The Great Bean Mystery

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Course Name: 7th Grade Integrated Science

Core Curriculum Standard Fulfilled:
Standard 5: Students will understand that structure is used to develop classification systems.

Core Curriculum Objective Fulfilled:
Objective 2: Use and develop a simple classification system.

Intended Learning Outcomes (ILOs) Fulfilled:
   1a. Observe objects and events for patterns and record both qualitative and quantitative information.
   1c. Develop and use categories to classify subjects studied.

   5a. Cite examples of how science effects life.

   6b. Understand that science investigations use a variety of methods and do not always use the same set of procedures; understand that there is not just one "scientific method."

Time Needed To Complete Inquiry: 90 minutes

Inquiry: In this investigation, students will sort beans based on their characteristics and create a dichotomous key using their knowledge of classification. It is a structured inquiry and requires some prior knowledge.

Prior Knowledge Needed: Students need to know that organisms are classified based on their similar characteristics. They need to know how to use a dichotomous key and how to trace the path of characteristics leading to a specific organism. Students will obtain this knowledge through classification warm-up activities as well as using simple dichotomous keys to identify common items.

Introduction: The inquiry activity will begin with an exercise in which students group themselves based on physical characteristics given by the teacher. A general class discussion of classification will follow to discuss how groups were chosen and which characteristics were used. This will lead into the bean activity which will use the concepts from the exercise to help students sort their beans.

Materials / Resources Needed for the Investigation:
- 10 plastic zip-lock bags
- 1 or more of each kind of the following beans per bag:
    - Garbanzo bean
    - Navy bean
    - Black-eyed Pea
    - Pinto bean
    - Kidney bean
    - Black bean
    - Brown Lentil
    - Red Lentil
    - Lima bean
    - Maya Coba bean
    - Soy bean
    - Cannelloni bean
    - Sprouting Mung bean
    - Adzuko bean
    - Anasazi bean
- mounted sample of each bean with assigned number

Procedures of the Investigation:
1) Working in their lab groups, have students dump the bag of beans onto their table-top. They are to determine how many different "species" (groups) of beans there are in the bag. Do not give the students any more information than this. This is part of a scientific process – to determine how much difference is needed to create a new "species" and how large of a population they think is needed to determine a new "species". For some beans there is only one individual represented in the bag and many of the bean types closely resemble each other.
2) After allowing the students to divide their beans up into "species", lead a classroom discussion where the students can present their results and rationales. If they feel only one bean is not enough to determine a new "species", there may be others in the classroom with a larger "population" of that bean. How big of a morphological difference is needed between beans

to determine a new "species"? These are very similar processes that scientists go through in determining a new "species". Eventually though, you will want the students to come to the conclusion that there are 15 bean "species".

3) Pass out the student sheets. Within their group, students will first give each bean type a special "code name" to be used in the key based on its number on the mounted sample board. For example, instead of calling the black bean by its true name the group might name it "Crackerjack" as its code name. Each lab group will fill in the chart below for each of their bean code names. Students will then observe the characteristics of the 15 different bean "species" and create a dichotomous key to identify the beans according to their code names.

Bean Number	Code Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

4) Lab groups will then exchange keys and use the other lab group's dichotomous key to identify the same beans using a different set of "code names". This is a means of testing the usefulness and accuracy of the keys developed. Can students in a different lab group use the key and get the same intended results?

Data Collection: Students will create a list of characteristics they use to sort the beans and will also list the distinguishing features of the beans.

Data Analysis: Students will analyze their data by tracing each bean through their completed key to find the "code name". If their classification criteria lead to ambiguous results, they need to rethink their group designations and make changes to their key.

Assessment:

Students will show they have met their objectives in three ways:
1. By designing a dichotomous key to correctly identify all 15 beans as tested by the teacher as well as another group.
2. By demonstrating their ability to use a dichotomous key created by another group to correctly identify their 15 beans by "code name".
3. By answering the questions in the **Conclusion** portion of the activity.

This activity can be extended to include a discussion on the variation of species, the discovery of new species, taxonomy techniques as well as genus and species designations. Comparisons can be made between the results of different groups and the questions of "right" way or "wrong" way to classify can be posed.

Name_____
Date_____
Period_____

Bean Classification

Directions: Use the chart below to create your "code names" for each of the 15 beans. Use these names in your dichotomous key and see if your friends can crack the code to discover the real bean.

Bean Number	Code Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Questions and Conclusions:
1. What does it mean to classify things?

2. What is the importance of classifying things?

3. When would this type of system be used in the scientific world to classify an organism?

4. Did all the members of your group agree on using the same characteristics to classify the beans? If not, how did you come to a consensus? How do scientists decide how to classify things in nature that have never before been seen?

Name_____

Date_____

Period_____