

Chapter 11. Experimental Design: One-Way Independent Samples Design

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Advantages and Limitations

Now that we have introduced the basic concepts of behavioral research, the next five chapters discuss specific research designs. Chapters 11–14 focus on true experimental designs that involve experimenter manipulation of the independent variable and experimenter control over the assignment of participants to treatment conditions. Chapter 15 focuses on alternative research designs in which the experimenter does not manipulate the independent variable and/or does not have control over the assignment of participants to treatment conditions.

Let's return to a topic and experimental design that we discussed earlier. Suppose we are interested in the possible effect of TV violence on aggressive behavior in children. One fairly simple approach is to randomly sample several day-care centers for participants. On a particular day, half of the children in each day-care center are randomly assigned to watch *Mister Rogers* for 30 minutes, and the other half watch *Beast Wars* for 30 minutes. The children are given the same instructions by one of the day-care personnel and watch the TV programs in identical environments. Following the TV program, the children play for 30 minutes, and the number of aggressive behaviors is observed and recorded by three experimenters who are "blind" to which TV program each child saw. (You should be able to identify several experimental control techniques in this description.)

The subject of this chapter is *one-way independent samples designs*. The term *one-way* means that there is one independent variable (IV). In our example, the IV is level of TV violence. *Independent samples* means that random assignment was used to create groups whose scores are independent of each other.

In our example, the independent variable has two levels. One level is a TV program with violence, and the other level is a TV program without violence. Thus, we have one dependent variable and one independent variable with two levels (see Table 11.1).

Table 11.1 Characteristics of Research Designs					
TYPE OF RESEARCH DESIGN	NUMBER OF INDEPENDENT VARIABLES	NUMBER OF LEVELS OF THE IV	NUMBER OF DEPENDENT VARIABLES	ASSIGNMENT TO CONDITIONS	MOST PROBABLE INFERENCE STATISTIC
One-way independent samples	1	2 or more	1	Random	<i>t</i> test or one-way ANOVA

Our design has several advantages. As noted in Chapter 9, our use of random sampling, at least in the geographical area that we are conducting the experiment, helps avoid bias that might be created by choosing one particular day-care center. It also permits us to generalize from our sample to the population of day-care centers from which our sample was drawn. Our use of random assignment is designed to avoid confounding variables associated with selection of participants. Can you imagine the characteristics of the two groups if you asked for volunteers to watch *Mister Rogers* and volunteers to watch *Beast*

Wars? The two groups would almost certainly be different before you even introduced the independent variable. Also, it is clear that we have a control group (TV program without violence) with which to compare the children who receive the TV violence.

As we have mentioned, no design is perfect, and this design has limitations. We know that our two experimental conditions have different children in them. These different children have different backgrounds and different personalities that will certainly influence their aggressiveness regardless of the TV program watched. Although random assignment is a technique designed to equate the groups at the start, there is no guarantee that they are in fact equated. Thus, the fact that there are different participants in the different groups constitutes an important source of random error. As we know, random error makes it more difficult to identify variability in the scores that is due to the independent variable. We will explore designs (correlated samples designs) that attempt to deal with this problem in the next chapter.

Comparing Two Groups

In our example, we have two groups. This is the same as saying there are two conditions or two levels of the independent variable. A two-group study is the simplest design that incorporates a number of experimental control techniques. Let's look at some data that might be recorded from this study (see Table 11.2).

Table 11.2 Number of Aggressive Behaviors Recorded						
TV PROGRAM WITH VIOLENCE (EXPERIMENTAL)			TV PROGRAM WITHOUT VIOLENCE (CONTROL)			
8	8	6	10	5	2	
9	8	5	2	7	4	
0	6	5	2	2	6	
10	12	9	2	0	4	
4	8	9	0	2	7	
7	4	15	1	6	7	
3	4	12	3	8	9	
2	5	3	3	11	5	
$n = 24; M = 6.75; SD = 3.52$			$n = 24; M = 4.50; SD = 3.12$			

From the table we can see that 48 children were randomly sampled and $n=24$ children were randomly assigned to each of the two experimental groups. The numbers in each cell represent our dependent variable—the number of aggressive behaviors that were observed. Clearly, the mean number of aggressive behaviors for children who watched the TV program with violence is somewhat higher than that for children who watched the TV program without violence.

In addition to this variability between the groups, there is also variability within the groups (as indicated by the standard deviation) such that scores were, on average, about 3 units from their respective means. The variability within the groups (also called error variability) is due to random error; the variability between the groups is due to any systematic error due to confounds plus any systematic variability due to the type of TV program. Thus:

$$\begin{aligned} \text{Variability Within Groups (error variability)} &= \text{Random Error (extraneous variables)} \\ \text{Variability Between Groups} &= \text{Systematic Error (confounds)} + \text{Systematic Variability} \\ &\quad \text{(effect of IV)} \end{aligned}$$

Recall from Chapter 8 that random error includes extraneous variables such as individual differences in the participants, characteristics of the experimenter, and characteristics of the experimental procedure. Systematic error includes many of the same factors but in circumstances in which the error creates unintended differences *between* the groups.

