Classification Systems
Introduction to Scientific Observation and Classification

Contents

Introduction

This guide contains background information about how observation and classification are important to scientists and directions for three activities that will help students better understand why organisms are classified in different ways. The activities are most beneficial to students when completed in order. This guide is specifically designed for seventh grade classrooms, but the activities can be modified for students at other levels.

Theme
Observation and classification of living things allows scientists to understand the relationships between a variety of organisms and helps them to properly identify different species.

Focus
This guide will help students to understand and learn how observations about organisms and their structures are used to develop classification systems.

Activities

Do You See What I See?
Students will try to list or draw all items from memory of a part of the classroom or school, and then check their accuracy. Students will then find a way to classify what they are able to observe in an outdoor area of school.

Divided in Two: Classification Part 1
Students will classify different animals that live in Zion National Park using a dichotomous key and taxonomic worksheet.

Canyon Creatures: Classification Part 2
After the class uses shoes to model how to create a classification system, students will create their dichotomous key using a worksheet of mythical animals.

Background

All science is initially based on observations of the world around us. The more we observe, the more our ability to gain knowledge can increase. Even the earliest scientists used direct observation to make sense of and categorize and classify the world around them.

The first modern classification of the natural world was by Swedish biologist Carl Linnaeus in 1735. Linnaeus, now known as the "Father of Taxonomy," first categorized everything in the natural world as either animal, vegetable, or mineral, then further divided each category into different classes based on observable differences. His system is the basis of the taxonomy system used today by scientists to classify animals, plants, and microorganisms. While much has been added and changed to how Linnaeus classified living things, the structure remains similar, including the use of Latin names by modern scientists. "Taxonomy" is now the name given to the science of grouping and naming organisms by their shared characteristics.

Even for people who are not familiar with the taxonomic structure laid out by Linnaeus, everyone uses some sort of classification system, especially when they are out in nature. All reference guides use different classification systems to distinguish between different plants and animals. For example, after narrowing an animal down to a reptile, features such as its size and color can help identify a specific animal.

Classification helps scientists understand the role of all plants, animals, and other living things in specific ecosystems. Based upon physical structure, classification systems can change over time as we learn more about the role and relationships of organisms.

Activity Materials

Corresponding materials which may include images, worksheets, and answer keys are provided for each activity. Materials can be downloaded from the lesson plan webpage, found here.

Core Connections

Utah Core Curriculum Seventh Grade Science

Standard 5: Students will understand that structure is used to develop classification systems.

Objective 1: Classify based on observable properties.

Objective 2: Use and develop a simple classification system.

Objective 3: Classify organisms using an orderly pattern based upon structure.

Do You See What I See?

Objectives
Students will be able to defend the importance of observation and be able to demonstrate different ways to classify things.

Method
Students will try to list or draw from memory all items in a part of the classroom or school, and then check their accuracy. Students will then find a way to classify what they are able to observe in an outdoor area of school.

Background
People notice different details depending on where they are and what they are looking for. Students look at their classroom every day, but may not be able to recall specific details. They may walk through their neighborhood every day, but because they are focused on getting somewhere, they may not notice details about the plants, animals, or buildings around them.

Observation skills are easily acquired but take practice. We can learn to be careful observers by practicing—even when there does not seem to be anything to observe—and by being aware of our surroundings, recognizing how different environments fit into a larger whole.

Materials
- Cloth sheet or large piece of paper
- Notepad or paper for each student

Suggested Procedure
1. Before students arrive to class, cover a section of wall, chalkboard, or desk with a cloth sheet or large pieces of paper. Cover a surface the students likely see on a regular basis and therefore have some familiarity with.

2. When students arrive, have them write down or draw everything they can remember from the surface that was covered. After two to three minutes or when students finish, remove the covering.

