Red Butte Garden
THE UNIVERSITY OF UTAH

ETHNOBOTANY: PEOPLE AND PLANTS

Lesson 1: Budding Taxonomists

Utah Core Curriculum Alignment 4th Grade Science Standard 5:	Intended Learning Outcomes: Science
Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.	• Develop and use simple classification systems. • Compare things. • Demonstrate a sense of curiosity about nature.
Objective 3: Use a simple scheme to classify Utah plants and Intended Learning Outcome 1g: Develop, use simple classification systems.	

Enduring Understandings

There are many ways to sort and classify scientific knowledge. Taxonomy is the branch of biology dealing with the classification of living things.

Essential Questions

What is the purpose of classifying plants? Is there a "best way" to classify?

Background Information

Sorting and categorizing plants helps us organize our knowledge and understanding of them. During the process of classification, patterns emerge about the plants, helping us process information about them. We might notice a plant's physical appearance, see how a particular plant could be a usable resource, whether or not it is toxic, or how long it takes to mature.

People have been sorting and categorizing plants informally for thousands of years according to their use and handing down this information through oral traditions. As people began to use writing tools and a more formal method of plant study, taxonomic information was recorded in book form. The European scientific taxonomic system used the structure of the plant to classify it. In Greece and Europe the following taxonomic plant studies were written during the period from 375 B.C. 1859 A.D.:

372-287 B.C.: Theophrastus, Historia Plantarum (folklore and form plant lists)
1583: A. Caesalpino, De plantis libri XVI (first scientific classification system)
1696: John Ray, Historia Plantarum (separation of monocots and dicots)
1753: Carl Linnaeus, Species Plantarum (beginning of Binomial Nomenclature System)
1763: M. Adanson, Familles des plantes
1789: A.L. de Jussieu, Genera Plantarum (evolutionary approach)
1824-1873: A.P. de Candolle et al., Prodromus systemati (58,000 species)
1846: John Lindley, The Vegetable Kingdom
1859: Charles Darwin, Origin of Species (evolutionary relationships; links by genetics)

Written in 1753, Carl Linnaeus's Species Plantarum introduced the binomial nomenclature (two-name) system, and revolutionized the way plants were named and classified. Taxonomists have continued to use this system and continue to refine classification systems as new information becomes available to them. This is significant, especially in the field of genetics. We can be sure that our methods will continue to evolve as we increasingly move towards phylogenetics, or classification by evolutionary relationships.

In North America, some native or indigenous tribes used the plant's function as one way to classify it. The plant was identified first by its most dominant structure, such as tree, shrub, herb, grass, or moss. Further subclasses such as utility, edibility, fragrance, color, size of leaves, or presence of spines or prickles might help to further identify one plant from another.

It is important to note that the tribal elders – the shaman (tribal doctor) or medicine person would usually have more extensive knowledge of the plants and their uses than others in the tribe, especially in the realm of healing. Most of the information about plants was passed down through oral traditions from one generation to the next. In the 1800s, various non-native anthropologists began to visit tribes throughout North and South America to try and document and preserve this native knowledge of plants and their uses.

Western science is based on empirical knowledge or knowledge we can derive from observing with our five senses. However, native people throughout the world have relied on a different view of the life around them. This has led us to see plants as separate from animals and humans and from other parts of the natural world. This quote from a member of the Tohono O'odham tribe of the Sonoran Desert helps us further understand the interactions of most native people with plants as well as with all of nature:

> Perhaps the best way to describe the Tohono O'odham regard for plants is that we have a personal and spiritual relationship with them. That relationship is a central part of our culture and is part of a broader connection with all living things. Our traditions teach us that we should be responsible caretakers of plants and animals, guided by our dependence on and respect for other forms of life. -Jefford Francisco

The preservation of this knowledge for the health of our ecosystems cannot be understated. In industrialized countries, most of the medicines used today are chemically synthesized based on

compounds found in nature, nearly all from plants. Some examples are aspirin (salicin, a chemical from willow bark), codeine in cough syrup (a chemical found in the opium poppy), and penicillin (a fungus in bread mold). About 80% of the people living in developing countries depend on traditional plant-based medicines for their primary health care (Moran 1997). Nature has provided us with a wealth of medicinal resources worldwide and it is our charge to protect the habitats that contain these materials.

As various cultures continue to assimilate into mainstream culture, much of the oral tradition of medicinal uses is being lost. The return of the cultural legacy of traditional medicines to the indigenous tribes could improve basic health of its members. It could also benefit them in many other ways, such as to: "(1) provide intellectual property rights concerning their traditional botanical knowledge and access to its resources on public lands; (2) provide culturally-based botanical medicine and a plant-based products industry for a tribe; (3) aid tribal cultural identity and enhance a sense of pride in their heritage." (Cozzo 2004).

