ACTIVITY 1.2

A Tasty Sample(r): Teaching About Sampling Using M&M's

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This tasty demonstration exposes students to the concept of sampling and gives them a real-life sampling problem. Each student receives a small package of plain M&M's and quantifies the sample by color. Students use these data to hypothesize the population's color distribution. By pooling samples, students achieve closer approximations of the population distribution. This in-class activity is appropriate for classes in introductory psychology, statistics, and research methods. It requires about 15–30 minutes to complete, depending on discussion. Students (and faculty) find this demonstration compelling.

Concept

One concept that causes students some difficulty is sampling. Students do not always understand the need for sampling or the relation between a sample and its associated population. This knowledge is vital to understanding the research and inference process psychologists use.

BACK TO CONTENT OUTLINE

Materials Needed

Teachers will need a small package of plain M&M's for each student. You should also bring a napkin for each student. If students have calculators, the activity will be easier for them. Teachers can design a data sheet if they desire. (Note that students who are on special diets or who have food allergies may want to abstain from this activity.)

Instructions

This M&M sampling demonstration enlivens the presentation of sampling and makes it more relevant to students. Buy large sacks of fun-size packs of plain M&M's and allow each student to choose an "intact random sample" (one pack) from the population of samples. Students should sort their subjects by color, placing them on the napkin provided (much more sterile than the desk surface). Note that it is important to use plain M&M's. The peanut variety raises the potential problem of peanut allergies, but worse, they have a habit of trying to escape by rolling off the desk.

Students should make a simple frequency distribution of the six M&M colors (blue, brown, green, orange, red, and yellow) on a data sheet you will provide (see Activity 1.2 Appendix); scratch paper will also suffice. Note that it is possible that some M&M packages will not contain all six colors. You should caution your students that they are to complete their frequency distribution before any premature subject mortality occurs!

Because sample sizes typically vary somewhat (you can raise quality control as another interesting concept *and* practical application) and because you will want the students to make some inferences about the population on the basis of their sample, have them convert their raw data into percentages.

Ask each student to generate a hypothesis about the distribution of M&M colors in the population on the basis of the student's sample. These estimates generally vary considerably. Students then form pairs to pool their data (not literally, of course) and generate a joint hypothesis. Finally, we pool the data for the entire class to generate an overall hypothesis.

Discussion

Students learn some valuable lessons about sampling from this exercise. You can increase the sample size of M&M's (e.g., by using larger individual packages or 1-, 2-, or 3-lb bags) and demonstrate how larger samples typically yield better estimates of the population. Students gain an appreciation of statistics applied to real-life situations.

Because students individually generate hypotheses from small samples (usually about 24 M&M's in a fun-size pack), the hypothesized population parameters are usually low in accuracy. For example, it is not uncommon for one student to have eight of one color, say orange, whereas another student has only one orange M&M. Indeed, you will find that the bags, because the sample is so small, show considerable variability. However, as the students pair and combine their M&M's into larger samples, their estimates of the population proportions decrease in variability and more accurately approximate the population figures. When we combine the data for the entire class, variability decreases markedly, the samples become even better estimates of the population, and the hypotheses generally become more accurate.

Mars, Inc., is quite precise about the percentages of colors for the different M&M products, and the percentages are different for the various products. For plain M&M's, the current percentages are as follows: blue 24%, orange 20%, green 16%, yellow 14%, brown 13%, and red 13%. You can see those figures and the percentages for the other M&M products on the official M&M's website (http://www.m-ms.com). You should check percent-

ages at the website before using the demonstration. When this activity was published less than 10 years ago, the percentage of brown M&M's was 30%, blue was 10%, and the other colors varied accordingly.

If you wish, you can compare the fit of your sample data to the population parameters using the chi-square statistic. I have collected large samples of data (more than 1,000 M&M's in each sample) on three different occasions. Interestingly enough, two of the three samples showed significant departure from the expected data $p < .00l$ in each case).

Students react quite favorably to this technique, especially in light of the fact that I teach statistics immediately before lunch. I can also report that this class session is probably the liveliest of the semester. Of course, at the end of the activity you should tell your students that it is okay at that point to consume their subjects if they wish.

If you want to use a writing assignment with this activity, I suggest having the students write a letter to Mars, Inc., that describes the outcome of the class's findings. It is always challenging for students to attempt to communicate statistical findings in plain and easy-to-understand language. Such an assignment will help both the teacher and students discover whether they truly understand the concepts of sampling and of drawing inferences from samples. Students might also enjoy learning something about the history of M&M's from the company's website. It is likely that students and instructors will not know that the candies originated in 1941 and were sold to the military as a snack for American soldiers in World War II.

References and Suggested Readiing

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Activity 1.2 Appendix

Frequency Distribution Data Sheet

Record your sample data and make a prediction of what you think the population of M&M's looks like:

	Blue	Brown	Green	Orange	Red	Yellow
Observed *f*						
Predicted %						