3. Have students share what they remembered, what they forgot, and anything they may have added or gotten wrong. Discuss whether there were any overall patterns of what was remembered or not remembered, whether most or all students remembered or missed certain items, and why that might be so (were
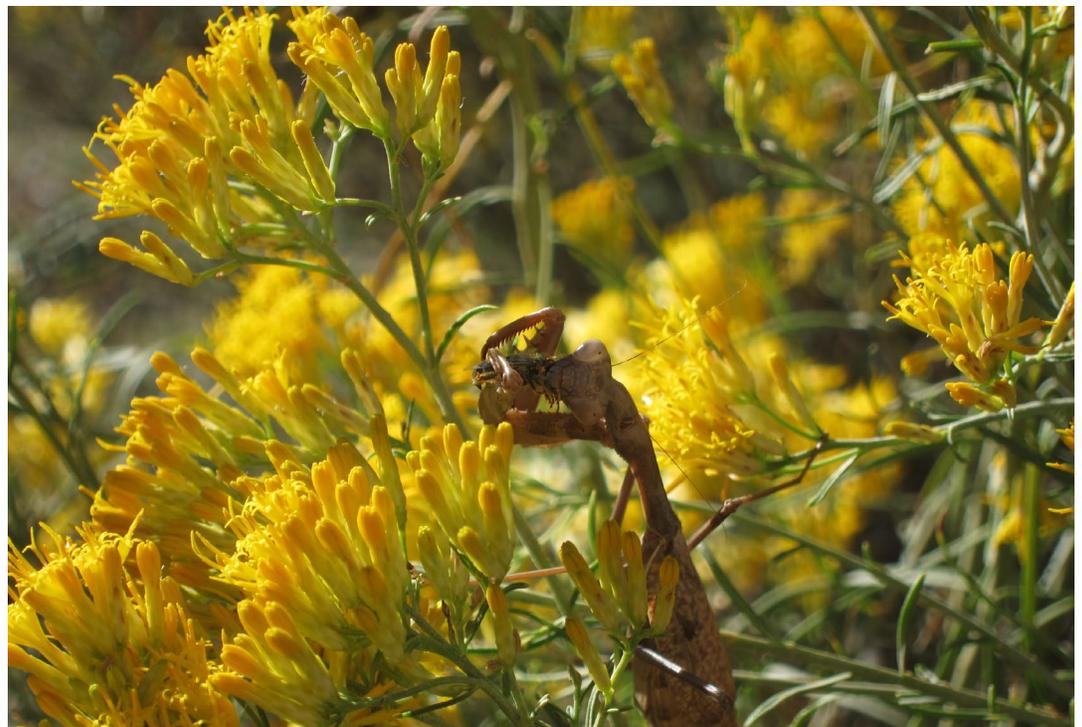
A praying mantis feeds on an insect.

NPS/JENNY EBERLEIN

certain things small or large, camouflaged, had bright or dull colors, or were something that students really liked or disliked?).

4. Have students repeat the activity for a specific outdoor area and have them write down or draw as many details as they can remember. Choose a space outdoors that is easily accessible and all students are familiar with (when students finish, the class will go outside together). Have students include as much detail as possible such as whether parts of the area are hard or soft, what color or shape they are, and what they might smell or sound like. When students are finished, take the class outdoors to the area and again have them compare what they remembered relative to what is actually there.

5. Have the students pick a spot to sit outdoors. Each student should sit at least ten feet away from other students if possible so they have their own quiet space. Have them record in as much detail all they see, again focusing on features such as what color, shape, or size something is, what it smells like or sounds like, and what it might feel like. Students can choose to focus on a small area (one tree, one rock, etc.) or the whole scene. Give students five to ten minutes to observe and record.

6. Once students are finished recording their observations, have them group items from their observation into five categories. Students can classify their items in any way they choose using any similarities and differences of their items (i.e. plants, animals, sounds, colors, etc.). Give students five to ten minutes.

7. Bring the group back together (either outside or in the classroom) and discuss the importance of observing the world around them and how they classified the items they observed. Did students come up with similar or different categories? What about the sub-categories? How did students categorize what they saw (structure, size, color). Explain that there are many different ways to classify things, and observations are an essential park of science.

