The Key to Classification

By ***Frank Taylor*** **for** BRPTV
Radford HS, Radford,VA

Grade Level: 7, 9 - 12

Time Allotment: Three 50 minute class periods

Overview: This lesson makes learning how to use classification keys fun. Students will need to demonstrate their ability to use a classification key on the Virginia SOL test for Biology. By participating in this activity, designing their own key, and learning to use PowerPoint in a new way, students will learn both biology and technology skills.

Subject Matter: Life Science and Biology

Learning Objectives:

Students will be able to:

- Explain why dichotomous keys are important tools in modern classification
- Use a dichotomous key
- Make a dichotomous key
- Utilize PowerPoint software to build a functioning key

Standards:

From the Virginia Learning Standards for Biology, available on-line at http://www.pen.k12.va.us/

LS .5 The student will investigate and understand how organisms can be classified. Key concepts include:

a) the distinguishing features of organisms
b) the distinguishing characteristics of major animal and plant phyla
c) the characteristics of species

BIO. 9 The student will investigate and understand the basis for modern classification systems.

Skills: Construct and utilize dichotomous keys to classify groups of objects or organisms.

Media Components:

Video:
From the United Streaming (www.unitedstreaming.com)
"Introduction to Classification" (02:43) which is a subtitle in *The Basics of Biology: How living things are classified.*

Websites:
http://webworld.freac.fsu.edu/cameras/keys/sa/tree.html- a classification key game

http://www.people.virginia.edu/~sos-iwla/Stream-Study/Samples/SampleIntro.HTML - practice using a macro invertebrate classification key for hypothetical stream bottom samples.

Software:
Microsoft PowerPoint

Materials:

- Large screen monitor for viewing instructional media by class
- One computer per student with Microsoft Word/Power Point
- Eight or more duplicate sets or collections of ten different specimens or objects for each group of three to four students. Objects could be: ten different leaf species; ten different insects; ten different shells; ten different classroom items - paper clip, tack, pencil, fastener, etc.; or anything else you are studying and have available.
- Each student should have paper and pen or pencil
- A table in the front of the room to place shoes so that all can see.
- A board or easel to write on and a writing instrument

Preparation for Teachers:

- Download United Streaming video ahead of time. Cue up video clip and have it ready to play.
- Decide what specimens or objects you want students to use to make their own keys. Collect enough of these specimens or objects to have eight or more sets. Place objects in eight containers or paper bags to distribute to student groups.
- This lesson assumes some basic knowledge of PowerPoint. Teachers, as well as students, should be able to open a PowerPoint presentation, make new slides with text boxes, and save the file. **Action buttons** will be used in the culminating activity. Some tips on using action buttons will be included in that section.

Introductory Activity:

1. Ask students to take out a sheet of paper and pen or pencil. **Ask** students: "How many different species do you think exist on the planet?" Ask students to write their best guess down on their paper.
2. Provide the students with a **FOCUS FOR MEDIA INTERACTION** by asking students to listen for the answer to the question about the number of species on the planet. **PLAY** the video clip "Introduction to Classification*"* (02:43) begin at (0:18) and **PAUSE** after the narrator provides the answer to this question at approximately (1:34). (*Over a million identified, and perhaps a million more undiscovered)* Ask

students to record this number. **Ask** students: "How does it compare to their estimate?" (*Answers will vary*)

3. **Ask** students: "Why didn't the video give an exact answer to this question?" Invite all possible answers to this question. (*We do not really know how many species exist. New species are constantly being discovered. We are learning more about how to identify species. We are exploring new areas. We are learning more about little studied groups.)*
4. **Ask** students: "How do we determine the identity or name of unknown or unfamiliar organism? (*Observable traits…as well as structural, biochemical and genetic features.*) Explain/review principles of modern classification with students if this is not already understood.
5. Provide the students with a **FOCUS FOR MEDIA INTERACTION**. Ask them to watch the video clip again, but this time without sound, and record observable traits of organisms shown on the video that would help them identify individual species. **TURN OFF SOUND. PLAY** the video again from the beginning without sound and **STOP** at 1:32. Ask students to share their observations. (*Answers will vary.)*
6. **Ask** students: "Given the number of different species on the earth, can anyone learn to identify them all?" (*No, it would not be possible for anyone to be an expert on all species.*) **Ask** students: "What do scientists produce and use to identify species?" (*Books, field guides, websites, Google, etc.)* Tell students that they will be engaging in an activity that will show them how scientists make and use an important tool for correctly identifying organisms called a "Dichotomous Key."

Learning Activities:

1. Ask six students to remove their left shoe. Place shoes on the front table. Explain to the students that you will be working together (teacher and students) to build a dichotomous key to their shoes. The key will identify the shoe with its rightful owner. (Be prepared for protests, giggling, and innocuous comments about shoe quality and selection….part of the fun and student engagement!)
2. Ask students to observe the shoes on the table and decide on criteria or characteristics that could be used to place the shoes into two groups. Explain to students that the criteria should be clear, identifiable, and unambiguous. (For example: black shoes/white shoes; low tops/high tops; canvas shoes/leather shoes). Use the criteria that the class agrees meets the requirements and divide the shoes into two groups.
3. On the board write the following:

   1. a. go to #_____
      b. go to #_____
4. Fill in the criteria or characteristics of one group of shoes next to the letter "a" and the other group of shoes next to the letter "b".
5. Beginning with the group with the "1.a" designation write a number "2" in the "go to # ____ space." Start breaking this group of shoes down into categories (working with the class to reach consensus) until you end up with a category with one shoe in it. Write in the name of person instead of "go to # ___" when you arrive at one shoe in a group. Add steps to the key as needed.
6. Continue adding steps to the key until the owner of every shoe is identified.

