Black Box Activity
And MBR
(See Power Point: Scientific Models)

1. Let them play (5 minutes) with very strict parameters. You have a bucket, which you cannot touch in any way at all, a funnel, water, pitchers, and beakers. Do not touch the bucket!
2. Students write down their observations. (see handout)

   Write down all that you, the scientist, have noticed about the bucket. Next write down what you would like to do (given the parameters) to further experiment.
3. Introduce talking sticks and have the students discuss what they observed. For the first round and then what they would like to do next for the second round.
4. Discuss what a phenomena is and the importance of Data
   a. What could we do to better understand the phenomenon?
   b. How to collect data in a systematic way
5. Data Collection (Give data table but they may not choose to use it)
   a. Use increments of 150 ml
   b. Test and Record 11 consecutive Attempts
   c. Record the "amount out" on the board (class data)
   d. Look for patterns

6. Students see a pattern of: Nothing, A little, A lot

7. Ask students what a scientist would do next? What are we really trying to figure out? Guide them to asking questions, the Driving Question.

8. Students ask several questions. Narrow them down to one question that will answer all the questions:
What is in the bucket?

9. Introduce the idea of a scientific model: A set of ideas that explain phenomena.

   Have students work on their white boards

   1. Begin by listing objects that must be in the bucket to cause the pattern of water observed. Focus just on objects at this point, have each person

contribute at least one object, then others can add more, they can be listed or sketched on white boards

2. What kind of mechanisms must be at work in order for the phenomena to happen? What are the relationships of the objects?
Begin sketching on white boards.

10. Give them 5 or so minutes and then play the trick
Play trick: test the fits with data , and then the plausible criteria

11. Have them continue to work, remind them about their prior knowledge
12. Give a time limit for them to do their best
13. Create poster of their best Model: Drawing and written explanation
16. Gallery walk and group discussion: can put sticky dot on poster if not meet any of the criteria.
17. Class discussion, do any of the models fit the Model Criteria?
18. How is this related to science? (Complete bucket follow-up questions)

- Think about the similarities and difference between this bucket experience and what you know about science.
- Think of an example of how your experience with the buckets relates to what you know about science.
- Do scientists get to "look" and see if they are "right?" Or do they have to rely on and trust their models?

19. Explain that this is how scientists work with phenomena, questions and trying to find answers. Example of the layers of the Earth and how scientists can't actually slice the planet in half to see if they get the layers right, they have to rely on their model.

Criteria for a Model
Simple
Match Observations (fits with data) (consistent)
Realistic (plausible)
Used to make prediction (useful)

Not wrong verse right
Only judge by criteria