Categories and Dichotomous Keys
4th or 5th Grade
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Benchmarks:
(4th)   SLC 1: Students will construct simple classification keys for others to use to distinguish between objects, organisms or phenomena.
(4th)   SLC 4: Students will use a dichotomous key, flow chart or tables to distinguish between objects.
(5th)   SLC 1: Given a key, students will identify safety rules and explain how the rules keep humans safe.

Objectives:
By using categories and sorting into groups, the students start to see grouping patterns. Building on to this with other materials to be presented later in the year will serve as another way to try to enhance memory. Once all categories are done, the tracing back of a dichotomous key reinforces that making groups has a purpose. This lesson, if done in full, will introduce vertebrates and invertebrates, living and non-living things and the main animal classifications (Birds, Fish, Amphibians, Reptiles, and Mammals).

Materials:
- Large sheet of paper (for final written out key)
- Writing utensil

1 picture each of the following:
- Bird
- Fish
- Amphibian
- Reptile
- Mammal
- Invertebrate (with an obviously missing backbone, like a jellyfish)
- Non-living object
- Test picture(s) for keying out at the end

Initial Demonstration:
Split the class up into groups. Hand out the Bird, Fish, Amphibian, Reptile, and Mammal (BFARM) pictures to each group and ask the students to sort the pictures into groups. Once done, the students should raise their hands and explain what the grouping is and why they chose it; after all of the groups are finished grouping, share the grouping methods with the class. If one group chooses the BFARM labeling, focus on how that is how scientists thought, too. If not, go briefly into how scientists chose the BFARM categories for their classifications. Ask students to raise their hands and name other animals that would fit into each category.

Target Observations:
- The BFARM pictures can be sorted in several different ways
- Scientists chose to sort the pictures one way because of certain differences between the animals: birds generally fly and have wings and beaks; fish swim in water and breathe through gills; amphibians live like fish for the first part of their life, then live like reptiles

(breathe air) for the final part of their life; reptiles lay eggs, breathe air, and are generally cold-blooded; mammals are warm-blooded, give birth to live babies, and breathe air.
- Some other animals that can fit in each category: bird – dove; fish – shark; amphibian – frog; reptile – dinosaur; mammal – lion.

Target Model:
-There are several different ways to group animals, however scientists have sorted them one particular way because of the ways that the animals are different: birds, fish, amphibians, reptiles, and mammals.

Demonstration:
   Hand out the invertebrate picture. Ask students to group once again, congratulating them if they can state why they chose their groups. Ask if there is a big difference between the picture just passed out and the other 5 they already had. Lead the students into recognizing that the new picture is of an animal without a backbone. Have the students separate their cards into two groups: backbone and no backbone. What are the scientific names for these groups?

Target Observations:
- Animals can be separated into "backbone" and "no backbone" groups
- Animals with a backbone are called "vertebrates," animals without a backbone are called "invertebrates."

Target Revised Model:
-There are several different ways to group animals, however scientists have sorted them one particular way because of the ways that the animals are different: birds, fish, amphibians, reptiles, and mammals; *animals are separated further by backbone and no backbone.*

Procedure:
   Hand out the picture of a non-living thing. By this point the students will be getting restless with sorting, since they might think they have mastered it. Ask them to find the big difference with all the other pictures and this new one. Have the students list off the 6 characteristics of living things, either quickly if students have had a living/non-living lesson, or by filling in the blanks, e.g. "Needs _____ or _____ source."

Target Observations:
- The 6 characteristics of living things are:
    1. Ability to grow and change
    2. Reacts to its environment
    3. Needs a food or energy source
    4. Takes in gases
   5. Can reproduce
    6. Has cells

Target Model:
-There are several different ways to group animals, however scientists have sorted them one particular way because of the ways that the animals are different: birds, fish, amphibians,

reptiles, and mammals; animals are separated further by backbone and no backbone; *things can be sorted into living and non-living.*

Procedure:

Ask the students to look at all the pictures and say what they all have in common. Target Response: They are all things on Earth. This will then become your top of the key. On the board draw the following:

Things on Earth
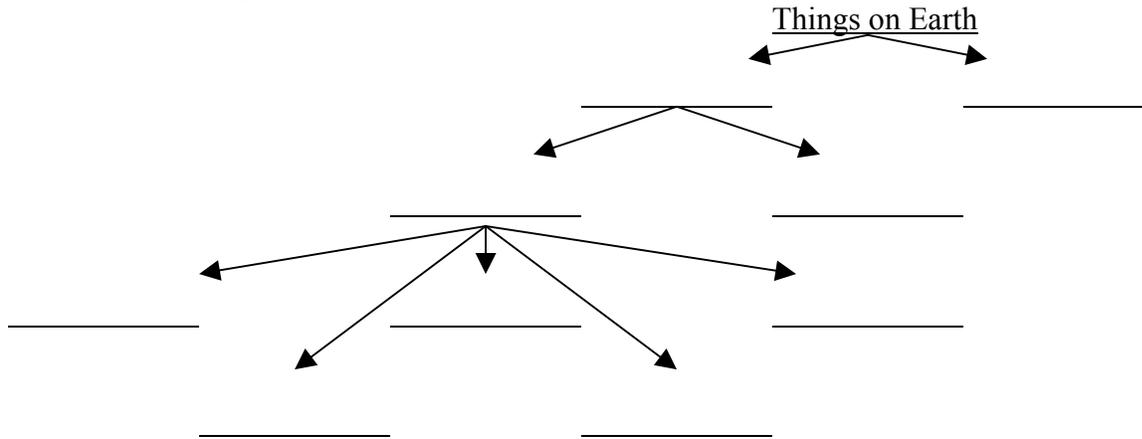
Have the students copy this down on the large paper you just handed out (to save time you can have this pre-written on the paper). Once they have finished, ask what were the last 2 categories they made. They were living and non-living. Have them place all the living object's pictures on the left line and all the non-living on the right. Are there any left over? So, that was a good start to dividing things into categories. Explain that when we put things in this type of groupings we always use only 2 categories. This makes things simple and easy to follow.

