What’s on the Bottom of the Cube?

(Michael Taber, Earth Sciences, University of Northern Colorado, Greeley, CO 80639)

Objective: Your task is to work with your colleagues on a very difficult scientific problem: *What is on the bottom of the cube?* It is very important that you keep an accurate record of your dialog. Your records will serve as evidence, which is critical in supporting your decisions.

# Rules

* You cannot touch the cube or cause the cube to move in any physical way. The letter “B” must always remain on top.
* You must keep a written record of your observations and dialog.

# Evidence and Answer

1. Record all observations and dialog on a separate sheet of paper. Include information about whether the group agrees with each other in observation and “the answer.” If there is agreement, explain how you came to that agreement. If there is disagreement, explain why you disagree and how you might be able to resolve the disagreement.
2. Draw a picture of what you think is on the bottom of the cube.
3. Describe how you and your group came to the conclusion as to what was on the bottom of the cube.
4. What are some key terms you would use to describe the scientific inquiry process?
5. Did everyone in the class have the same answer as to what was on the bottom of the cube? If not, what are some possible reasons for the disagreement?

**Cube**

(Dr. Willis – University of Northern Colorado)

Learning Goals:

* Students will understand the difference between observations, generalizations and hypothesis.
* Students will understand the importance of documenting your initial observations.
* Students will understand the scientists will not always agree on the predicted result is after observing the same phenomena
* Students will understand that scientists cannot “check” the answer to see if their predictions are accurate. They cannot always directly observe phenomena but must use evidence to make an educated guess.

**Day 1**

Give each group a cube and the “What’s on the Bottom of the Cube” handout. Approx 20 min.

**Day 2**

“forget” to bring the cubes back.

1. Tell students we are going to start with their observations. Write down all observations as students report them out. It usually takes several groups 20 -30 minutes to get all the information about the cube reported out because they didn’t make very good records the day before. They usually only write down conclusions.
2. Now ask for generalizations about the observations. (i.e. same shape on opposite sides but one is black and the other is white). I ask them to start with the easiest ones first and wait for the letter last. There were a few generalizations that were offered about the letter pattern that were inconsistent between groups. When that happened, I asked the groups to discuss amongst themselves. Then offer what they thought might fit. This is a time to throw any patterns out, not just the one they settled on.
3. Once generalizations are done move into predictions. Give groups the opportunity to reconsider their prediction after hearing all the observations and generalizations. Once discussion lulls, go from group to group asking them their final decision and why, then write on board. In the end I had 5 different answers all for logical reasons.
4. Tell the group how great it went and how what they just did was science. They first observed, then they didn’t get to reobserve because you can’t always hit replay again in real life. Maybe you observed a Tsunami or traveled to a geological site and recorded observations, or observed a particular people and their actions. You then must rely on your observations alone. You make the most reasonable generalizations you can and based on these make predictions.

Now scientists report their findings in journals or at conferences. So each of your groups is like a research university and this class discussion was a bit like what happens at a conference when scientists report on their observations, generalizations and predictions. Then they go home and think about what they learned and decide on their next steps.