Statistics: Sampling

7/16/19

Context: This was the beginning of the data collection section of a four-week summer statistics course for entering Columbia College (non-engineering) first-year undergraduates. I had two sections of about 20 students each.

My goal was to draw on students' experience with surveys to introduce basic ideas about (mainly simple) random sampling and surveys. The students had lots of informal or formal prior contact with surveys, so this lesson was about formalizing and consolidating their varied ideas about what makes a good survey.

I started here by explaining briefly what I meant by sampling and a survey, and then I asked them what made a good or bad survey. I wrote their ideas in two lists on the board.

Sampling Example

Suppose, this coming year, you want to know how much Columbia students like the food at Ferris dining hall.

What seems good or bad about each of the following survey methods?

I wanted a pretty straightforward context so that the survey ideas would be centered. The students were eating at this dining hall for the summer.

The students had made an initial list of good and bad features of surveys. In the activity following from here, I wanted them to draw on those lists and expand or change them. For each of the four following survey methods, I gave them a couple minutes to think alone or to discuss with others around them the strengths and weaknesses of each of the survey methods. I listened in on some of their discussions. We then returned to a full class discussion; I made lists on the board of the strong and weak features that they suggested. I sometimes prompted for a particular idea, e.g. “What about this aspect?” I would also sometimes ask a particular group to share something I had heard them discussing.

Survey Method #1

You go to the dining hall during lunch, pick three random tables, and ask everyone who sits at those tables to rate the dining hall’s food on a scale of 1 to 5.

Survey Method #2

You ask ten friends, “Don’t you like the food at Ferris dining hall?”

Survey Method #3

You set up a table on College Walk and ask students who pass by to take a ten-question survey about Ferris dining hall.

Survey Method #4

You choose two random dorms and ask one person in every other room whether they agree or disagree with the statement, “I am satisfied with Ferris dining hall’s food.”

Qualities of a valid survey

- Random sample from the population of interest
- Large enough sample size
- Specific questions
- Neutrally-phrased questions
- Tuned/pilot tested

Only after a lot of student discussion did I provide this pretty standard list of what makes a valid (good in the sense that we had been discussing) survey. I was able to point out how these aligned with what the students had put on their original list or what they had brought up as we discussed the four methods. The only one of these ideas that hadn’t come from the students was tuning/pilot testing, so we talked more about that.

Political Poll Example

DC Statehood:
https://news.gallup.com/poll/260129/americans-reject-statehood.aspx?

Methods Details:

https://www.gallup.com/201200/gallup-poll-social-series-work.aspx

With the basic ideas of surveys pretty solid, we could turn to a real survey and more complicated context. We looked at the results, then the methods, and then the details of the methods. The students commented on what they thought was strong and weak about the methodology and asked questions about aspects of the methods.

This lesson was followed by a similarly-formatted one about experiments and observational studies. The students then did an in-class assignment that included identifying strengths and weaknesses of surveys, designing experiments, and identifying whether a study was a survey, an experiment, or an observational study. They also did a reading assignment, looking at and discussing in small groups one of several articles about a statistical study.

The students overall showed very strong understanding of this topic on the midterm exam (with questions similar in format to those on the studies assignment).