

Lesson 1: Introduction to Classification and Dichotomous Keys

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Grade Level(s)

Grades 6-8

Lesson Overview

Through a brief background presentation on Classification in Life Science, then hands-on practice using and creating dichotomous classification keys, students will be introduced to the concept of biological classification. In addition, they will understand that dichotomous keys are one method by which scientists identify living things and will practice observation and recording skills.

Learning Objectives

- To explain the need for classification in Life Science
- To create a dichotomous key
- To use a dichotomous key

Standards

Next Generation Science Standards: MS-LS1D Information Processing, MS-LS3B Variation of Traits, MS-LS4D Biodiversity and Humans

Preparation

Read through background information, set up the classroom with a central table where every student can see and have access to items, make copies as instructed below, and check technology for lecture.

- Using “Create Your Own Dichotomous Key” (in Lesson 1 Supplementary Materials), make wild cat photos from pages 5-6 large enough to display or printed out for small groups to use; print pages 7-8, “Key to Wild Cats,” with answer key printed on the back, enough copies for small groups; print student copies of pages 1-4.
- Download “Lesson 1 Presentation Slides” (ppt).

Materials and Resources

- Laptops or tablets with internet connection
- “How Many Species Are There on Earth and in the Ocean?”
Scientists recently have estimated the number of eukaryotic species on Earth
<http://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.1001127>
- Discussion of the “How Many Species” study
http://www.nytimes.com/2011/08/30/science/30species.html?_r=0
- An online dichotomous key for Oregon trees:
http://oregonstate.edu/trees/dichotomous_key.html
- Background Information: Classification is important in understanding the natural world. It is a specific way of organizing information so that it can be more useful. Recent estimates suggest there are nearly 9 million living things on Earth today, and that’s not even including bacteria and archaea! Classification of these living things helps us see similarities and differences that exist among these diverse organisms. Scientists have classified many millions of living species based on their physical characteristics and they have given a unique name to each unique species. The scientists who classify living things record their classifications so that later, others who encounter a certain species will be able to identify it in the same way. Making sure that two scientists are referring to the same thing when using a certain name is important for clear communication. Dichotomous keys help guide scientists toward identification so classifications can be shared and used mutually. A dichotomous key is a guide for classification and identification, somewhat like a map through a classification system that was developed previously. Dichotomous comes from the Greek root dich-, meaning “two” and -tomy, meaning, “to cut.” By asking a series of questions to which there are only two possible answers with respect to the object to be identified, the key leads users toward the proper identification. Many parts of the natural world that have been classified, categorized, and grouped can be identified using a dichotomous key. Dichotomous keys can be developed to identify anything in any sort of classification. Let’s develop our own dichotomous key to better understand them.

Activity 1: Discussion of Classification (15-30 Minutes)

- Lead students through lecture on classification (see Lesson 1 Presentation Slides).
- Slide 1: Show picture. Ask students, “Who knows what this is?” Solicit responses. Students should have several names for this crustacean such as roly-poly, pill bug, wood louse. Click through rest of slide.
- Slide 2: Go through slowly. Students take notes.
- It is assumed that students are building on previous knowledge of the Domain-Kingdom-Phylum-Class-Order-Family-Genus-Species system of classification. You will want to tailor your lesson to your students’ familiarity with this system. The last slide contains a link to a video of scientists from New Zealand discussing their work re-classifying ferns based on DNA analysis. Use this video to lead a brief class conversation around this type of research: “Could you see yourself working as a fern taxonomist?” “How do you think these men ended up in this career?” “What is the value in their research?” “Do you think their classification will be the final way these ferns are classified? Why or why not?”

Activity 2: How Do Scientists Classify Things? (70 Minutes)

- Ask students: “You want to find your friend in a crowd of people. What do you do?”
- Solicit responses: Look for certain key traits that you associate with your friend.
- Extend discussion: “If your friend is tall or has pink hair, you might look for that trait first. It’s usually pretty easy if it’s not a big crowd. But what if you had to pick out someone from the crowd whom you’ve never seen before? That would complicate things a bit. You would need a list of that person’s observable traits in order to find him or her. Let’s try something similar with our class’s shoes.”
- Students (those willing) remove one shoe and place it on a central table where everyone can see the shoes. Shoes are labeled with the owner’s name.

Part A: Create a Classification System (15 minutes)

- Direct students’ attention to the shoes on the table. Instruct students that these are mystery shoes, you are just now discovering them, learning all about them, and creating a way to make sure that all scientists that come after you can identify them in the same way.
- Ask students to design a way to classify these shoes. Have them work in teams of 3-4, and give them 6-8 minutes to prototype a classification system.
- Regroup and discuss: What did you come up with? How did you separate the shoes? How did you identify the shoes? Is your system simple? Would another scientist be able to easily use your system? How could you communicate your system with the world?

Part B: Experience a Dichotomous Key (15 minutes)

- Let’s look at one way that scientists help each other identify organisms (and nonliving things as well).
- Use “Create Your Own Dichotomous Key” pages 5-8. Display photos of cats on the screen. Distribute dichotomous keys to pairs of students. Go through key together.
- Discuss what students noticed about how dichotomous keys work.

Part C: Create a Dichotomous Key (30 minutes)

- Assign roles: recorder, shoe “namer,” shoe manipulator, photographer.
- Materials Can be anything! (Collection of various seeds and leaves, variety of buttons, student backpacks, and cell phones, etc.) This lesson will use students’ and teacher’s shoes as an example.
- What to Do: Distribute worksheet, “Create Your Own Dichotomous Key” pages 1-4.
- Lead students through the steps, or have them work independently.
- This activity is adapted from “Classification: How to Make Your Own Dichotomous Key,” by Joan Leonard, Green House Director, Department of Plant Biology, The Ohio State University. For additional ideas, including discussion questions, refer to this website:

<https://wow.osu.edu/experiments/Plants/Classification%3A%20How%20to%20Make%20Your%20Own%20Dichotomous%20Key>

Activity 3: Use a Scientific Dichotomous Key (30 Minutes)

In the field, scientists, naturalists, and curious observers use dichotomous keys to identify the living things around them. Students will practice using an online key to identify trees.

- Materials: laptops or tablets with internet connection
- What to Do: Now that students have practiced making a dichotomous key of an everyday collection of objects, it is time to think about how life scientists use dichotomous keys.
- Direct students to this website:
http://www.quia.com/pop/324544.html?AP_rand=1559298521
- Discuss botanical terms used to describe leaves: compound, simple, divided, palmate, pinnate, leaflets.
- Each student should work through the dichotomous key until they are successfully able to identify each leaf.
- Summarize/Check for Understanding: Ask two students to volunteer demonstrating to the class how they were able to identify one of the leaves using the key.

Troubleshooting

In Activity 2, students might have trouble developing the yes/no questions and subdividing groups. Encourage them to think in terms of characteristics that apply to more than one of the objects in the group, eventually trying to narrow down to specifics. Start with broad characteristics, and then get narrower. Also, students may encounter difficulty writing out the steps because it's not a linear process. Just encourage them to stay with each subgroup until each item has been classified, then go back to the remaining subgroups and repeat.

Assessment

- Write a paragraph explaining the importance of classification and identification to scientists.
- On a class Google Doc, upload photos and name four of the shoes you classified using your own version of binomial nomenclature. Explain the rationale behind your naming system.