Extension
Have students observe an insect or small animal if available. Pretend that no one has ever seen this animal before and have students make a report to a scientist. Provide a detailed description. If they were reporting these findings to the general public, would they change any details they would describe?

Have students keep a journal of the local phenology (seasonal biological phenomena such as when the first flowers bloom, when animals migrate, when leaves change color etc.).

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Tansy aster *Machaeranthera spp.*

Divided in Two
Classification Part 1

Duration
60 Minutes

Location
Inside

Key Vocabulary
classification, classification key, dichotomous key, kingdom, organism, species, taxonomy

Objectives
Through discussion and practice, students will understand that organisms are classified based on observable properties.

Method
Students will classify different animals using a dichotomous key and taxonomic worksheet.

Background
The first modern taxonomy, or classification system, was written in 1735 by Swedish biologist Carl Linnaeus. He first grouped all things as animal, vegetable, or mineral, and then further divided them into different classes. Today, while scientists use different groups, the idea of classification through observation has remained the same.

Taxonomies and some classification keys show the relationship between organisms and their commonalities. Dichotomous keys, on the other hand, are only used for identification. The keys identify a variety of objects by going through a series of opposite choices (one "is" and the other "is not") that lead to a correct identification. Dichotomous means "divided in two parts" and at each step of the key, the group is divided into two distinct smaller groups, then two groups again, and keeps dividing until one individual is left at the end.

Materials
- Divided in Two Worksheet, Dichotomous Key, and Answer Key
- Animals of Zion National Park images

Suggested Procedure
1. Ask students whether all organisms are related to one another. Explain that scientists have devised a way to show how organisms are related by their similar characteristics. One way scientists do this is by classifying the organisms.

2. Review or introduce the classification system used today by scientists to classify organisms. The system flows from broad, general categories to specific: kingdom, phylum, class, order, family, genus, and species. Write these on the board in a column, starting with kingdom and ending with species. Explain and review that all organisms are grouped into different kingdoms first–can the students name any of the kingdoms (animals, plants, fungi, etc.)? Allow student discussion of the traits used for classification. Explain that as one moves through the taxonomic categories, the traits for organisms become more specific, and the group becomes smaller. The genus and species, a two-word phrase in Latin, is how scientists name a specific organism. To assist students to remember the order of the taxonomic levels, they can use a mnemonic device such as, "King Phillip Came Over For Good Soup."

3. Hand out one Divided in Two Worksheet and Key per student (keys can be shared). Display Animals of Zion National Park images on the board (or print out packets for student groups). Explain that on the worksheet they will practice two types of classification. Go over the worksheet, using a turkey vulture to demonstrate the steps of the dichotomous key in order to classify each animal. After the example, give students 20 to 25 minutes to complete the worksheet.

4. Allow students to share their answers from the worksheet and discuss the different animals they classified. (Refer to animal images if desired and help determine the correct response if students disagree.) Ask students whether classification is an easy task or not. Explain that classifying organisms is not easy for scientists and that dichotomous keys were designed to help the scientists classify organisms.

Extension
Have students brainstorm habitats these animals might live in (desert, cliffs, riparian, forests, etc.). Students then write down how they would classify each habitat, animals paired with that habitat, and why.

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Coyote *Canis latrans*

Western bluebird *Salia mexicana*

Collard lizard
Crotaphytus collaris

NPS/JASON BURTON
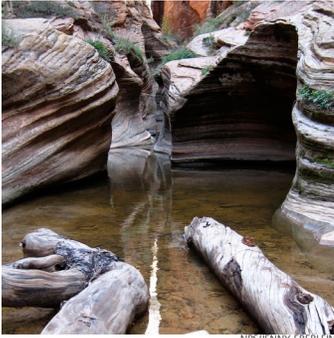
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Ranger and students discuss classification of organisms.

Echo Canyon, a slot canyon in Zion National Park, is home to many living creatures.

