Virginia Master Naturalist Program Basic Training: Unlocking Keys Activity for Citizen Science and Research Skills

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Overview

This lesson plan is intended to serve as an interactive activity to accompany a presentation on citizen science and research skills during the Virginia Master Naturalist basic training course for volunteers.

This lesson plan includes four activities that build on each other. If time is short, we recommend doing activities 1 and 2. With additional time, add in activities 3 and 4.

Objectives

- Become familiar with the structure, form, and function of dichotomous keys
- Practice using and developing basic dichotomous keys
- Develop keying skills that can be used with a variety of keys to plants and animals
- Develop awareness of multi-access keys

Materials

- Examples of books with keys that VMN volunteers might use (e.g., VDOF Common Native Trees of Virginia, VDOF Common Native Shrubs and Woody Vines of Virginia, pocket "Finder" books. Flora of Virginia). Additional examples of field guides (e.g., VDWR guide to frogs) that are not keys may also be useful for comparison.
- Wacky People Key, included in this lesson plan. (one copy per person, with the pictures on one side and the key on the other)
- A computer and internet connection (Activity 3 only)
- A sample from a tree, shrub, or grass from which participants can observe all necessary characteristics for the online keys (Activity 3 only)

Other Resources

- Citizen Science and Research Skills multimedia presentation and handout
- Citizen Science and Research Skills background readings

Both of these items are found on the VMN Basic Training Citizen Science and Research Skills page, https://www.virginiamasternaturalist.org/training/basic-training/citizen-science-and-research-skills/.

Time

Allow 30 minutes for Activities 1 and 2 combined, 15 minutes for Activity 3, and additional time if you choose to do Activity 4 and go into the field.

Leader Instructions

Activity 1: Wacky People Key

This activity will bring all participants to the level of understanding the structure, form, and function of dichotomous keys. As a quick assessment of the audience, ask the participants to rate themselves with a show of hands, where 1 means they have never used a dichotomous key or don't know what that phrase means, 2 means they have used dichotomous keys but do not feel very confident with them, 3 means they have used dichotomous keys quite a bit but could use more practice, and 4 means they could instruct this part of the class. Let participants know that any starting point will be fine and that by the end of the activity, everyone will be at least a 2 or possibly 3. Ask the 3s and 4s to help the 1s and 2s as you move through the activity.

1. Begin by describing the purpose of dichotomous keys. One important skill for a naturalist and a citizen scientist is being able to identify what you see in nature. This skill can be built through self-study, through learning from other naturalists, or even by interacting with online communities like iNaturalist.org. Keys are useful tools to help in this learning process, and they are used by expert scientists as well as amateurs. Keys are tools used to identify organisms in a methodical way, and dichotomous keys are one common type of key. Dichotomous means branching or dividing into two parts. Dichotomous keys offer a question with two choices for answers. The choice made leads to another question with two answer choices. Users are taken to a different part of the key depending on their choices, much like the old "Choose Your Own Adventure" books for kids.
2. Pass around examples of dichotomous keys that Master Naturalist volunteers might use. Some possibilities include the keys in the Virginia Department of Forestry guides to native trees and native shrubs and vines, the keys in the Reptiles of Virginia book, the "Finder" series pocket books, and keys in the printed Flora of Virginia.
3. Next, explain that you will start by practicing with a key that will be new to everyone; no one in the room will be a prior expert. Pass out copies of the Wacky People Key. Point out how the numbers on the left-hand side of the page show the question or couplet number and point out how the numbers on the right-hand side tell the user where to go next in the key. Also explain that one should always start with question or couplet 1 in a key.
4. Have the participants work in pairs. Start by having all the pairs work on the same Wacky Person. The person in the upper right-hand corner (Lugio wirum) is a good one with which to start. Provide assistance to any pairs that seem to be having trouble. Note: if time is limited, you can walk through the example as a whole class together.
5. Once every team has correctly identified Lugio wirum, talk about some of the failings of this key. Ideally, the questions in dichotomous keys should all be objective, but this key has several subjective questions, such as "Looks a lot like a human" or "Looks like a girl". Those questions may have caused difficulties as teams were using the key. Point out how, when using a key, you should keep track of the choices you make and any points where you were uncertain. If you get stuck, you can go back to any points of uncertainty and select the other option.
6. Let all the pairs try identifying one or two more Wacky People of their choosing. Discuss any challenges that arise. Note that the Wacky Person in the middle on the 2nd row is particularly confusing because they identify what looks like a nose as a foot. Also, the Wacky Person in the middle of the bottom row is problematic because in one question it has one foot and in another question it has two. Both of these can make good examples of how keys are not always perfect and can be tricky.

Activity 2: Shoe Key

This activity will solidify participants' understanding of keys by having them make a simple one.

1. Describe that the next activity will involve developing a key from scratch. Ask for at least five volunteers to take off one shoe and bring it to the center or front of the room where everyone can see it. You need a minimum of six different shoes to make this activity effective. You can use more, but the more you use, the more time it will take to develop the key. With five shoes, it can be done in 10-15 minutes.
2. Have the participants divide the shoes into two categories based on a single characteristic (e.g., laces or no laces, leather or not leather.) The two categories do not have to result in equal numbers of shoes. Write down the characteristic in the form of a dichotomous key couplet.
3. Next, have the participants sub-divide each of the two categories into another two categories based on additional characteristics. Remind participants that the characteristics should be as objective as possible. "Low top" and "high top" is less objective than "Does not cover the ankle" and "Covers the ankle". Keep writing down the choices in the form of a key. Continue this pattern until each shoe is in its own category, and give each shoe a species name (the name of its owner.)
4. Test the key by choosing a shoe and working through the key to see if its correct owner can be found. Ideally, have someone who was not present for the key development try it out.
5. A sample shoe key is below. Each class and set of shoes will lead to a different key, but the general format should be as follows.

