an effect simply by subtracting your experimental group mean from your control group mean. Instead, you must determine whether the difference between your group means could be due to random error.

30. The *t* test is a common way to analyze data from a simple experiment. However, you should not use the *t* test if your data do not meet the assumptions of that test.
31. The *t* test involves dividing the difference between means by an estimate of the degree to which the groups would differ when the treatment had no effect. More specifically, the formula for the *t* test is: (Mean 1 – Mean 2)/ standard error of the difference.
32. The degrees of freedom for a two-group between-subjects *t* test are 2 less than the total number of participants.

KEY TERMS

blind (masked) *(p. 390)*
central limit theorem *(p. 408)*
coefficient of determination *(p. 404)*
Cohen's *d* *(p. 404)*
control group *(p. 371)*
dependent variable (dependent measure) *(p. 376)*
double blinds *(p. 390)*
empty control group *(p. 390)*
experimental group *(p. 371)*
experimental hypothesis *(p. 366)*
independent random assignment *(p. 365)*
independent variable *(p. 371)*
independently, independence *(p. 373)*
inferential statistics *(p. 377)*
internal validity *(p. 363)*
levels of the independent variable *(p. 371)*
mean *(p. 394)*
normally distributed, normally distribution *(p. 407)*
null hypothesis *(p. 369)*
null results (nonsignificant results) *(p. 379)*
$p < .05$ level *(p. 377)*
placebo treatment *(p. 390)*
populations *(p. 392)*
power *(p. 384)*
simple experiment *(p. 377)*
single blinds *(p. 390)*
statistically significant *(p. 377)*
t test *(p. 400)*
Type 1 error *(p. 381)*
Type 2 error *(p. 383)*

EXERCISES

1. A professor has a class of 40 students. Half of the students chose to take a test after every chapter (chapter test condition) outside of class. The other half of the students chose to take in-class "unit tests." Unit tests covered four chapters. The professor finds no statistically significant differences between the groups on their scores on a comprehensive final exam. The professor then concludes that type of testing does not affect performance.
   a. Is this an experiment?
   b. Is the professor's conclusion reasonable? Why or why not?
2. Participants are randomly assigned to meditation or no-meditation condition. The meditation group meditates three times a week; the no-meditation group is an empty control group. The meditation group reports being significantly more energetic than the nomeditation group.
   a. Why might the results of this experiment be less clear-cut than they appear?
   b. How would you improve this experiment?
3. Theresa fails to find a significant difference between her control group and her experimental group—$t(10) = 2.11$, which is not significant.
   a. Given that her results are not significant, what—if anything—would you advise her to conclude?
   b. What would you advise her to do? (Hint: You know that her *t* test, based on 10 degrees of freedom, was not significant. What does the fact that she has 10 degrees of freedom tell you about her study's sample size, and what does that sample size suggest about her study's power?)

4. A training program significantly improves worker performance. What should you know before advising a company to invest in such a training program?
5. Jerry's control group is the football team; his experimental group is the baseball team. He assigned the groups to condition using random assignment. Is there a problem with Jerry's experiment? If so, what is it? Why is it a problem?
6. Students were randomly assigned to two different strategies of studying for an exam. One group used visual imagery, the other group was told to study the normal way. The visual imagery group scores 88% on the test as compared to 76% for the control group. This difference was not significant.
   a. What, if anything, can the experimenter conclude?
   b. If the difference had been significant, what would you have concluded?
   c. "To be sure that they are studying the way they should, why don't you have the imagery people form one study group and have the control group form another study group?" Is this good advice? Why or why not?
   d. "Just get a sample of students who typically use imagery and compare them to a sample of students who don't use imagery. That will do the same thing as random assignment." Is this good advice? Why or why not?
   e. "Setting up the room for the different conditions takes time. Let's save some time by running all the experimental participants in the morning and all the control participants in the afternoon. We will still have independence because we will randomly assign participants to a condition and because we will test participants individually." Why is this bad advice?
7. Bob and Judy are doing the same study, except that Bob has decided to put his risk of a Type 1 error at .05 whereas Judy has put her risk of a Type 1 error at .01.
   a. If Judy has 22 participants in her study, what t value would she need to get significant results? (Hint: Review main point 32, then consult Table 1 in Appendix F.)
   b. If Bob has 22 participants in his study, what t value would he need to get significant results? (Hint: Review main point 32, then consult Table 1 in Appendix F.)
   c. Who is more likely to make a Type 1 error? Why?
   d. Who is more likely to make a Type 2 error? Why?
8. Gerald randomly assigned participants to receive their test on either yellow or blue paper. Gerald's dependent measure is the order in which people turned in their exam (first, second, third, etc.). Can Gerald use a t test on his data? Why or why not? What would you advise Gerald to do in future studies?
9. Are the results of Experiment A or Experiment B more likely to be significant? Why?

Experiment A

Control Group	Experimental Group
3	4
4	5
5	6

Experiment B

Control Group	Experimental Group
0	0
4	5
8	10