Canyon Creatures
Classification Part 2

Duration
60 Minutes

### Location
Inside

Key Vocabulary
classification, classification key, dichotomous key, kingdom, organism, species, taxonomy

Objectives
Students will understand that organisms can be classified by taxonomy and be able to successfully create a dichotomous key.

Method
After the class uses shoes to model how to create a classification system, students will create their dichotomous key using a worksheet of mythical animals.

Background
Zion National Park is home to hundreds of species of plants and animals. People must often reference field guides to identify what they have seen in order to learn more about it. Sometimes by focusing on categories, such as mammals, reptiles, amphibians, or birds, naturalists can narrow down the field of search. After narrowing a search down to birds, for example, one can use the physical characteristics of color, size, or shape to further identify what bird it is.

Dichotomous keys can help us identify a specific plant or animal. When scientists create a new dichotomous key, they have to use concrete measurements, rather than broader categorization such as "big" or "small." This type of identification system is valuable when identifying common plants or birds found in a region. While classification schemes show the natural or evolutionary relationship between organisms, dichotomous keys focus on observable physical structure and may only show artificial or contrived relationships.

Materials
- Variety of shoes from students
- Canyon Creatures Worksheet
- Canyon Creatures Answer Guide

Suggested Procedure
1. Have students gather their chairs to sit in a circle and ask about ten students to take off one of their shoes to place in the center of the group (try to get a variety of shoes).

2. Looking at the shoes in the circle, have students brainstorm similarities and differences in the individual shoes. Help the students choose one characteristic by which to split the shoes into two similar sized groups. Make sure the distinction between the groups is concrete (such as "has laces" vs. "does not have laces") instead of something general like "big" or "small." Starting with one of the groups, continue dividing the shoes into more and more specific categories until individual shoes are categorized. Keep track of the keying-out process on the board through a flow chart (see example in Answer Guide), signifying individual shoes by drawing a box around the name of the shoe. Check the accuracy of the dichotomous key by choosing one of the shoes to key out and see if it works.

3. Give each student a Canyon Creatures Worksheet. Tell the students they have discovered a previously unknown slot canyon in Zion National Park. In that canyon are ten brand new species of creatures that they will need to classify and name. They get to name all the creatures they found in the new canyon. Using these mythical creatures, students will then create their own dichotomous key, using the flow chart. On the worksheet, the beginning of the key has been started and they will need to continue adding lines (there are many possible outcomes, remind student to use pencil) until all species are identified. Students should outline the names of the creatures with a box.

4. Once students complete their dichotomous keys, have them switch with a partner to see if someone else can follow their key.

Extension
Create an animal tracks field guide of animals in your area. Have students follow a key to identify each track. They can later use the guide on a field trip to a local park.

Glossary

canine: a member of the Canidae, or dog, family, whether domesticated or wild. Characterized by a snout, tail, and four large pointed teeth.

classification: the organizational system of grouping organisms by category or type.

classification key: a chart or key used to identify an organism by comparing one organism with another (e.g. dichotomous key).

dichotomous key: a method of identifying an organism that only offers two choices at time. The chart allows you to compare organisms using observable principles such as size or structure.

feline: a member of the Felidae, or cat, family, whether domesticated or wild. Characterized by a round head and retractable claws.

kingdom: the largest and most general group of organisms. Every organisms fits under one of the five kingdoms: plants, animals, fungi, monera (bacteria), and protista.

mammal: an animal in the class Mammalia. Mammals are endotherms (warm-blooded), give live birth, and are covered by hair. Includes deer, dogs, whales, bats, and humans.

organism: any living thing, large and small. All organisms need air, water, and energy and can grow and reproduce.

reptile: an animal in the class Reptilia. Reptiles are ecotherms (cold-blooded), lay eggs, and have bodies covered in scales. Includes snakes, lizards, crocodiles, and turtles.

species: the most specific classification of an organism. Species are the same type of plant, animal, or other organism that can mate and produce fertile offspring.

taxonomy: grouping and naming organisms by their shared characteristics.

vulture: a large bird with a featherless head who scavenges or feeds on carrion (dead animals).

References

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