

Sixth Grade Curriculum Project:
Plant Kingdom, Photosynthesis, and Global Effects

Introduction to Topic: Plant Kingdom, Photosynthesis, and Global Effects.

This eight-day curriculum unit is designed for an urban 6th grade classroom in Hartford, Connecticut. We use the textbook from the Hartford Middle Magnet (Padilla et. al.) and planned this curriculum around a similar environment. Gardener's theory of multiple intelligences support the different activities for students to partake such as note taking, research, and labs. Through these various activities we hope that various multiple intelligences will be used so that each child may show more strength in one activity or another. Our principle objective is to challenge fourth term sixth-grade earth science students in preparation for seventh-grade life science. The constructivist Vygotsky's "Zone of Proximal Development" (Phillips & Soltis 58) encourages students to be challenged beyond their grade level in groups of students with different abilities. By teaching a seventh grade unit to sixth graders and by putting them in groups, Vygotsky's philosophy will be followed.

Students will be finishing up Chapter 3 on Protists and Fungi in their textbook (Padilla et. al.). This eight-day lesson is based on Chapter 4, an Introduction to Plants. In the eight-day period, students are exposed to an introduction to plants, nonvascular and vascular plants, photosynthesis and global effects. Bloom's Taxonomy sees knowledge gained as a student's ability to "arrange, define, duplicate, label, memorize...etc." and through class notes, laboratory experiments and a class project this knowledge will be assessed, or evaluated.

Day 1 (Monday)

Context #1: Introduction to the Plant Kingdom

Objectives: It is our goal that by the end of the first class period students will be able to understand the following:

- ✓ To be able to identify what makes a plant a plant
- ✓ To understand what cell structures are unique to plants

Activities:

Beginning of Class:

In the initial 5-10 minutes of class students will be asked to brainstorm about plants. They will be asked “What makes plants unique from other living things?” and these ideas will be written on the left side of the board. Following this activity the teacher will write notes on the right side of the board that pertain to plant characteristics and the students will be able to compare and contrast the facts with their previous knowledge. (Appendix A)

Middle of Class:

During the middle of the class period students will break into STAD groups to learn this new information. STAD, or Student Teams-Achievement Divisions, are groups of students working together mixed by “performance level, gender, and ethnicity” (Slavin 5). In these groups all students will teach each other to master the material for an upcoming quiz.

End of Class:

Students will remain in STAD groups until the end of class. In the last few minutes they will be given a vocabulary worksheet to use as a reference for a quiz on the plant kingdom. If the students do not finish this worksheet in class it will be assigned as homework.

Evaluation:

Students will be evaluated on participation during the brainstorming at the beginning of class and within their STAD groups. No quizzes, tests, etc. will evaluate students on day 1.

Day 2 (Tuesday)

Context # 2: The non-vascular plants: Bryophytes

Objectives: It is hoped that by the end of day 2 students will begin to understand the following:

- ✓ To learn the characteristics that define bryophytes (the non-vascular mosses, liverworts and hornworts)
- ✓ To understand why bryophytes are important

Activities:

Beginning of Class:

As in day 1, students will start class taking notes on nonvascular plants (Appendix A). Notes may be given on the blackboard or on an overhead projector.

Middle of Class:

Similar to the previous day, for a brief period in the middle of class students will work in STAD groups on worksheets pertaining to non-vascular plants.

End of Class:

At the end of class students will perform a quick lab in STAD groups to help them understand water transport in a nonvascular primitive plant. The lab, entitled “Will Mosses Absorb Water?” (Padilla et. al. 125; Appendix C) calls for moss, three graduated cylinders, sand and water.

Students will then be asked to explain what they found during the lab to other students within their STAD groups and amongst the entire class. In the last minutes students will be reminded to study for a quiz on nonvascular plants that will be given the following class day. They will use the worksheet that they completed during the middle of class as a guide.

Evaluation:

Students will mainly be evaluated on their participation during lab and in the class discussion that follows. The teacher will be looking not only for participation, but for comprehension of the material.

Day 3 (Wednesday)

Context # 3: Introduction to vascular plants: ferns

Objectives: After having learned about nonvascular plants in the day prior, on day 3 students will begin to learn about the following:

- ✓ To learn the characteristics that define seedless vascular plants (ferns, etc.)

