

166. (a) There are $4 \times 4 = 16$ different treatments from the combination of the two fertilizers:

AP
HW
2B

	Levels	Phosphate			
		0	20	40	60
Nitrogen	0	0,0	0,20	0,40	0,60
	20	20,0	20,20	20,40	20,60
	40	40,0	40,20	40,40	40,60
	60	60,0	60,20	60,40	60,60

- With 64 similar plots, randomly assign each treatment combination of fertilizers to four plots since $64 \div 16 = 4$.
- (b) Divide each field into 16 plots and randomly assign each treatment combination of fertilizers to the plots field so that each treatment is used four times, once in each field.
- (c) The researcher would wish to see an effect of increased yield from the fertilizer. Ideally, he or she would like to attribute the differences between the groups to the fertilizer treatment only and conclude that the fertilizer causes the increase in yield.
167. (a) Randomly assign 10 subjects to each of the four treatment levels.
- (b) Randomly assign five males and five females to each of the four treatment levels.
- (c) This is a matched-pairs design with a before and after measurement of the rage index.
- (d) The lurking variable that could have an effect on the outcomes is experience with technology or teaching experience. Participants could be pre-assessed for levels of expertise in technology and teaching experience and grouped to block for variation just like blocking for gender above.

168. (a) Randomly assign the females to one of the four treatments—music, meditation, exercise, and the new pain medication—so there are 12 subjects in a group. Run the experiment and measure pain levels after the treatments are complete.
- (b) Make a control group that receives a placebo to measure the psychological effect of receiving a treatment.
- (c) Keep the treatment group of each subject hidden from the researchers who are doing the pain level screenings.
169. (a) The number of absences during the semester and the grade points earned in that class contributing to GPA.
- (b) This is an observational study, which can determine that the variables are related but cannot be used to determine cause and effect.
- (c) The college could have half the teachers implement group work in the classes while the other half maintains traditional instruction as a control group.
- (d) Attendance is confounded with other variables, such as income, illness, family responsibility, and risky behavior.
170. (a) This is an observational study, which can determine that the variables are related but cannot be used to determine cause and effect.
- (b) Divide the AD children into two groups. One group will receive the treatment and the other group a pill that looks exactly like the treatment pill. The group receiving the placebo can be used to control for the placebo effect.
- (c) To make the study double-blind neither the subjects nor the researchers can know who is receiving the treatment or the placebo. This is done to control for bias on the part of researchers in their evaluation of the outcomes. It also controls for the placebo effect.