By combining the scientific and genetic knowledge of plants with the traditional uses of plants, people will surely reap the benefits of various systems and ways of studying plants.

Lesson Plan

Materials

BB = Materials included in Botany Bin

- BB 35-45 plant specimens in rikers (specimen display boxes)
- BB Blackline for Classification Chart. Make 9 copies; a set of three for each group.
- BB Teacher Example for Classification Chart
- BB Instruction cards 1-3 (laminated)
- BB Optional: Fibonacci Numbers in Nature and Fibonacci Numbers Pine Cone Lab
- BB Optional: Lesson 1 Extension: Classification
- pencils

Procedure

Warm-up

Introduce the module to the students:

> **Ethnobotany** is the scientific study of the traditional knowledge and customs of people's interactions with plants. "Ethno" means people and their culture, and "botany" is the study of plants. In these lessons, you will explore the various ways different groups of inhabitants used Utah's native plants for food, shelter, clothing, medicine, ceremonies, and other uses over time. You will also discover three major biomes found in Utah and the adaptations plants have made in order to survive in each of these areas.

Explain that today they are going to come up with different systems of classifying plants. Check for understanding of the word **classification**. Then tell them they will begin by classifying one another's shoes. Ask students what might be different ways of sorting they could use to classify shoes (color, use, etc.). Write their ideas on the board. Ask if they think there is a right or wrong way to classify. Explain that now they are going to practice shoe classification, possibly using one of the ideas they just brainstormed.

Bring nine students up to the front of the classroom. Choose two additional students to come to the front to be the taxonomists or classifiers. They will decide on a way or system to classify the students into three groups by the characteristics of the shoes they are wearing. When they have sorted them into three groups, have the two taxonomists explain their system.

Ask for two more volunteer taxonomists. Have the new students repeat the process, using a different classification system. Discuss whether they now think there is a right or wrong way to classify. With some prompting, they may come to the conclusion that there are many diverse ways of classification and all that is needed is agreement or consensus regarding a system.

Activity

Explain that now they will begin to classify plants. They will be divided into three groups and will rotate between three different tables. At each table they will create and use a different system of classification for plants. Each table will have several plant specimens in rikers (plant specimen display cases), with some information about the plant on the back. They will be working in teams and will need to follow group work protocol (taking turns, being respectful, listening to one another, etc.)

Note: You may want to assign roles and tasks to members of the group, such as Reader, Recorder, Facilitator, Presenter.

Show the students one of the rikers (plant specimens). Explain that they will be using these plant specimens for this activity. Show the Instruction Cards to the students, and give them a brief overview of what is on each card. Explain that they will use these cards to help guide their work.

The last instruction on the card is to record their work. You can demonstrate how to fill in each of their charts by showing the Teacher Example Classification Chart. (This can be projected onto a white board.) Using group decision-making, they must come up with each of their own column headings to label and sort their plants.

Practice

Choose groups and send each group to a table. Give them about five minutes to explore the plant specimens and to make observations and ask questions.

Then set the timer and begin the activity. Rotate groups every 10 minutes.

Discussion

When they are finished with all three rotations, meet as a group and have each group share one of their systems. When they have finished sharing, have others compare their classification

systems and share similarities and differences. Ask if they think there is a wrong way to classify. Do they think there is a "best" way to classify? Did the sorting methods differ according to the purpose for classifying?

Assessment

Informal observations can be made as students are working; observe how they are filling in the charts, if they are engaged, etc. Make anecdotal notes of students' verbal responses during discussions.

Extensions

- To teach a lesson on how to use a "dichotomous key", use the enclosed lesson plan, *Lesson 1 Extension: Classification*.

- Brain research has shown the brain to be a pattern-seeking device that more efficiently stores information in patterns. This aids in memory and retrieval of information. Therefore, it is important to observe and note patterns all around us. It is the basis of classification. Fibonacci demonstrated a sequence of numbers that has a pattern 0,1,1,2,3,5,8,13,21,34,55,89,144. To get the next number in the sequence, you add the previous two numbers together. This pattern can be observed in nature. Use the enclosed book, *Fibonacci Numbers in Nature* to introduce the concept of Fibonacci numbers and the Fibonacci Numbers Pine Cone Lab to have students practice looking for Fibonacci patterns. You can also do this activity outdoors by looking for Fibonacci patterns in nature. Take a nature walk and observe patterns on leaves, seeds, flowers, cones, spider webs, etc. See lesson plans on Fibonacci mathematical patterns from www.mensaforkids.org.

- An excellent lesson plan on phylogenetic classification (based on evolutionary relationships) can be accessed at: www.evolution.berkeley.edu/evolibrary/article/0_0_0/evo_06.