



## UTAH Nature Explorers

**Time:**

(2) 45 minute classroom sessions

**Level:**

Grades 3-8  
Standards selected for grades 4 and 7

**Goals:**

This lesson will give students an opportunity to use hands-on exploration to learn about classification and create dichotomous keys, and to discover their importance in the scientific world.

**Objectives:**

Students will be able to

1. Observe characteristics of a variety of items
2. Working in groups, create a dichotomous key based on the identified characteristics of the shoes or other objects
3. Using photographs, identify characteristics and create a dichotomous key for 12 Utah animals and plants
4. Test the reliability of the created keys, and identify areas of possible improvement

*Materials listed with each individual lesson plan.*

## Classy Classification – Dichotomous Keys

*Based on lesson plans from National Geographic, National Park Services, and the National Park Foundation, as well as a lesson plan from the Utah Four Corners School. Links to the original lesson plans can be found in the 'resources' section of this lesson plan.*

*Adapted by Elisabeth Anderson, Neicca Butts and Mark Larese-Casanova*

**Correlations to Core Curriculum:****4<sup>th</sup> Grade**

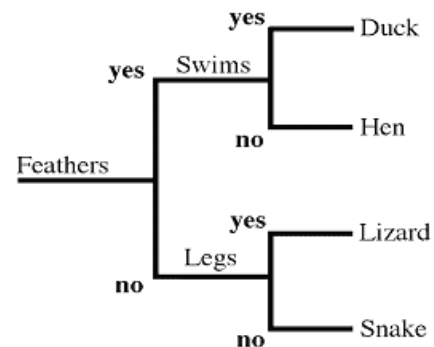
- Standard 5: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.
  - Objective 3: Use a simple scheme to classify Utah plants and animals.
    - Indicator b: Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

**7<sup>th</sup> Grade**

- Standard 5: Students will understand that structure is used to develop classification systems.
  - Objective 2: Use and develop a simple classification system.
    - Indicator b: Develop a classification system based on observed structural characteristics.

**Background Information:**What is a Dichotomous Key?

A dichotomous key is a tool that allows the user to determine the identity of items in the natural world, such as trees, wildflowers, mammals, reptiles, rocks, and fish. Keys consist of a series of choices that lead the user to the correct name of a given item. "Dichotomous" means



### Did you know?

"Dichotomous" means "divided into two parts". Therefore, dichotomous keys always give two choices in each step.

[http://oregonstate.edu/trees/dichotomous\\_key.html](http://oregonstate.edu/trees/dichotomous_key.html)

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### Importance of Classification/Dichotomous Keys

Classification is important in understanding the natural world. All of the information known about living species is used to organize them into a sort of family tree, which helps us to see the similarities and differences that exist in the living things all around us. 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 temnein, 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.

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

### Biological Classification

Classification of living things is called "Taxonomy." This is when scientists put organisms into groups when they have things in common. There are seven main groups that living things are classified into. Each group is named and briefly explained below:

- Kingdom – There are five kingdoms that organisms are divided into.
  - Animal Kingdom
  - Plant Kingdom
  - Fungi Kingdom
  - Protist Kingdom
  - Moneran Kingdom
- Phylum – The phylum can also be referred to as the 'division.'
- Class – A class is a group of organisms that have similar characteristics, qualities, attributes, or other traits. A class contains one or more orders.
- Order –
- Family – A family may be subdivided into one or more subfamilies.
- Genus – Used to further classify living and fossil organisms
- Species -- The species has the biggest gene pool possible under natural conditions. It is the group that does and potentially could interbreed.

**Materials:**

**Supplies –**

- Shoes (use 10 shoes from class members)

**Equipment:**

- Document Camera
- Whiteboard

**Did you know?**

Scientific Classification is all done in Latin!

**Lessons and Activities:**

**Day 1 --**

**Engage (10 minutes)** – Introduce the topic of sorting by reading a children’s book, such as ‘The Button Box,’ by Margarett S. Reid, ‘Sorting,’ by Henry Pluckrose, or ‘Classification of Animals’ by Casey Rand. Although these books are simple, they can start a great discussion on why sorting is important, and various ways that we can sort things.

