Towards Ideal Experimental Design with Smaller Groups

We talked previously about how random assignment to treatment and control works best to make the treatment and control groups as alike as possible because it eliminates systematic differences (bias). With enough subjects, random differences average out. But what do you do if you have a small sample?

A solution: _____

With small sample sizes researchers "block" subjects into relatively homogeneous groups first and then randomly decide within each block who gets which treatment within each group.

Computer-Graded vs. Hand-Graded Homeworks

Suppose I wanted to do a randomized controlled experiment with a small class of data science students to see if PrairieLearn HW helped students learn better than hand graded HW. Let's say there are 20 students in the class & we know that 10 of them had A averages and 10 of them had B averages in previous math courses. With only 20 students, random assignment into the treatment and control groups could result in large accidental differences. For example, when we did this, we got 8 A students and 2 B students in the PrairieLearn group and only 2 A students and 8 B students in the hand graded group.

a) First of all, what is the treatment and what is the response?

b) Why would the differences in the two groups be a problem?

c) Can you think of a way to ensure the same proportion of A and B students in each group but still randomize assignment to treatment and control?

d) Does blocking introduce bias? If so, how? If not, why not?

e) Is it always better to block first and then randomize even with large samples?

Blocking first, then randomizing ensures that the treatment and control group are balanced with regard to the variables blocked on. If you think a variable could influence the response, you should block on that variable.