

# Harry Potter



PHOTOGRAPH BY ELLEN SENISI

## and the Dichotomous Key

An attention-grabbing product from the Harry Potter series—Bertie Bott's Every Flavor Beans—is a fun tool for teaching students about classification.

By David T. Crowther

**W**ant to teach classification in an engaging, fun-filled way that capitalizes on the Harry Potter craze *and* models good science instruction by following the 5E learning cycle (Bybee and Landes 1990)? Sound impossible? It's not!

In this lesson, students use Bertie Bott's Every Flavor Beans—a “wild” candy written about in the Harry Potter books and now available in stores—to learn about classification and dichotomous keys. In these activities, students sort jelly beans according to a key and then construct a key for a “new” flavor of beans. Students then build on their knowledge by classifying buttons and constructing their own dichotomous key.

The lesson follows the 5E learning cycle, in which lessons are constructed to address various phases—Engage, Explore, Explain, Elaborate, and Evaluate. Although I used Bertie Bott's beans because of Harry Potter's enormous popularity with both students and adults, a variety pack of any type of gourmet jelly beans will work for these classification activities, provided there are variations among the beans (i.e., some jelly beans have spots and some are solid) and that you make your own key.



**Always consider student allergies when bringing any food item into the classroom.**

Most recently, I conducted the lesson with a group of university education majors, however, I've also used the lesson successfully with students of all ages. Students in upper grades can do the activity to learn more specifically about classification and dichotomous keys, but students in kindergarten through the primary grades can also learn to sort jelly beans based upon their physical characteristics to develop a foundation of understanding of classification upon which to build in later years.

## About Dichotomous Keys

In classifying both living and nonliving things, scientists have tried to provide an order to life so that we can better understand the world in which we live. All living organisms are organized (classified) according to genetic relationships. Currently the classification system contains eight levels: Domain, Kingdom, Phylum, Class, Order, Family, Genus, and Species.

Shared patterns and physical characteristics among related organisms can be organized and denoted in a classification tool called a *dichotomous key*. The key—used to identify organisms—is based on the premise an organism either possesses an observed physical characteristic or does not possess the characteristic. For example, when attempting to identify a flowering plant with a key, you might see:

- 1A Petals red go to 4
- 1B Petals orange go to 5

Once a characteristic is recognized in the key, a person follows the other physical characteristics until it has been isolated and identified on the key. New organisms are not found on an existing key; therefore, the key must be adapted in order to accommodate the new organism.

The following exercises aim to introduce students to the classification system in a fun way.

## Engagement

### Creating Interest

The 5E learning cycle begins with *Engagement*, which accesses students' background knowledge and generates interest in the topic. To pique student interest in the upcoming activities, I like to begin by reading a children's literature book on sorting. Two books that accomplish this task quite well are: *The Button Box* by Margarette S. Reid and *Sorting* by Henry Pluckrose. After reading one or both of these books, we have a brief discussion on how we sort things.

Next, we conduct a short (about 10 minutes) introductory activity: Select six students with distinctive characteristics (e.g., two with blonde hair, two with brown hair, and two with black hair) and have them stand in the front of the classroom. Have students organize the children into three groups and discuss the characteristics by which they “classified” their classmates. When dividing the group of volunteers, be sure to model “dichotomy” language.

For example, I might say, “The classification characteristic is brown hair, so we have a group of students that possesses the characteristic of brown hair and we have a group of students that does not possess the characteristic of brown hair.” Students always enjoy this activity and soon begin using classification terminology and looking for unique characteristics among their classmates to classify.