*(As an alternative engagement activity, do the following activity: Under a document camera, or in another area visible to all students, show students a handful of candy. There should be a variety of candy types, colors, flavors, etc., therefore creating many different ways that this candy could be sorted. Ask students to tell you how to sort the candy. Sort the candy as per student directions. Ask students if there is more than one way to sort the candy. Sort the candy in a few different ways.)*

Both of these activities will naturally allow you to launch into a discussion about the importance of classification in our world today.

Explain that scientists classify and sort objects on a regular basis. One tool that they use for classification is called a dichotomous key. A dichotomous key is an identification tool made up of a series of steps. Each step has two possible options, thus allowing you to narrow down the object you are trying to identify to its true classification. Explain to students that dichotomous means ‘divided into two parts.’

**Explore (25 minutes)** – To introduce how dichotomous keys are created, do the following activity, originally found at [www.fourcornersschol.org](http://www.fourcornersschol.org). *(To see the original lesson plan, follow the appropriate link in the ‘resources’ section of the lesson plan.)*

Arrange chairs of students in a circle. Ask for ten volunteers. Each of these volunteers should take off one of their shoes and place it in the middle of the circle.

Tell the class that they have to divide these shoes into two different categories, based on their characteristics. The two groups do not have to have the same amount of shoes, but there needs to be two distinct groups. Allow students to give suggestions about how they could divide the shoes, and discuss as a class the pros and cons of dividing the shoes in a variety of ways.

Once an agreement has been reached about how to divide the shoes, write the two opposing characteristics on the board, about 2 feet away from each other. (An example dichotomous key is found below so you can get an idea of how this should look.)

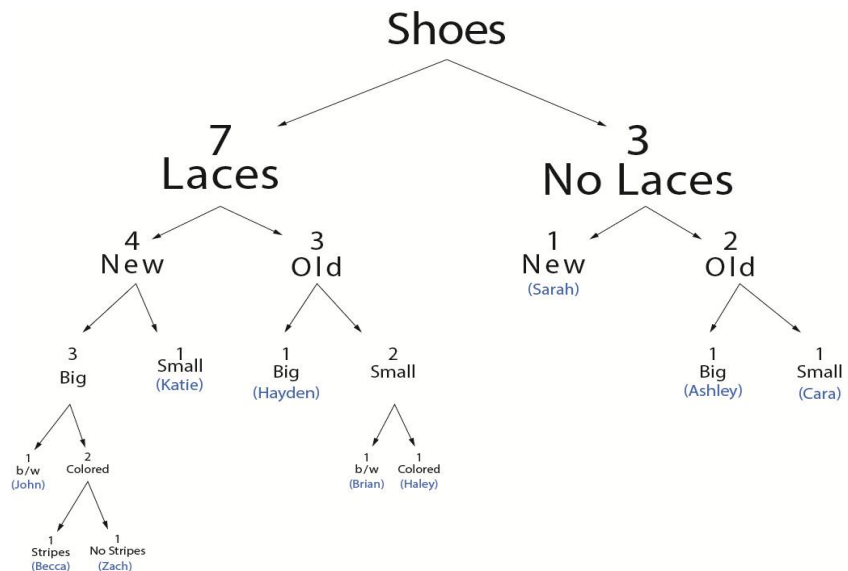
Come back to the piles of shoes. Explain that for a moment, one of the piles will be pushed aside; however, the students will have a chance to work with that pile again later. With one pile now in the center, tell the students they must again divide this pile into two piles, but this time, with a new set of characteristics. When the new agreement is reached, write the two new distinguishing characteristics on the board, as in the example below.

Continue this process until there is only one shoe left for a specific characteristic. At this point, label the characteristic with the shoe owner's name on the whiteboard, as well as the shoe type and make, if desired.

Once this process has been completed for one of the original piles, go back to the other pile and go through the same process.

### Did you know?

You can remember the sequence of classification categories by memorizing "King Phillip, Come Out For Goodness Sake!"



**Explain (10 minutes)** – Discuss how dichotomous keys work. Why are they important? Why is detail an important part of the creation process? Did the key for the shoes work? What was good about the created key? What could have been better?

