Ray Block, Jr.
7/9/2k2
Upward Bound Social Studies
Lecture Notes

Upcoming Events:

1. College tour?! [Have the students tell you about it]
2. Keep reading
3. Talk to them about my teaching performance. Ask for their feedback.

Today's Blueprint:

1. Define some of the terms that went on the diagram I gave class yesterday
2. Interactive Lab: The M&M Project. [To get students used to actually doing research]

The Scientific Method (Learning by Doing)

Theory = has 4 levels:

- Level 1: Summarize observations
- Level 2: Describe the relationships between observations
- Level 3: Turn observations into propositions that can be accepted or rejected
- Level 4: Place observations into frameworks from which other propositions can be emerge

Concept = Abstract ideas that scientists use to describe the real world.
Serve 4 functions:

Provide common language for scientists to communicate with each other

1. Give scientists a way of looking at things
2. Allow scientists to classify things and generalize from them
3. Define the content of theories

Defined in 2 major ways:

Conceptual definition = Defining concepts by using other concepts. Not observable.

1. Example: Political trust = having faith in your government
2. Example: The concept of length

Operational definition (operationalization) = Links concepts to observable properties

1. Example: Variables = empirical properties of constructs that can take on 2 or more values
2. Example: the notion of a ruler

…Helpful analogy, think of the difference between conceptual definitions and operational definitions like you think of the difference between the "concept" of length and the notion of a "ruler" (which measures length).

Operationalization = How scientists move from theoretical concepts to empirical variables.

Hypotheses = A testable relationship between variables.

1. Can either tell you that variables are related to each other (correlation)
2. Or can tell you how they are related (direction)

Recipe for good hypotheses:

1. Must be clear
2. Must be specific

3. Gotta be able to test it
4. [Should] be value-free

…Note: the process of "operationalizing" is closely tied to the idea of measurement.

Measurement = Assigning numbers or other symbols to empirical properties of concepts based on specific rules.

…implies that there are different levels of measurement.

Levels of measurement for variables:

1. *Nominal* (categorical) = Observations classified into categories (i.e. nationality)
2. *Ordinal* = Observations classified in rank order (i.e. rank in education)
3. *Interval* (a type of continuous variable) = Distance between measurement values are constant (*i.e.* temperature: the distance between 60 an 61 is 1; the distance between 59 and 60 is 1 as well)
4. *Ratio* (another type of continuous variable) = There is a "natural zero point"—zero is a meaningful value, not just the absence of value (*i.e*. weight, height, money, time, etc.)

Describing levels of measurement for variables:

1. **Frequencies:** Simply a count of what you observe
    1. *i.e.* "if there are 10 red M&Ms in a bag of 100 M&Ms, then 10% of the bag of M&Ms are red
2. **Central tendencies:** Summarizes the distribution:
    - *Mode* = Most frequently occurring observation
        1. *i.e.* the most common M&M is supposed to be the brown kind

    - *Median* = The median is the middle-most value in the distribution, once you label the observations from most to least.
        1. i.e. "in the distribution of test scores: 12, 13, 23, 43, and 32, the median is 23". By convention, the median of the distribution 123, 154, 160, 187 is taken to be half way between the two center values: Median = (154 + 160)/2 = 157.

    - *Mean* = The mathematical average of the observations—the sum of the value in the distribution divided by the number of such scores
        1. (*i.e*. the average test score is 12, 13, 23, 43, 32 = 24.6, because the mean = (12 + 13 + 23 + 43 + 32)/5 = 24.6

Remember:
Nominal Variables ➔ Use mode only
Ordinal Variables ➔ Use mode and median
Interval Variables ➔ Use Mode, median, and mean

Bias = Anything that happens during the research process that can affect the results (usually unintended)

- There are several major "stages in the research process:
    - **A.** Problem selection (your world views motivate you to pay attention to some things more than others)
    - **B.** Theory construction (your personal perspective affects how you "package your research)
    - **C.** Concept formation (how you are trained affects how you come up with ideas)
    - **D.** Data selection (what you have access to often determines what you study)
    - **E.** Data interpretation (subjectivity can easily occur here)
    - **F.** Verification (are you accepting or rejecting the null hypothesis?)

- If personal values play a role in your research, then bias occurs. Bias can occur at each of these stages.

The M&M Project

Summary:
This project was offered through the Global Schoolhouse Network HiLites and involved students around the world sharing data about M&M's. The purpose of the project was to determine the frequency, average, ratio, and percentage of each color of M&M's in a 1.69-ounce bag. Students predicted the number of M&Ms in their bag and the most common color of the candy pieces. After counting the M&Ms and recording the actual number, students sorted the candy by color and determined the percentage of each color of M&M. They compared their results with their predictions and graphed the data on the computer. The separate data was combined and we determined the most common M&M color (brown) and the percentage of each color. Students graphed the data, figured out the percentage of each color, and created a spreadsheet to send to our team member through e-mail. When all schools completed their spreadsheets, the data was compiled and the spreadsheets were available for schools to download and study.

The M&M Project found out that the blue M&M is not common in most countries, including the United States. It is common in many African and Asian countries, which we found interesting. Two separate spreadsheets were designed for children to input the data. We found blue M&M's (it was hard!) and so we could use the spreadsheet that contained a space for blue. Not surprisingly, brown is the most common color of M&M followed closely by yellow. Since many students preferred red, they felt that the Mars Company could really clean up by adding more red candies. Brown, they said, was boring.

The project was not boring, however. Students learned how to calculate averages and percentages. They used the computer to design graphs and spreadsheets. We discussed marketing concepts and the wide market for M&Ms. They were astounded to hear from kids in Afghanistan and other far reaches of the world. The project was motivating and students got to eat the experiment after the work was done.

Our goal:
Replicate the M&M Project

Lessons involved:
1. Making predictions
2.Collecting data and organizing information
3. Determining averages, ratios, and percentages, and formulating hypotheses.
4. Using calculators, databases and/or spreadsheets, and can extend by making graphs.

Our Research Team will include:
Record keepers
Information specialists
Research Analysts
Research Consultants

M&M DEMOGRAPHICS

1. Guess how many M&M's are in the bag. _____
2. Open your bag. Count the M&M's. How many M&M's are in the bag? _____
3. How far off was your guess? _____
4. Sort your M&M's by color.

R = red _____

G = green _____ Y = yellow _____

O = orange _____ LB = light brown _____

B = blue _____ DB = dark brown _____

1. Which color had the most candies? _____
2. Which color had the fewest candies? _____
3. Were there more blue or yellow? _____
4. Were there more light brown or dark brown? _____
5. Were there more red or orange? _____
6. Do all the candy bags contain the same number of candies and colors? How can you explain this?_____
7. M&M's have between _____ and _____ candies in a bag.
8. The least common color is _____.
9. The most common color is _____.
10. Why were more dark brown candies in the bag? _____
11. What combination of two colors equals the greatest amount of candies? _____ and _____
12. How does the number of dark brown candies compare with the number of all the other candies together? _____