Activities:

Beginning of Class:

In the first 5-10 minutes of class students will be given a short quiz on nonvascular plants. This quiz will be similar to the Section 3 Review (Padilla et. al. 128; Appendix B).

Middle of Class:

After the quiz students will begin taking notes on vascular plants (Appendix A).

End of Class:

After brief note taking, students will perform a simple lab to understand water transport in a seedless vascular plant, such as a fern. The lab, “How quickly can water move upward?” (Padilla et. al. 130; Appendix C) requires a petri-dish, narrow glass tube, food coloring and water.

For homework students will be asked to construct a Venn Diagram comparing vascular and nonvascular plants. In addition they will study for a quiz 2 on vascular plants to be given the next day. Students should study for this quiz using class notes and the book.

Evaluation:

Student will be evaluated on quiz 1 performance and laboratory comprehension. Quizzes will be scored and students will receive individual grades. In addition, students will receive STAD scores, averaging how each student in the group improved from the last quiz. STAD evaluation, “teacher presentation, team practice, and quiz, usually takes 3-5 class periods” (Slavin 5). This method challenges every student to learn the material, not only for individual grades but for group ones as well.

Day 4 (Thursday)

Context # 4: Compare/Contrast vascular and non-vascular plants; Photosynthesis; its history and makeup

Objectives: While the objectives may seem rather lengthy for day 4, all should be accomplished within one class period.

- ✓ To distinguish the differences between bryophytes (nonvascular) and ferns (vascular) plants
- ✓ To make speculations about vascular seed plants in accordance with Plato’s theory that all knowledge comes from prior knowledge (Phillips & Soltis 9).

- ✓ To understand how photosynthesis was historically discovered (scientists)
- ✓ To understand what photosynthesis is and where it occurs in the plant (CT framework asks that students “recognize that basic life processes, such as photosynthesis...occur at the cellular level” 121)
- ✓ To be able to write and explain the photosynthesis equation ($6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$).

Activities:

Beginning of Class:

In the first 5 minutes of class students will be quizzed on vascular plants. The quiz will be very similar to the Section 4 Review (Padilla et. al. 134; Appendix B). After this students will take out their homework and compare it to the Venn Diagram the teacher will draw on the board. In addition, students will make some speculations about vascular seed plants that they will learn about in the upcoming weeks.

Middle of Class:

After the brief quiz and homework review, students will take notes on photosynthesis. They will take notes on the scientists that discovered photosynthesis, as well as the notes on the actual phenomenon (Appendix A).

End of Class:

Students will get into their STAD groups and read the photosynthesis lab. They will be asked to come up with protocol for second part of the lab. For homework, they should be prepared to do the lab the next day.

Evaluation:

Homework on Venn Diagrams will be graded. In addition, the protocol for part 2 of the lab will be critiqued for the upcoming lab.

Day 5 (Friday)

Context # 5: Photosynthesis lab and Intro to Global Warming

Objectives: Students will be expected to display knowledge of photosynthesis in the lab performed and will also be held responsible for research done during class period.

- ✓ Lab: “Eye on Photosynthesis” –to see how each component of the photosynthesis equation is necessary for its occurrence (philosopher Jerome Bruner’s mental map theory)
- ✓ To understand how external factors can have a negative impact on plants and photosynthesis (CT framework grades 5-8 asks that students “understand that all organisms in the biosphere are linked to each other and to their physical environments by the transfer and transformation of matter and energy”)

Activities:

Beginning of Class:

Photosynthesis lab-part I: This lab will be performed to understand the process and conditions needed for photosynthesis of a plant. The materials needed are two test tubes, two wax pencils, Elodea plants, water boiled then cooled and a wide-mouthed container with sodium bicarbonate solution (these products will be supplied by the school science department). The students will do the first half of the lab and are then instructed to let the plant sit in water and wait thirty minutes before continuing.

Middle of Class:

Intro to Global Warming and project assignment, students will be given instructions of what is required of their projects; certain questions that must be answered, and topics that must be discussed. The students will then be put into their STAD groups to go into the computer lab and research.