**Day 2 –**

**Materials:**

**Supplies –**

- 9 sets of 'Utah's Plants and Animals' photos (available from [www.utahnatureexplorers.com](http://www.utahnatureexplorers.com))
- Lined paper
- Writing Utensils

**Equipment--**

- Projector (optional)

**Engage (10 minutes)** -- Ask the class, "What would a \_\_\_\_\_ be like without a classification system?" (Fill in the blank with a system such as a library or grocery store.) Do a think-pair-share with this question. First, ask the students to silently think about this question for 1-2 minutes. When you feel that they have ideas flowing and are ready to talk, ask them to turn to a partner and share their thoughts. This process should last about 5 minutes as partners discuss their thoughts and ideas. After they are finished talking to their partner, you should open it up to a whole class discussion, in which students can share what they discussed with their partner, as well as their personal thoughts on the matter with the entire class.

Talk about how scientists have their own classification systems to help them identify and classify various plants and animals that live in our world. *(If desired, you could introduce the biological classification system and the concept of taxonomy to your students at this point. This information can be found in the background information section.)*

Remind students of the meaning of the word 'dichotomous' (divided into two parts).

Explain that students will have the opportunity to sort real plants and animals of Utah today, and to create scientific dichotomous keys for them, so that they can classify them, just as real scientists do.

**Explore (25 minutes)** – *Depending on the age you are teaching, you can choose to do the following activity as a whole class, or in small groups.*

Make the 'Utah Plants and Animals' photo set available to the class – either by projecting the pictures on a screen, or by giving each group a copy of the photos. *(You may choose to give all groups the same photo set, or you may choose to give some groups the plant set and others the animal set.)* As groups of students observe each photo, they should list noticeable characteristics, such as 'has a tail,' 'no shell,' and 'long needles.' Students should list characteristics for each of the 12 photos.

Using the list of characteristics that they have created for the plants and animals, they should create a dichotomous key to help identify each item. *(It may be helpful to remind students about how they created a dichotomous key for their shoes the previous day, and may help some students to post the finished dichotomous key from the shoe activity for use as a reference.)*

If this activity is done as a whole class, you may choose to invite another teacher or student from another class to test out the effectiveness of the key. If the activity is done in small groups, students may move around to other groups to test out each other's keys. If possible, have students who created a key for plants test out a key made for animals, and vice versa.

**Explain (10 minutes)** – Discuss why or why not the created keys were effective. What was good? What could have been better? Talk about how these keys could be used if someone was visiting Utah. Who would find it especially beneficial?

**Elaborate (5 minutes)** – If time is still available, ask students what other types of dichotomous keys they think would be available for their use. Encourage students to look for dichotomous keys have been created specifically for the area they live in. If you want to carry this activity further, see the 'extensions' section.

**Assessment:**

The assessment for this activity should be based on the group-created dichotomous keys for the plants/animals of Utah. A rubric can be found at the end of the lesson plan.

**Did you know?**

Here is how humans are classified:

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Primates

Family: Hominidae

Genus: Homo

Species: Homo sapiens

**Extensions:**

- Research what types of dichotomous keys are available in your area, and provide opportunities for your students to use them. Dichotomous keys are especially common for trees. A few resources are listed below for your use.
  - [Trees of Logan Canyon](#)
  - [Amphibians of Utah](#) (When you click on this link, it will direct you to a page asking if you want to open a PDF document about the amphibians of Utah. Open the PDF file.)
  - [Virtual Dichotomous Key](#)
- If your class loves Harry Potter, then this is the perfect extension for you! Learn about dichotomous keys using 'Bertie Bott's Every Flavor Jellybeans.' Engage students by reading pages 103-104 of the first Harry Potter book (The Sorcerer's Stone), where Ron is telling Harry about all of the different flavors. After reading this, explain that students can use a dichotomous key to help them identify their jellybean flavors. The full lesson plan can be found [here](#) (including the dichotomous key), and if you want to watch another teacher teach this lesson, click [here](#).
- Divide students into groups of 6-8 people each. Explain that

as a group, they will be making a dichotomous key to describe and identify themselves. They can build a key based on physical characteristics, such as 'has glasses,' 'blue eyes,' or 'has braces,' or they can choose to use social/personality traits, such as 'loves pizza,' 'rides bike to school,' or 'class clown.' Remind students that if social characteristics are used, they must be well known characteristics. Discuss why it is critical to the success of the dichotomous key to have well known characteristics listed. The students will have 15-20 minutes to identify characteristics and then create a logical dichotomous key that leads to individual answers. Remind students that once they have created their key, it is a good idea to go through it and see if it makes sense. Have one student from each group move to another group and test their dichotomous key to see if it works.