## Exploration

### Hands-On Inquiry

Once students' interest has been tapped, the Exploration phase begins—this is the point at which students delve deeper into the topic with a hands-on, heads-on inquiry-based activity. I usually begin this phase by reading a passage from *Harry Potter and the Sorcerer's Stone* (Rowling 1998)—when Harry is on the “Hogwarts Express” and has purchased some treats from the cart:

*“He [Harry] finally tore his eyes away from the druidess Cliodna, who was*



Keyword: Classification  
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**Figure 1.**

## Bertie Bott's Every Flavor Beans dichotomous key.

1a. Bean is green	go to line 2	11a. Bean is dark brown	Dirt
1b. Bean is NOT green	go to line 6	11b. Bean is light brown with dark brown spots	Toasted Marshmallow
2a. Bean is light white/cream green w/brown spots	Booger	12a. Bean is yellow/cream and may or may not have spots	go to 13
2b. Bean is NOT light white/cream green w/brown spots	go to 3	12b. Bean is NOT yellow/cream	go to 16
3a. Bean is lime green without spots	go to 4	13a. Bean is cream with yellow spots	Buttered Popcorn
3b. Bean is lime green or darker and may have spots or not	go to 5	13b. Bean is NOT cream with yellow spots	go to 14
4a. Bean is light lime green	Grass	14a. Bean is brownish yellow cream	Ear Wax
4b. Bean is medium lime green	Green Apple	14b. Bean is NOT brownish yellow cream	go to 15
5a. Bean is dark green w/red swirls	Watermelon	15a. Bean is bright yellow	Lemon Drop
5b. Bean is lime green w/spots	Spinach	15b. Bean is yellow with brown spots	Banana
6a. Bean is gray	Black Pepper	16a. Bean is pink with or w/out spots	go to 17
6b. Bean is NOT gray	go to 7	16b. Bean is NOT pink	go to 18
7a. Bean is dark white	Sardine	17a. Bean is light pink	Bubble Gum
7b. Bean is NOT dark white	go to 8	17b. Bean is pink w/spots	Tutti-Fruitti
8a. Bean is blue	Blueberry	18a. Bean is orange w/spots	Vomit
8b. Bean is NOT blue	go to 9	18b. Bean is NOT orange w/spots	go to 19
9a. Bean is dark purple	Grape Jelly	19a. Bean is red w/spots	Cinnamon
9b. Bean is NOT dark purple	go to 10	19b. Bean is plain red	Cherry
10a. Bean is brown or light brown and may have spots	go to 11	** Note: Watch for new species!!	
10b. Bean is NOT brown	go to 12	To download this key, click on this article at <a href="http://www.nsta.org/elementary_school">www.nsta.org/elementary_school</a> .	

scratching her nose, to open a bag of Bertie Bott's Every Flavor Beans.

'You want to be careful with those,' Ron warned Harry. 'When they say every flavor, they mean every flavor—you know, you get all the ordinary ones like chocolate and peppermint and marmalade, but then you can get spinach and liver and tripe. George reckons he had a booger-flavored one once.'

Ron picked up a green bean, looked at it carefully, and bit into a corner. 'Bleargh—see? Sprouts.'

They had a good time eating the Every Flavor Beans. Harry got toast, coconut, baked bean,

strawberry, curry, grass, coffee, sardine, and was even brave enough to nibble the end off a funny gray one Ron wouldn't touch, which turned out to be pepper." (pp. 103–104)

The passage always grabs students. They're eager to find out what we're going to do with the "beans," so we begin the activity right away. For this activity, each group of three students will need:

- A small (3 oz) cup filled with about 10 Bertie Bott's Every Flavor Beans (1/2 pound total for a class of 30



students) and one jelly bean *not* found on the Bertie Bott's key. (I try to make sure that every group gets a nice selection of disgusting flavors and normal flavors from the box.);

- A copy of the Bertie Bott's dichotomous key (Figure 1). A classification key that uses regular-flavored Jelly Belly gourmet jelly beans (Figure 2, page 22) is also available—or you can make your own key to any brand jelly bean; and
- A sheet of paper and a pencil.

I usually model how to use the dichotomous key once using a single Bertie Bott's bean and have students follow along. I like to use the dark-white colored bean as the example. I have a student taste it and they quickly respond to the "fishy" flavor. This usually gets a good reaction with the class.

I then state, "It sure would be nice to know what flavor it was going to be before we taste the candy! Let's try to identify the nasty flavor of this bean." We then go through the key and identify the dark white bean as salmon. The class catches on right away and immediately the orange beans with spots are discarded, they are vomit flavored!

Students continue to identify the beans in their cup using the dichotomous key. A good exploration of classifying and taste-testing beans takes 10 to 15 minutes.