Target Observations:
- All of the things on the cards are found on Earth
- Dividing the cards into living and non-living did not leave any cards not in a group
- It was simple and easy to only divide the cards into two groups

Target Model:
-There are several different ways to group animals, however scientists have sorted them one particular way because of the ways that the animals are different: birds, fish, amphibians, reptiles, and mammals; animals are separated further by backbone and no backbone; things can be sorted into living and non-living.
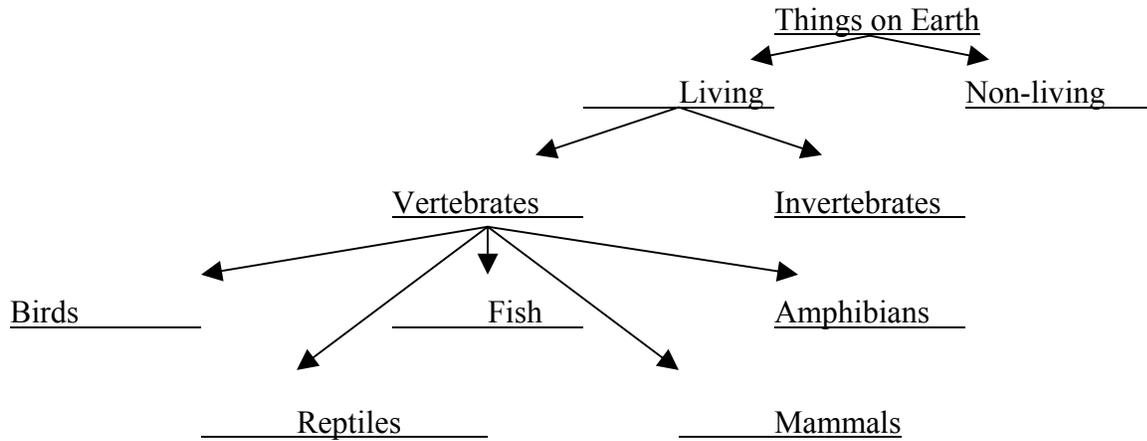-*Sorting things into two groups makes things easy and simple.*

Procedure:

Have them write the words living and non-living on the lines. The non-living picture can stay there since it is the only one left. Explain that the object is done being broken into categories when there is only 1 left. You can't get 2 categories out of 1 picture!

Next, you need to sort the living things into 2 categories. Have them try to remember vertebrates and invertebrates. If they can't, refer to the definition on the board. Separate as necessary and label lines appropriately.

Continue finally to the vertebrates breaking down into the BFARM groups. Label lines and their papers and the board should look like this:

<u>Things on Earth</u>

<u>Living</u>   <u>Non-living</u>

<u>Vertebrates</u>   <u>Invertebrates</u>

<u>Birds</u>   <u>Fish</u>   <u>Amphibians</u>

<u>Reptiles</u>   <u>Mammals</u>

Ask what this kind of classification this is called. When separating the vertebrates, we didn't use a 2-group system. Can you think of a way to make this a 2-group system? You may have to make up some groups of your own.

Target Observations:
- Living things can be separated into vertebrates and invertebrates
- The separating ends when there is only one object in each group.
- The vertebrates can be separated into breathing air and breathing under water
- Breathing air can be separated into flying (birds) and non-flying, breathing under water can be separated into always breathe under water (fish) and sometimes breathe under water (amphibians)
- Non-flying can be separated into cold-blooded (reptiles) and warm-blooded (mammals)

Target Model:
-There are several different ways to group animals, however scientists have sorted them one particular way because of the ways that the animals are different: birds, fish, amphibians, reptiles, and mammals; animals are separated further by backbone and no backbone; things can be sorted into living and non-living.
-Sorting things into two groups makes things easy and simple.
-*Separating things into groups ends when there is only one thing in each group.*

Post Test:
- Give them pictures to classify
- Have them make up their own key with objects you give them. Then pass their keys to the next table and have those groups classify the objects until all are separated
- Have them fill in the blanks by reading the key backwards:
  A _____ is a _____ that is _____ and is a _____.
  A <u>fish</u> is a <u>vertebrate</u> that is <u>living</u> and is a <u>thing on Earth</u>.