7. When the key is finished toss all the shoes back into the pile and test the key to see if it works. Randomly pick up a shoe and begin with "#1" on the key and ask which feature does the shoe best match- choice "a" or choice "b". Follow the directions on the key, read each couplet of the key out loud, with students sharing in decisions. If the key is properly designed you should be able to match the shoe to its owner. If not, go back and revise the key. Remember, criteria should be clear, unambiguous, and NOT subject to interpretation. Continue testing the key until all shoes have been returned to their owners.

Example:
The following is an example of what six students in a class might be wearing.

Student Owner	Description of shoe
John	Italian hiking boot with brown leather and red fabric
Sue	High heeled shoe with black leather
April	White canvas tennis shoe with an open heel like a slipper
Carly	White leather running shoe with white laces
Joe	Black leather walking shoe with black laces
Paul	Tall brown leather boot

The following is a dichotomous key that might be developed for the above students.

1. a. High tops (shoe extends two or more inches above ankle)……..Go to 2
   b. Low tops (shoe does not extend above ankle)…….Go to 3

2. a. Smooth brown leather……..Paul's Shoe
   b. Suede leather with red fabric…….…..John's Shoe

3. a. Shoes without laces…….…..Sue's Shoe
   b. Shoes with laces …… ……...……go to 4

4. a. Shoe with black laces…… …….Joe's Shoe
   b. Shoes with white laces……...…… ……go to 5

5. a. Shoe with white leather and white canvas uppers …….Carly's Shoe
   b. Shoe with white canvas uppers only ……..April's Shoe

**** Also see Power Point Presentation: "How to do shoe learning activity PPT" in addition, or as an alternative to these instructions. (attached) ****

Culminating Activities:

Activity # 1:

Student groups will make their own key using objects provided by the teacher.

1. Divide students into groups of three to four students. While students will be working together on this assignment, require each student to have paper and a pen or pencil and record a copy of the key.
2. Give each group a container or bag of ten different specimens or objects. Ask students to work cooperatively and build a dichotomous key using the specimens or objects provided. Students should use the same format as the key to the shoes. Remind students that each step or number of their key should have two choices. The choices or criteria should be determined by group consensus and be clear, brief, and unambiguous.
3. When students are finished with their key, have them exchange keys and objects with another group. Students in the other group should test the key by picking up objects one at a time and working through the key. All objects should key out properly. After testing, the keys and objects should be returned to the original group and the key should be revised if there were any problems.
4. Collect the bags or containers of specimens and objects.
5. Provide each student with access to computers with Microsoft Word/PowerPoint software.
6. Ask students to convert their "paper key" to a "PowerPoint" version. Each PowerPoint slide should contain one couplet or pairing of two choices. Instruct students to use the action buttons to move from page to page as dictated by the key. (See attached PowerPoint example for the key to shoes made above**.)**
7. **Teaching Tip: Using Action buttons.** Put text for the key in two separate text boxes. If the key prescribes to go to a particular number, add an action button next to the end of the text box. You can make an action button by going to the tool bar and selecting "Slide-Show" on the tool bar, opening the pull down menu, selecting "Action buttons" and then choosing "Action Button-Custom". When you click on the slide at the location you want your button to appear, a new menu will pop-up. From the "Mouse-click" menu choose "Hyperlink to" and then choose "Slide" and type in the number of the slide you want to jump to. This slide will be the number of the couplet your key is guiding you to.

Activity #2

Direct students to the Classification Key Game:

http://webworld.freac.fsu.edu/cameras/keys/sa/tree.html At this website students choose a photo of a plant species and use the interactive key to determine its species name. This game can be played as a class activity or at individual computers.

Optional activity:

Another good activity to use for practice is the following key to stream macro invertebrates. http://www.people.virginia.edu/~sos-iwla/Stream-Study/Samples/SampleIntro.HTML Students can practice using the key to identify macro invertebrates in different hypothetical stream bottom samples.

Cross-Curricular Extensions:

Art:

Students could draw pictures or diagrams of specimens they are classifying.

Technology:

Students could add backgrounds, visuals, clip art to enhance their PowerPoint presentations.

Language Arts:

Students could make in-depth descriptions of each feature in key, just as biologists do when identifying new species.

Social Studies**:**

Students could research how classification is used in businesses such as grocery stores, shoe stores, building supply stores and others.

Community Connections:

Students could create a classification key to the twenty most common tree species found locally. These keys could be printed and made available to the public. Keys could be distributed to teachers at local elementary schools. Keys such as this would also be of interest to community groups such as garden clubs, Boy and Girl Scouts, and other youth groups. Classification keys could be written for other organisms such as wildflowers, common garden flowers, or common insects.