Be sure to circulate the room and question kids on how the taste compares to the key identification. Once students are almost finished, they inevitably realize one jelly bean (the "new species") is not on the key. I ask them to follow the format of the key and construct an addition so that the new "species" fits within the construct of the dichotomous key.

This is quite easy for most upper-grade students, as they are able to follow the pattern of the dichotomous key and find the right place for the new flavor. Sometimes, students get a little confused trying to renumber the key, but I emphasize to students that the bean's description is more important than the numbering.

## Explanation

### Making Connections

After the bean activity comes the *Explanation* phase, when the content of the lesson is conveyed and reaf-

firmed. This phase is accomplished best through teacher-guided questions.

For example, in this case, after sorting beans and making modifications to the key to fit the new jelly bean, we discuss the following questions. In this way, I assess students' understanding of classification and how to use a dichotomous key.



- What did you use to determine what flavor of bean you had? (*A physical characteristic, i.e., the bean's color.*)
- What did you do to determine if you were correct? (*Taste the bean.*)
- What other things do we classify? (*Plants, animals, fungi, and bacteria. In the nonliving world, we classify rocks, minerals, and landforms.*)
- Why would we want to classify things? (*Humans classify all things—living and nonliving—in order to understand about our world, and new species are still being found today!*)

The last question gets students talking about classification. At this point, if working with younger students I usually introduce the taxonomic system generally, by discussing that living things are grouped together by shared characteristics.

If, however, I'm working with older students or preservice teachers, the discussion is more in depth, covering the taxonomic system originated by Carolus Linnaeus. With older students, we usually go through one or two organism's classification, such as shown in the example below.

Domain: Eukarya  
Kingdom: Animal  
Phylum: Chordata  
Class: Aves  
Order: Passeriformes  
Family: Embaridae  
Genus: Sternella  
Species: neglecta

Common name: Meadow Lark



Reading the Harry Potter passage always grabs students' attention. They're eager to find out what we're going to do with the "beans."

## Figure 2.

### Jelly Belly jelly bean classification key.

The bean is...

1a. yellow, orange, red, or pink	go to line 2	17a. purple	go to line 18
1b. blue, purple, or green,	go to line 16	17b. blue	go to line 19
1c. black or brown	go to line 24	18a. purple or lavender	Island Punch
2a. yellow or orange	go to line 3	18b. dark or blackish purple	Grape Jelly
2b. pink or red	go to line 11	18c. purple with spots	Plum
3a. yellow	go to line 4	19a. bright blue	Berry Blue
3b. orange	go to line 7	19b. dark blue	Blueberry
4a. solid yellow	go to line 5	20a. solid green	go to line 21
4b. yellow w/ brown spots	Top Banana	20b. green w/ spots	go to line 22
4c. yellow w/ white or yellow spots	Lemon Drop	21a. dark green	Jalapeno
4d. white w/ yellow spots	Buttered Popcorn	21b. light or pale green	go to line 23
4e. yellow w/ green spots	Mango	22a. dark green w/ red spots	Watermelon
5a. dark yellow	Lemon	22b. pale green w/ dark spots	Juicy Pear
5b. bright or pale yellow	go to line 6	22c. light green w/ green spots	Margarita
6a. bright yellow	Pina Colada	23a. bright green	Green Apple
6b. pale yellow	Crushed Pineapple	23b. light green	Kiwi
7a. solid orange	go to line 8	23c. yellow green	Lemon Lime
7b. orange with red spots	Peach	24a. black	go to line 25
8a. bright orange	go to line 9	24b. brown	go to line 26
8b. light or pale orange	go to line 10	25a. black	Licorice
9a. orange, orange	Orange Juice	25b. dull purple black	Wild Blackberry
9b. creamy orange	Orange Sherbet	25c. shiny purple black	Dr. Pepper
10a. light orange	Cantaloupe	26a. brown	go to line 27
10b. pale orange	Tangerine	26b. light brown	go to line 28
11a. pink	go to line 12	26c. dark brown w/ spots	Cappuccino
11b. red	go to line 13	27a. brown	A&W Root Beer
12a. bright pink	Cotton Candy	27b. dark brown	Chocolate Pudding
12b. light pink	Bubble Gum	28a. light brown	Caramel Apple
12c. pale orange pink	Pink Grapefruit	28b. light orange-brown	Peanut Butter
12d. pink w/ red spots	Strawberry Daiquiri	28c. pale brownish-white	Café Latte
13a. solid red	go to line 14		
13b. red w/ light spots	Sizzling Cinnamon		
13c. red w/ dark spots	Strawberry Jam		
14a. bright red	Very Cherry		
14b. red	Red Apple		
14c. dark red	go to line 15		
15a. deep red	Raspberry		
15b. cinnamon red	Cinnamon		
16a. blue or purple	go to line 17		
16b. green	go to line 20		

