

Preposterous Dichotomous Keys

A MIDDLE SCHOOL LESSON FOR CREATING AND USING DICHOTOMOUS KEYS

By Sharon Donovan

INTRODUCTION

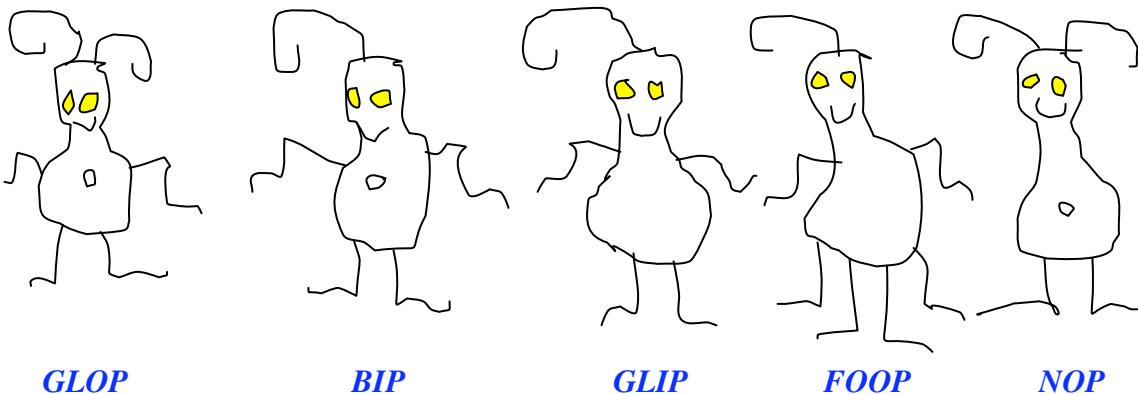
One of my most enjoyable lessons is on the concept of dichotomous keys. It not only addresses a multitude of subjects in the science standards, but also is just plain fun for my students and me. The lesson is based on the students' participation in naming preposterous "critters," creating a dichotomous key for them, testing the results and then creating their own unique group of critters to key out. The results of the lesson are that I have a class of students who can successfully use dichotomous keys and, more importantly, create keys of their own.

OBJECTIVES

- The students will be able to
- Use a dichotomous key to identify unknown organisms.
- Create a dichotomous key for a group of unknown organisms.

PROCEDURE

To begin, draw at least five "critters" on the board before the students enter the room. These critters must not resemble any known creature on this planet because they will be introduced to the students as aliens from another planet, which has just been discovered. Here are some critters I have used:



The critters are unnamed when the students arrive to take their seats. Much laughter and discussion usually result when the students spy the drawings. Allow a few minutes for the students to make some natural observations.

....IN THE BEGINNING....

Begin the class by telling the students that they are going to be scientists on a special mission to a newly discovered planet. Their job is to study the life forms on the planet, record all their observable characteristics and bring this information back to earth. Ask the students to name this new planet. However, they cannot use any known word from earth to name it. The students love this and come up with some pretty nonsensical names. Let's say they call the planet **BEBONK**. Next, ask them to think of some interesting names for the critters that the scientists found. I love throwing in some language arts here by telling them they can only use one-syllable names that make absolutely no sense. I'll use the names I have given under the critters as an example.

UH-OH

Tell the students that, when they get back to earth, they realize that the scientists who travel to Bebonk on the next mission will not know how to identify the critters very quickly when they see them, even with the information that the first team gave them. They will need to use some sort of identification key to help them. Explain that scientists use a dichotomous key to identify living things, by splitting a group of organisms into two groups based on a difference in a particular characteristic (you can play with the definition of "dichotomous" here, depending on the level of your students). Each group is then divided into two more groups based on another characteristic. This continues until only one organism is left and this leads the scientist to the name of the organism.

WHAT'S SO DIFFERENT?

Ask the students to make a list of all the different characteristics they observe for these critters. They may come up with the following:

- Number of hairs
- Number of legs
- Belly button
- Arms
- Crooked smile
- Small
- Fat

You can see that the students could come up with more, but these will do. Next, ask the students which of these characteristics could change because of age, eating habits or emotions and which ones are almost impossible to change. Hopefully, they will see that physical *structures* like arms, legs, belly buttons and hair usually don't change (well...maybe hair).

CREATE THE KEY

Ask the students to pick one structural characteristic that they could use to divide the critters into two main groups. There are several possibilities:

- One hair – two hairs
- Two legs – four legs
- Belly button – no belly button
- Arms – no arms

Guide the students to choose a characteristic that will divide the group into two smaller groups that have more than one member. Suppose they choose the number of hairs. Write the choices on the board in this way:

1. Has one hair.....
 Has two hairs.....

Explain to the students that every key starts with the number one, with two choices listed. Each choice will direct the user to another number, which will divide the organisms with each characteristic into two more groups based on another characteristic. Place the number 2 at the end of the first statement.

