

Helping Kids Learn – Post #20 8/18/20

STEM: Science – Taxonomy

Lots of us like things to be organized. It's easier, less frustrating, and less time consuming to know exactly where your socks are when you're ready to get dressed. STEM professionals are no exception. In their varied professions they put things in categories to make it easier to name them and study them. The technical term is **taxonomy**. This lesson can be used by a wide range of learners from very young to advanced. See [Lift the Level](#) below.

Be a Taxonomist – How Science Names Things – Categorizing

Taxonomy is the science of organizing. You can organize just about anything from socks to screws to plants and animals to events in a computer program to kinds of bridges to cells in the human body. Today we're going to get organized!

Investigation 1 *What's That Smell?* You'll need a blindfold and 8-10 items that have a scent or odor. Choose safe things, not cleaning products. For example, tap water, coffee (beans, ground or liquid), a bar of soap, spices such as cinnamon, cheeses, pickles, cut or canned fruit.

When you want to organize stuff, you have to know something about it. The easiest way to learn about it is to use one or more of your **5 senses**. You're going to use your sense of smell. Put on the blindfold and ask a partner to line up the things to smell. *You never smell something unfamiliar by sticking your nose in it and inhaling. Instead, hold it in front of your nose with one hand and brush your other hand over it toward your nose.* Smell the one on the far left, then turn away from the items and breathe in deeply through your nose, exhale through your mouth. Then smell the second item and repeat the deep breathing. Continue through all of the items. Then ask your partner to group them using your directions. For example, you might think of putting together all of the sweet smells, the sour smells, the smells that make your mouth water, etc. Or you could make two groups: the items that you think you can name and ones that are not familiar.

Whatever way you do it, you have made a **rule** for what to put in which group. If your rule "works," then it will be easy to use it to put any new item in the correct group. See [What's the Science?](#)

Investigation 2 *Fish or Not Fish* A taxonomist tries to develop a strong classification system based on the **characteristics**, traits of an object that one can identify. Here are some things you might consider in deciding if an animal you found is a fish. Answer Yes or No.



- | | |
|-------------------------------|-----------------------------|
| 1. Do all fish live in water? | 4. Do all fish have fins? |
| 2. Do all fish have gills? | 5. Do all fish lay eggs? |
| 3. Do all fish have scales? | 6. Do all fish have a tail? |

The answers are 1. All fish live in water. Even Lung Fish, an ancient species. 2. All fish have gills which they use to pull oxygen out of water (the Lung Fish's are specially adapted). 3. Not all fish have scales; scales protect the fish's skin and can act as camouflage; some fish have a slimy coating instead of scales, such as the White Catfish. 4. All fish have fins but they don't all have the same number of fins. 5. Not all fish lay eggs; some fish bear live young. 6. All fish have tails – their tail is a specialized fin.

What about the animal in the picture? Is it a fish? It does live in water. Is everything that lives in water or has gills a fish? See [What's the Science?](#) and [Solutions](#).

What's the Science?


Investigation 1 Rather than tell you a taxonomy created by someone else and have you follow it, having you explore and create your own categorization results in deeper, more imbedded construction of knowledge. You'll remember it longer, too.

We asked you to take a “cleansing breath” between samples because your sense of smell gets overwhelmed easily. The neurotransmitters can hold information, sending your brain “mixed signals” after a few samples.

Smell is one of the most enduring senses in memory. It is also one of the more difficult to categorize. And it is one of the most economically important. From the glue on birthday card envelopes to the detergent you use to wash your clothes, scents are added to many things we buy. Scientists have categorized scents in multiple ways. Here are two: Floral, Oriental (Spicy), Woody, Fresh; and Top Note, Middle Note, Base Note. See [STEM Online](#) for more information.

Investigation 2 A Swedish scientist, Carl Linnaeus, developed the science of taxonomy in the 18th century. He used Latin, a language nobody speaks anymore so it doesn't change over time. And he gave everything two names that identified where they belonged and with what they were related. The names sound strange to most of us but if you know Latin, they usually make sense. Humans, for example, are *Homo sapiens* (the first word is capitalized, the second isn't). *Homo* is Latin for *man*; *sapiens* for *wise*, meaning humans use reason. Of course, we know now that lots of animals can reason but in Linnaeus's time, that wasn't commonly understood.

Linnaeus's taxonomy, with an update by Carl Woese, uses the RNA structure and characteristics of living things to sort them into increasingly more specific “buckets.” Look for where the sorting is the same and different in these examples:

Level (“bucket”)	Humans	Domestic Dogs	Marigolds 
Domain	Eukarya* (made of cells with nuclei)	Eukarya	Eukarya
Kingdom	Animalia (animals)	Animalia	Plantae (plants)
Phylum	Chordata (spinal cord)	Chordata	Tracheophyta
Class	Mammalia (mammals)	Mammalia	Magnoliopsida

Order	Primates	Carnivora (meat eater)	Asterales
Family	Hominidae	Canidae (all dogs)	Asteraceae
Genus	Homo (man)	Canis (dog)	Tagetes
Species	sapiens (wise)	familiaris (familiar with)	Pictured is erecta (upright) There are 50 species depending upon specifics like color, plant height, etc.

*The other domains, Archaea and Bacteria, are made of simpler life forms whose cell or cells lack nuclei.

Lift the Level You can make this lesson deeper and/or suitable for older students by any of the following:

1. **For young learners** Use a pile of anything you have around – paperclips of different sizes and colors, buttons, bird seed, whatever you have. Dump it on a table with room to make new, smaller piles. Think of a way to organize the big pile into small piles that follow a rule, then sort. Ask someone else to look at the small piles and guess your rule. See [Solutions](#).
2. **For more advanced learners** You can often decode Latin names by looking for similarities to English or Spanish words. For example, “familiaris” looks like the English or Spanish word “familiar.” You can find the Latin or *scientific* names of plants and animals with an online search engine. Create a list of common names and scientific names for 10 plants and animals.

STEM Online These are suggestions only and no endorsement is implied. Although they have been screened for appropriateness before posting, adults should vet the websites children use, as they may change over time.

Sense of smell <https://phys.org/news/2020-07-invasive-hedgehogs-ferrets-habituate-categorize.html>
<https://scentappreciation.com/2020/05/16/categorizing-scents/>
<https://thenaturalwalk.com/how-to-categorize-essential-oils-2-ways-you-can-do-it>

Scientific classification https://www.ducksters.com/science/scientific_classification.php
[https://en.wikipedia.org/wiki/Taxonomy_\(biology\)](https://en.wikipedia.org/wiki/Taxonomy_(biology))

NJ Student Learning Standards

K-ESS2; 1-LS3, 1-ESS1; 2-LS4; 2-ESS2; 3-LS3; 4-ESS2

Solutions

Investigation 2 – It is a flying fish, using its fins to lift out of the water. Regarding scales: sharks have specially adapted scales called *dermal denticles*, literally “skin teeth.” Not everything living in water or having gills is a fish.

Lift the Level 1 – For example, buttons could be categorized using the rule “Number of holes.” Then the “buckets” might be all buttons with two holes, four holes, more than four holes, no holes (shanks on the back). The best categorization I ever got from my kindergarteners was “Ones I like; ones I don’t like”!