- ✓ Students will be shown how to use internet search engines and given a sheet on library searches
- ✓ The EPA’s website on global warming for kids:
<http://www.epa.gov/globalwarming/kids/gw.html>
- ✓ The National Geographic for Kids website and quickflick videos:
<http://magma.nationalgeographic.com/ngexplorer/quickflicks/>
- ✓ Middle School curriculum ideas
<http://www.middleschoolscience.com/>

End of Class:

Photosynthesis lab-part II will be completed and the students will finish their observations and start to answer the lab questions. Students will also be asked to sign-up for after school times to come in and complete research for their global studies project.

Evaluation: Students will be evaluated on their completion of the photosynthesis lab and their behavior in the computer lab. The STAD group with the most information after the first computer lab session will receive extra credit for their efficiency on the computers.

Homework:

Completion of laboratory worksheet done alone for homework

Day 6 (Monday)

Context # 5: Global Issues

Objectives: Students will return from the weekend with the expectation that they have researched on their own and/or met with their groups over the weekend. The students will be in their STAD groups and will have the class to gather information from the library or internet in hopes to finalize their project to be presented the next day. The CT framework requires that the sixth grade curriculum covers how human activities have altered the Earth's land, oceans, and atmosphere, we will be achieving this through this project.

- ✓ To work in groups of mixed race, gender and ability (Jeannie Oakes believes inequality is due to tracking and the above organizational groups)
- ✓ To use research time in library and computer lab effectively and efficiently. Students will be required to present written notes and completed draft of the project to the teacher at the end of class.

Activities: At the beginning of class the students will share where they are in their groups, giving a summary of the information found and will then be asked to plan their class period around what they need to complete the project for the following day. Research time will then be given.

Rest of Class period

Groups of four will research an assigned topic (i.e. global warming, greenhouse effect, conservation, clear cutting etc.). The students will also be expected to write out their own notes and create a visual of some sort to aide them in their presentation.

Resources:

- ✓ Library research books, newspapers, internet, and teachers
- ✓ Poster board, markers, magazines etc. (Supplied by school art department).

Evaluation: The students will be graded at the end of class by each of their individual compilation of notes. Each student in the STAD group will be required to have notes and have contributed in some way to the group visual. Students will also be evaluated on their behavior during class and their ability to work effectively in a group. At the end of the six days students will be expected to present their topics to the class. Students will be expected to take notes during each presentation and will be quizzed

on the various presentations to test their understanding of their peers work. Students will have assigned codes so that no bias is given during grading. This may help students that fear a stereotype threat, as described by Claude Steele.

The Plant Kingdom Unit is completed by the students with hopes that each child may gain a greater understanding of plant makeup, plant life, and global issues. The curriculum is created on the basis of challenging sixth-grade urban students using Vygotsky's Zone of Proximal Development by pushing them in their greater understanding of life sciences. Also, Gardener's theory of Multiple Intelligences is implemented by the various activities assigned: Note taking, lectures, labs, research, artistic visuals for projects, and verbal presentations in front of class.

Literature Cited

- Oakes, J. "The Distribution of Knowledge," *Keeping Track: How Schools Structure Inequality* (New Haven: Yale Press, 1985) excerpts from chapter 4.
- Padilla, M.J., Miaoulis, I. And M. Cyr. *Science Explorer From Bacteria to Plants* (Needham, MA: Prentice Hall, 2000) chapter 4: 111-137
- Phillips, D.C. and J. F. Soltis, *Perspectives on Learning* (New York: Teachers College Press, 1998) chapter 2: 9-20 and chapter 6: 53-64
- "Science Performance Standards Grades 5-8." *The Connecticut Framework: K-12 Curricular Goals and Standards*, p. 111-142. Connecticut State Department of Education. <http://www.state.ct.us/sde/dtl/curriculum/currkey3.htm> (Retrieved 1 May 2003).
- Slavin, R. *Cooperative Learning: Theory, Research, Practice*, 2nd edition. (Boston: Allyn and Bacon, 1995) chapters 1 and 2.
- Summary of Bloom's Taxonomy <http://www.trincoll.edu/depts/educ/curric/bloom.htm> (Retrieved 1 August 2000)