1. Has one hair..... 2.
 Has two hairs.....

Ask the students to give a characteristic that will divide the group with one hair into two groups. Tell them they will have to leave the second choice alone until they finish with the first one. Suppose they choose belly buttons. Write the number 2 under the first group of choices and write the two statements that describe the difference.

1. Has one hair..... 2.
 Has two hairs.....
2. Has a belly button.....
 Has no belly button.....

Ask the students if they can divide all the critters with one hair and a belly button into two more groups. They will discover that there is only one critter. Ask them for the name of the critter they have described. When the students tell you, say YES!! with enthusiasm, write the name after “has a belly button” and tell them that they have just identified one of the critters. The alien with one hair and a belly button is **BIP**.

1. Has one hair.....2.
Has two hairs.....
2. Has a belly button..... BIP
Has no belly button.....

How about the group with one hair and no belly button? The students should see that it needs to be divided again and will also see that the difference is in the number of legs. Place the number 3 after “no belly button,” write the two remaining choices after the number 3 below the other two steps. The students will see that, just like BIP, two more critters have been identified because there is only one of each. The key should now look like this:

1. Has one hair..... 2.
Has two hairs.....
2. Has a belly button..... BIP
Has no belly button..... 3.
3. Has two legs..... GLIP
Has four legs..... FOOP

Now, tell the students that they can go back and divide the group with two hairs, but that they need to use the number 4, because 2 and 3 have already been used. Place the number 4 after “has two hairs” and put a number 4 under the third step. The students will be able to see that there are only 2 remaining critters and they are different because one has no arms. Adding two more statements to distinguish this characteristic will result in their key looking like this:

1. Has one hair..... 2.
Has two hairs..... 4.
2. Has a belly button..... BIP
Has no belly button..... 3.
3. Has two legs..... GLIP
Has four legs..... FOOP
4. Has arms..... GLOP
Has no arms..... NOP

The last important job that the students need to do is create a title for the key. How about “Key to the Critters on Bebonk?”

KEY TO THE CRITTERS ON BEBONK

- | | |
|----------------------------|------|
| 1. Has one hair..... | 2. |
| Has two hairs..... | 4. |
| 2. Has a belly button..... | BIP |
| Has no belly button..... | 3. |
| 3. Has two legs..... | GLIP |
| Has four legs..... | FOOP |
| 4. Has arms..... | GLOP |
| Has no arms..... | NOP |

Now, the fun begins! Erase the names of the aliens from under their pictures. Tell the students that they are now members of the second mission to Bebonk. Their job is to estimate the populations of **Glops**, **Bips**, **Glips**, **Foops** and **Nops** by using the dichotomous key to identify the specimens and then counting, using sampling techniques (which is another lesson). Ask for a volunteer to pick one of the critters on the board and identify it, using the key that we just created. Direct the volunteer to read through the key out loud, so that we can all follow his or her thinking. Continue to have volunteers identify the critters, using the key, until all five are identified. Ask the students who originally named each critter if we identified them correctly. We never have a problem!

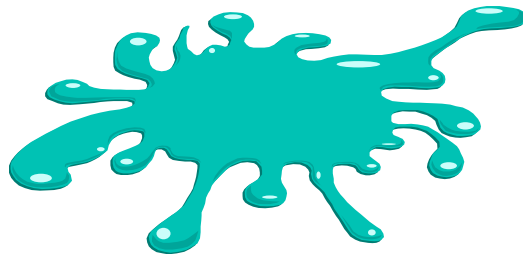
ASSESSMENT

This is one instance in which the assessment is actually more fun than the lesson! Tell the students that they are now going to create their own aliens from an imaginary planet. They must name the planet and the aliens. Supply paper and markers, colored pencils or crayons for the students to draw five aliens. After their artwork is finished, they must create a dichotomous key for their critters. Each student should keep the names of the critters a secret and then test their key on another student to see if they can be identified correctly. Display the aliens in the classroom for all to see. Students at this age enjoy creating the weird space creatures. Some create very detailed drawings with rather unusual physical characteristics. Encourage imagination. In most biological keys, a diagram of the organism is included, with important structures labeled. You may want to include that in your assignment, as well.

....AND ANOTHER THING....

* I have used this lesson in 4th, 5th, 6th, 7th and 8th grade science classes with great success. I have found that it is a great demonstration lesson when visitors are expected because the students are so enthusiastic.

* If you have ever used the GEMS guide called OOBLECK, imagine how easily a dichotomous key could be incorporated into the unit. Students could create drawings of several different creatures from OOBLECK and make a key for them.



* **A *Key to the Freshwater Fish of South Carolina***, created by Dr. Ed Donovan, et. al., is a logical unit to go to next. The key matches the poster of ***Freshwater Fish of South Carolina***, which can be purchased from the South Carolina Department of Natural Resources. I have also followed this lesson up with a ***Key to the Trees of South Carolina***, which can be found at the South Carolina Forest Commission.

* Other connections to this lesson are Scientific Naming and the Binomial System of Classification. Older students could use Latin words (or Latin – *sounding* words) to make up Genus and species names for their creatures.