\*\* Note: Watch for new species!

To download this key, click on this article at [www.nsta.org/elementaryschool](http://www.nsta.org/elementaryschool).

The jelly beans in this key were selected from Jelly Belly's official flavors for 2003. The classification lesson based on jelly beans was created by myself and a colleague, Kathleen Jacobitz, at the University of Nebraska-Lincoln, and adapted from an idea presented by Karen Reynolds at San Jose State University.

Finally, with both older and younger students, we discuss that the classification system changes as advances in technology allow scientists to make new discoveries about the genetic relationships between organisms.

## Elaboration

### Extending Content Learning

The next phase of the learning cycle allows for both practice and application to a new context. The *Elaboration* phase—usually another hands-on, heads-on inquiry activity—allows for content to be extended or explored in a different setting.

During this activity (about 30–45 minutes) students practice their classifying skills using buttons. Each group of three students will need:

- 6 different buttons in a sealable plastic bag (about 100 buttons total for a class of 30); and
- lined paper or a science journal and a pencil to construct a dichotomous key.

Give each group a bag of six assorted buttons. Have the students sort the buttons into three groups.

Have the groups use the six buttons to construct a dichotomous key, using a large characteristic (e.g., four holes in button, two holes in button, or shank) to

begin the process. Then have them subgroup and continue to construct the key using the Bertie Bott's key as a guide. Bring the activity to a close by having the different groups share the characteristics they used for classification.

## Evaluation

### Assessing Understandings

The final phase, *Evaluation*, is conducted throughout the classification lesson and activities. Formative assessment occurs as I monitor, question, and observe that children understand classification. As a summative assessment, I have students construct their own dichotomous key following the button classification activity.

After students make their dichotomous keys, have them switch keys and buttons to see if they can properly key out the buttons using another group's dichotomous key. Basically, if the key works and the students have used a dichotomy for division, the key is correct.

Classification is something that children naturally do. They sort their socks, arrange their pencil boxes, and, on occasion, even clean their rooms. As children develop their process skills they eventually begin to sort things using more sophisticated criteria, such as physical characteristics. This activity is fun way for students to practice the art of classification and learn about the construction of dichotomous keys. ■

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### Resources

- Bybee, R., and N.M. Landes. 1990. Science for life and living: An elementary school science program from biological sciences curriculum study. *The American Biology Teacher* 52(2): 92–98.
- National Research Council (NRC). 1996. *National Science Education Standards*. Washington, D.C.: National Academy Press.
- Pluckrose, H. 1995. *Sorting*. San Francisco: Children's Book Press.
- Reid, M.S. 1995. *The Button Box*. New York: Penguin Putnam.
- Rowling, J.K. 1998. *Harry Potter and the Sorcerer's Stone*. New York: Scholastic.

### Internet

- Jelly Bean Sources  
[www.jellybelly.com](http://www.jellybelly.com)  
[www.bulkcandystore.com](http://www.bulkcandystore.com)  
[www.justborn.com/products/tb.html](http://www.justborn.com/products/tb.html)

## Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

### Content Standards

#### Grades K–12

#### Unifying Concepts and Processes

As a result of activities in grades K–12, all students should develop understanding and abilities aligned with the following concepts and processes:

- Systems, order, and organization
- Evidence, models, and explanation
- Constancy, change, and measurement
- Evolution and equilibrium
- Form and function

#### Grades K–4

#### Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

#### Grades 5–8

#### Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry