artificial lighting that is necessary in the process of photosynthesis. These plants grow faster and appear to be healthier.

Since Mr. McGregor has chosen the typical home garden, the experiment will be geared to that type garden.

Lesson No. 6

Objective: To show if plants grow best in rocks, composted soil, or sand.

What to do...

Place composted soil in one cup. Put the sand in another cup and rocks in the third.

Place a sprouted seed in each cup or a bean seedling. Plant them at the same depth and in the same spot in the cups. Place the cups in a sunny window. Water them the same amount each day. Record what happens to each.

Recording the results.

Have the children observe daily what happens to the plants. Allow them to draw and write about what they observe.

Question No. 4: What would make Mrs. McGregor think that garden plants need light from the sun in order to grow?

Photosynthesis

Plants make food through a process called photosynthesis. By taking light energy from the sun, plants are able to convert this energy into chemical energy. Growth and reproduction are some of the life processes which living things use this chemical energy for.

Plants absorb air through tiny openings in their leaves. The roots of the plant draw water from the soil. Chlorophyll, which is the green substance in plants, absorbs the light from the sun. The light from the sun divides the water in the leaf into hydrogen and oxygen. The plant releases the oxygen into the air while the hydrogen is combined with carbon dioxide, which the plant takes from the air. The hydrogen and carbon dioxide combine to make sugar and starch. The plant uses this food for growth.

It is the energy from the sun that makes it possible for plants to produce food out of substances that are not food. The plant makes strawberries, corn, blueberries, and all the other good foods which we enjoy by using the light, air, water, and the minerals taken out of the soil.

The sun is the most important source of light. The light we get from the sun is natural light. We get natural light from the stars too. Stars are very far away from the earth but some of their light still reaches the earth.

The light energy of the sun is changed to heat or chemical energy when it reaches the earth. Not only does this light help plants to grow but also scientists use this light for many other purposes. Electricity is generated

by solar energy.

Question No. 5: Why is Peter Rabbit always invading the garden and why is that bird interested in that mouse? Whose cat is that anyway and why is he always staring at the goldfish?

Lesson No. 7

Objectives: To examine how most forms of life are dependent upon plants.

New Words

Recycle

Reuse

Reduce

Producers

Consumers

Decompose

Carnivores

Herbivores

Most of the foods we eat come from flowering plants. All forms of life depend in some degree or another on plant life. Whether they consume plant materials as their primary source of food (herbivores) or consume it in its secondary form by eating those animals that do depend upon plants (carnivores), plants play an essential part in the lives of all living things. It is amazing that in the planning of this world, all elements necessary to support life were in place at the very beginning. The manner in which these elements interact with each other to continually support an atmosphere conducive to life is truly of remarkable design. The ecosystems are a fascinating way to engage the active minds of the young child in the learning process. By studying how we affect our environment and how our environment supports us, the child can learn the role of the many systems in place to support and sustain life.

Many animals, as their primary source of food, use plants. The sun is the ultimate source of all energy. Green plants are able to produce their own food by the energy derived from the sun. They are called producers. Consumers are those living things that depend on plants or other animals for their food. As energy is passed from one source to another, the food chain is created. There are many different food chains, including the one in which human beings are a part.

Peter Rabbit had been warned by his mother not to go into Mr. McGregor's garden. It seems Peter's father had wandered into the forbidden zone and had ended up in a pie. What do Peter Rabbit, Mr. McGregor's garden, and the plant-tastic world of photosynthesis have in common?

Literature Connection

Read the title of the book and allow the children more time to consider the content of the book.

Ask the children to consider how this story will help them to answer the focus question: What to things in the story go together and why?

Tell the children that this book will describe the various types of animals who live in the water and how they interact or live with each other in their environment.

Display the book, *The Magic School Bus Gets Eaten: A Book about Food Chains*. Allow the children to discuss what they see on the cover of the book and to predict what they think the story might be about.

Focus Question

What two things in the picture go together and why?

Discuss the kinds of food you eat with the children. Ask the children where they think their food comes from. Give specific food groups and discuss where the children think the food in the group comes from. List some of the foods shown in the protein group: chicken, fish, hamburgers, etc. Ask what animals these foods come from. List foods from the fruits/vegetable groups: squash, peaches, tomatoes, etc. From grains, and dairy, etc.

Display the book, *The Magic School Bus Gets Eaten: A Book about Food Chains*. Allow the children to discuss the picture on the front cover and predict what the book might be about.

Read the story to the children, reminding them to keep the focus question in mind.

Allow the children to look carefully at the pictures as you read the story. Help the children to determine if this book is fiction or non-fiction. List the children's response.

Classifying

Upon completion of the book, discuss with the children the food chain that exists in the ocean. Divide the children into small groups and give each group a portion of the story to illustrate. One group will illustrate the plant life (plankton), another will illustrate the zooplankton (corals, urchins), the next group may draw small fish (anchovies that eat the zooplankton), etc. Continue until each group has contributed a drawing to the ocean food chain. Display the children's work on a bulletin board. Let the children think up a caption for the board.

Peter Rabbit and Mr. McGregor's Garden

Ask the children why they think Peter Rabbit spent much of his time in Mr. McGregor's garden. Make a copy of the following graph and record the children's answers in the grid boxes provided. Ask the children what Mr. McGregor might grow in his garden. Record their answers in the grid boxes under that title. Next ask the children what foods Peter Rabbit, the mouse, etc. might eat that grew in Mr. McGregor's garden. Record those answers in the appropriate boxes.

(figure available in print version)

Repeat this kind of grid or questioning with the children until the children can answer the question: What food chains existed in Mr. McGregor's garden?

What Did You Eat?

Label graph paper with the food group headings. Allow the children to share what they ate for breakfast, lunch, and dinner. Record the children's responses under the correct food heading.

Student Bibliography

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Ehlert, Lois, *Growing Vegetable Soup*, Scholastic, Inc., New York, N.Y., 1987.

A colorful story about growing vegetables for vegetable soup.

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Children learn that plants that never bloom are called gym-no-sperms.

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An excellent source of biology projects for primary and junior age students.

Tucker, James & Priscilla, Nature Quest, A Christian devotional book that gives a refreshing encounter with the world as created by God. Each reading is based on what was created on that day of Creation week. For example, every Sunday's devotional is connected in some way with light, while Thursday's reading deals with birds and water creatures.

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