   1. Does the shoe have laces?
      a. Yes, go to 2.
      b. No, go to 5.
   2. Is the shoe leather?
      a. Yes, go to 3.
      b. No, go to 4.
   3. Does the shoe have a heel?
      a. Yes...Mary's shoe
      b. No…Bob's shoe
   4. Is the shoe white?
      a. Yes…Jane's shoe
      b. No…Tim's shoe
   5. Does the shoe have an open toe?
      a. Yes…Gloria's shoe
      b. No…Mike's shoe

Activity 3: Multi-access Keys

This activity will familiarize participants with multi-keys available online and on mobile apps. An internet connection is required.

Describe that while the dichotomous key is standard and has been used for centuries, the online or app format allows for different kinds of keys that sometimes are easier to use. One of these is a multi-access key, also called a polyclave key. In this type of key, users can focus on the characteristics that they can observe and about which they are confident, rather than having to answer all the questions in a key in a linear fashion.

The Virginia Tech online tree key is an example of a polyclave key. It is available online at http://dendro.cnre.vt.edu/dendrology/idit.htm under the heading "Interview Key." It is also available as a mobile app, called vTree. There are links to the Android and iPhone versions of the mobile app at https://dendro.cnre.vt.edu/dendrology/vtree.htm. Another example of a free, online polyclave key is the weed ID key from Virginia Tech, found at https://weedid.cals.vt.edu. The Flora of Virginia app also has an excellent multi-access key as well as dichotomous key. If you are able to screencast your mobile device while teaching this lesson, you can demonstrate the use of that app. We also have videos on how to use the Flora of Virginia app in the VMN Plants (Botany) curriculum at https://www.virginiamasternaturalist.org/training/basic-training/plants-botany/.

Using a sample from a tree, a photograph, or even just your knowledge of a tree or a plant sample, work through one of these polyclave keys. Once you have answered a sufficient number of questions, it will provide a list of possible matches.

At that point, you can adjust your answers to any of the questions and/or view each of the possible matches to see if they seem to match your sample.

Many additional polyclave keys can be found online at sites such as http://www.discoverlife.org/mp/20q. You may choose to try practicing with one or more of these.

Activity 4: Using a "Real" Dichotomous Key

If time allows, have participants practice using a real key that they might encounter as VMN volunteers. Recommended choices include the keys in the VDOF tree and shrub books, the online keys to reptiles and amphibians from the Virginia Herpetological Society, or one of the "Finder" series pocket ID books. You may choose to take participants outdoors to choose a species and practice with the key, or to bring in samples or photos that can be identified using the keys. You may want to determine how long it takes to key a sample using one of these sources and how challenging the particular sample is to key. Knowing this information ahead of time can help you better plan for the right amount of time. If a sample is particularly challenging, it can take up a lot of your training time.

Wrap-Up

Tell participants that once you think you have identified a species using a key, the next step would be to check that identification against information in a field guide or a reliable online source to confirm your identification. Look to see if any drawings or photographs match up. Check the range of the species to see if it is known to occur in your location. Check to see if it is a common or rare species. Look at any species listed as similar or look-alikes.

Encourage participants to get to know experts on different taxa such as birds and plants within their own chapter or community. These individuals are great resources to help you learn to identify new species.

As an informal evaluation, ask the same question you asked at the beginning of Activity 1. At this point, everyone should consider themselves at least a 2, and some of the 2s should have moved to 3s.

Acknowledgements

The Wacky People key activity is adapted from a lesson plan by Vivian Johnson, *http://www.lessonplanspage.com/OWackyPeopleDichotomousKey612.htm*

A Sample of Wacky People

WACKY PEOPLE

Key To Wacky People
Adapted from key by Vivian Johnson, http://www.lessonplanspage.com/OWackyPeopleDichotomousKey612.htm

1a Two feet	2
1b Some other number of feet	3
2a Does not look at all human	4
2b Looks a lot like a human	5
3a One leg	6
3b Three or four legs	7
4a Fly-like	Mosk Cara
4b Not fly-like	8
5a Seems to be a girl	Rita Nita
5b Not a girl	9
6a Leg is curled , two feet	Ru-ela Brella
6b Leg is straight, one foot	Giggles
7a Three legs	10
7b Four legs	11
8a Has webbed feet	Hex Oculate
8b Clawed feet	12
9a Curly hair, no toes	Lugio Wirum
9b Wiggly looking mouth, three toes on feet	C. Nile
10a Very long nose, open mouth	Elle E. Funk
10b Some other appearance	13
11a Has duck bill, two pinchers	Tri D. Duckt
11b No arms or pinchers	14
12a Has ears, tail, and beak	Grif Leon
12b Four eyes on stalks	Eggur Ondy
13a One eye, webbed feet	Cue Kide
13b Four stalked eyes, four pinchers	Quadrumenox
14a Three toed feet, nose like a flower	Tunia petalos
14b Spider-like, has spots	Patterned mulywumpus