WHAT'S IN THE BAG?

by Candace Lutzow-Felling

A variation of the **Mystery Box** lesson
ENSI website: http://www.indiana.edu/~ensiweb/lessons/mys.box.html
This also focuses on hypothesis-building and testing,
collaborative efforts, and associated terminology.

Many students of science (and even science teachers) do not have a clear understanding of how to formulate a good hypothesis and then, to make predictions based on the hypothesis. Here is a simple inquiry activity that I developed to help teach these concepts to both teachers and students.

1. Place an unusual object inside an opaque bag. Items I have used at different times are a hand lens and a small figurine (made of wood, plastic, and fake flowers) placed in a make up bag.

2. Hold it up to the class and ask if the bag invokes any thoughts. Someone will say, "I wonder what's in the bag?" [They just asked a **question**/ defined a **problem**.]

3. Invite the class to give ideas of what is in the bag. Write down all ideas without being judgmental. [They just guessed what is in the bag.]

4. Now tell them that you will pass the bag around to give everyone a chance to gather some information about what may be in the bag. They are NOT allowed to open or unseal the bag and each person can have the bag for a count of 5. Again ask what they think is in the bag and write down all responses. [They just made an *informed* guess *about possible answers to the question*, because they now have a bit more information about what may be in the bag. Avoid saying just "educated guess."]

5. Next, categorize all the responses (5 said its a rock, 3 said it is a statue, 2 said they are still clueless, etc) and ask the class to formulate a statement about what they think is in the bag. [They now have considered several hypotheses, and selected one most likely **hypothesis**--a tentative explanation of what is in the bag--after first asking a research question, gathering some background information, and considering what they know so far]

6. Now, ask them to devise a method or methods to obtain information that would help them to evaluate whether their hypothesis is supported *or not* [this is the investigation design to **test** the hypothesis. Ideally, each test would have two predictions: what to expect if hypothesis was correct, and a *different* prediction if hypothesis was wrong. This is a true "fair test," but you may want to put this detail off until your review.]

7. Now, restate the hypothesis (For example: The item in the bag is made of wood) and ask them IF the hypothesis is supported *and* they did such-and-such (what they suggested in their method - for example, burn the bag) THEN what would they predict would happen. [They just made a **prediction** *based* on their hypothesis.]

8. Repeat 6 and 7 with a different method (for example, place in a container of water and see if it floats; if it is wood then it will float. Of course, this will not PROVE the hypothesis but it will SUPPORT the hypothesis.) [This points out that a well-stated hypothesis often can generate more than one **test**. The more test results that match their predictions, the greater the support for the hypothesis.]

9. Now, **review** what the class just did and clarify what a **hypothesis** is and how they are formulated. A hypothesis is NOT just a guess - not even an "educated guess." That's much too vague. It is **TENTATIVE explanation** for a problem/question, based on some type of observation. IF the hypothesis is valid, THEN such-and-such should happen or be observed as a result of some action to **test** the hypothesis. We can make PREDICTIONS (expected results) assuming a hypothesis is correct, and *different* predictions if the hypothesis is *wrong*. Next, we must design steps to investigate the problem; these steps must generate data that will allow us to evaluate the hypothesis.

Next, you can describe an **example**. Earth scientists investigate the composition of the Earth's core, but they cannot directly observe it nor can they touch it. They must make observations of the Earth (mass and size, density of crust, etc.) and propose what its composition and structure must be (hypothesis). If their hypothesis is correct, then this can be tested by planning particular actions and/or observations (like setting off explosives at certain points, and recording Earth vibrations at different distances) and predicting the expected outcome, based on the hypothesis (and different outcomes if their hypothesis is wrong). If results match the predictions, the hypothesis is confirmed. If not matched, hypothesis is wrong, needs further testing, modification, and/or replacement.

This entire process takes 20-30 minutes. I have done this with middle school, high school and older students with much success. Typically, the next activity I have the students do is to find a question to investigate and to develop and conduct an investigation. Most of the students have no difficulty with formulating a hypothesis, making a prediction, and designing an investigation after going through this simple exercise.

Kiindly shared by:
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[Minor modifications by L. Flammer]