- To review the topic of classification, introduce students to 'Alien Dichotomous Key,' which can be found at [http://bowenpeters.weebly.com/uploads/8/1/1/9/8119969/dichotomous\\_key\\_snack\\_copy.pdf](http://bowenpeters.weebly.com/uploads/8/1/1/9/8119969/dichotomous_key_snack_copy.pdf). Explain to students that these 12 aliens are from another planet, and we need to figure out what they are. Work together as a class to go through the dichotomous key and identify each alien. After all of the aliens have been identified, tell students to now imagine that they need to describe animals and plants from Earth to aliens from another planet. Talk about the importance of detail while creating a dichotomous key.
- Visit the website [http://www.kidsbiology.com/biology\\_basics/classification/classification1.php](http://www.kidsbiology.com/biology_basics/classification/classification1.php) with your class. The website should be displayed over a projector so that the class can see the page. Go through the activity on the webpage, which shows how classifying candy is similar to how scientists classify life forms. This activity should take between 5-10 minutes, and could very much enrich your students' understandings of why scientists classify life.
- To give students an opportunity to try to classify various life forms on their own, visit <http://www.pbs.org/wgbh/nova/nature/classifying-life.html>. This website has an interactive game in which students are given three different plants or animals and asked to classify them, starting with the kingdom and ending with the species. All of the needed information is given to the students, and if they wrongly classify an animal, they are given additional chances until they can correctly classify the animal.

## Resources:

### Books

- *The Button Box* by Margarette S. Reid
- *Sorting* by Henry Pluckrose
- *Sort it Out* by Barbara Mariconda
- *Classification of Animals* by Casey Rand
- *Classification of Organisms: Common Core Lessons and Activities* by Carole Marsh
- *Carl Linnaeus: Father of Classification* by Margaret Jean Anderson

### Websites

- Alien Dichotomous Key --  
[http://bowenpeters.weebly.com/uploads/8/1/1/9/8119969/dichotomous\\_key\\_snack\\_copy.pdf](http://bowenpeters.weebly.com/uploads/8/1/1/9/8119969/dichotomous_key_snack_copy.pdf)
- Original Lesson Plan on Classification --  
[http://www.electronicfieldtrip.org/saguaro/lessons/saguaro\\_1.pdf](http://www.electronicfieldtrip.org/saguaro/lessons/saguaro_1.pdf)
- Original Dichotomous Key Lesson Plan --  
[http://www.fourcornersschool.org/images/stories/boep/boep-lesson-plans/Microsoft\\_Word\\_-\\_Utah\\_Shshrubs\\_and\\_Trees.pdf](http://www.fourcornersschool.org/images/stories/boep/boep-lesson-plans/Microsoft_Word_-_Utah_Shshrubs_and_Trees.pdf)
- Dichotomous Key to Logan Canyon Trees --  
<http://forestry.usu.edu/htm/treeid/key-to-the-trees-of-logan-canyon/>
- Amphibians of Utah --  
[http://www.uen.org/Lessonplan/downloadFile.cgi?file=15085-2-20920-dichotomous\\_key.pdf&filename=dichotomous\\_key.pdf](http://www.uen.org/Lessonplan/downloadFile.cgi?file=15085-2-20920-dichotomous_key.pdf&filename=dichotomous_key.pdf)
- Virtual Dichotomous Keys --  
<http://electronicfieldtrip.org/canyon/students/activity-dichotomous.htm>
- Great Candy Classification Activity --  
[http://www.kidsbiology.com/biology\\_basics/classification/classification1.php](http://www.kidsbiology.com/biology_basics/classification/classification1.php)
- PBS classification activity --  
<http://www.pbs.org/wgbh/nova/nature/classifying-life.html>



## Dichotomous Key Rubric

The key is dichotomous – each category separates into two parts. <i>(20 points)</i>	The key is not dichotomous – each category separates into more or less than two parts. <i>(10 points)</i>	No key has been created. <i>(0 points)</i>
The key is clear, easy to follow, and legible. <i>(20 points)</i>	The key is somewhat clear, somewhat easy to follow, and legible. <i>(10 points)</i>	The key is not clear or easy to follow, and is not legible. <i>(0 points)</i>
The key identifies each of the 12 plants or animals. <i>(20 points)</i>	The key identifies at least 6 plants or animals. <i>(10 points)</i>	The key identifies less than 6 plants or animals. <i>(0 points)</i>

Student Names:

Score:        /60