Appendix A

Class Notes

Day 1 notes

Characteristics of Plants

- **Eukaryotes:** multicellular organisms (humans are eukaryotes too! Bacteria are single-celled, or prokaryotes)
- **Autotrophs:** produce their own food (a sugar called glucose)
- How do plants make their own food?
 - Photosynthesis (we start learning about this on Thursday!)
- **Features of Plant Cells**
 - **Cell Wall:** boundary that surrounds the cell membrane* and separates it from the environment. (*review components of the cell from cell unit!)
 - **Cellulose:** chemical that makes plant cell walls rigid
 - **Chloroplasts:** the green structures in which the plant food (glucose) is made
 - **Vacuole:** large, sack-like storage area; stores water, wastes and food. Without enough water in the vacuoles, the plant will wilt!

Day 2 notes

Nonvascular Plants: Bryophytes

- mosses, liverworts and hornworts
- liverworts and hornworts → like mosses they are nonvascular
 - **liverworts** grow flat on the ground on moist soil and rock
 - **hornworts** only grow in soil and are often found growing amongst grasses
- **Nonvascular plants:** low-growing plants that lack vascular tissue (they can only pass materials from one cell to the next! No tube-like structures)
- **Rhizoids:** thin root-like structures that anchor the moss and absorb water and nutrients from the soil; These plants lack roots and thus obtain water and minerals directly from the surroundings
- **Why are bryophytes so important?**
 - Ground cover
 - Bogs - peat

Day 3 notes

Seedless Vascular Plants: Club mosses, horsetails and ferns

- **Ferns and their relatives share two characteristics:**
 - Vascular tissue
 - Spores to reproduce

- **Vascular tissue:** solves the problems of support and transpiration; it transports water quickly and efficiently throughout the plant's body. It also transports the food produced in the leaves to other parts of the plant, including the roots

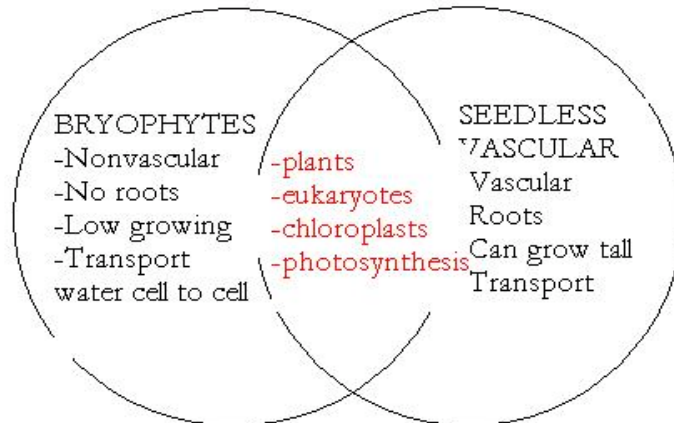
- (strength and stability: straw demonstration)

- **Importance of seedless vascular plants: ferns**
 - Ground cover
 - Easy household plants
 - Some people eat them!
 - Natural fertilizer in rice fields

Day 4 notes

Comparing Nonvascular and Vascular Plants; Photosynthesis: its history and makeup

- Make sure that your Venn Diagram you did for homework looks something like this!



- **Now we start on photosynthesis!**

- In photosynthesis, the energy in sunlight is used to make sugar and oxygen from carbon dioxide and water. The chemical equation is seen here:
- 6CO_2 (carbon dioxide) + $6 \text{H}_2\text{O}$ (water) + light \rightarrow $\text{C}_6\text{H}_{12}\text{O}_6$ (sugar) + 6O_2 (oxygen)
- Carbon dioxide and water combine in the presence of light to produce sugar and oxygen

- **How was this all figured out? Let's look at the scientists that put it all together!**

- Jean-Baptiste Van Helmont (DUTCH)
- Joseph Priestley (ENGLISH)
- Jan Ingenhousz (DUTCH)
- Julius Sach (GERMAN)
- TW Engelmann
- Melvin Calvin (AMERICAN)

Appendix B
Section Reviews to be
used as example quizzes

(only found in hard copy of report)

Appendix C

Chapter 4 Laboratory

Descriptions

(only found in hard copy of report)