The goal is for our experimental design and procedures to reduce random error due to extraneous variables, to eliminate systematic error due to confounds, and to maximize the systematic variability due to manipulation of the independent variable. Although this is our goal, we in fact expect some degree of error in the scores. Thus, we expect some difference between the two group means even if there is absolutely no effect of the independent variable. So, the basic question is whether the difference between the two group means is due to error alone or due to error plus an effect of the independent variable (TV violence).

Comparing *t* Test to ANOVA

Let's return to the data in Table 11.1. Notice that we have already used descriptive statistics (mean and standard deviation) to summarize the data. We now need to use inferential statistics to determine whether our independent variable had a significant effect on our dependent variable. That is, did the level of TV violence have an effect on aggressive behavior? We actually have two options. An independent samples design with two groups can be analyzed with either an **independent samples *t* test** or a **one-way independent samples ANOVA**. Recall from Chapter 10 that parametric tests require assumptions of normality and homogeneity of variance. If there is reason to suspect that these assumptions are seriously violated in an independent samples design, then a nonparametric test such as the Mann-Whitney test is more appropriate. For the examples in this chapter, we will assume normality of the data and homogeneity of variance.

Whereas *t* tests are restricted to the comparison of two groups, ANOVAs can be used with two groups or more. In either case, the inferential statistic is based on a ratio of variability between groups to variability due to error.

$$\text{Inferential Statistic} = \frac{\text{Variability Between Groups}}{\text{Error Variability}}$$

Let's look at each one.

Independent Samples t Test

The independent samples t test uses the difference between the two group means as a measure of variability between groups and uses the standard error of the difference between means as a measure of error variability.

$$t = \frac{\text{Difference Between the Two Group Means}}{\text{Standard Error of the Difference Between Means (Error)}}$$

The difference between the two group means is a straightforward calculation. The standard error of the difference between means tells you, on average, how different the two group means should be if the difference is due solely to error variability. If you examine the formulas in a statistics book, you will see that the standard error is based on the variance of the scores within each of the groups.

If the null hypothesis (H_0) is true—that is, there is no effect of the independent variable—then you would expect the difference between the two group means to be small and the t -statistic to be near 0. If, on the other hand, the null hypothesis is false, then you would expect the difference between the two group means to be large (in either a positive or a negative direction) relative to the standard error. This would produce a t -statistic that has a value away from 0 (in either a positive or a negative direction). The larger the absolute value of the t -statistic, the lower is the probability that the difference between the group means is due solely to error variability. If the probability is low enough (lower than the alpha level), then we reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1). We conclude that the independent variable had an effect.

Because this is not a statistics book, we are not going to present the detailed calculations of the t -statistic here. You can consult a statistics textbook for the relevant formulas. Most people now do the statistical analyses using a computer with statistical software. For the data presented in this example, the output from one of these programs would include the information in Table 11.3.

Table 11.3 Output From an Independent Samples t Test		
<i>t</i>	<i>df</i>	<i>p</i>
2.34	46	0.023

This table shows that the t -statistic is 2.34, the degrees of freedom are 46, and the probability value is 0.023. The probability value tells you the probability (likelihood) of obtaining that t -statistic assuming the null hypothesis is true. Typically, researchers set their alpha level at .05 for deciding to reject the null

hypothesis. Because the probability is low enough ($0.023 < .05$), we decide to reject the null hypothesis and conclude that there was a significant effect of the independent variable on the dependent variable. Specifically, children who watched a TV program with violence showed significantly more aggressive behaviors than children who watched a TV program without violence, $t(46) = 2.34, p = 0.023$.

Independent Samples ANOVA

As noted earlier, these same data could be analyzed with an independent samples analysis of variance (ANOVA). By the way, the results based on a t test will always match those based on an ANOVA. The logic of the ANOVA is very similar to that of the t test. Again, a ratio of variability between the groups to error variability is calculated. The resulting statistic is referred to as the F -ratio.

$$F\text{-ratio} = \frac{\text{Variability Between Group (Mean Square}_{\text{between groups}})}{\text{Error Variability (Mean Square}_{\text{error}})}$$

$$F\text{-ratio} = \frac{\text{Treatment Effect} + \text{Systematic Error}}{\text{Random Error}}$$

Here, the numerator of the formula is not simply the difference between the group means. It is a measure of variability based on how different the group means are. Therefore, whereas the t -statistic can have negative values and has an expected value of 0, the F -ratio must be positive (because variability is always positive) and has an expected value of 1. Remember that expected values are based on the null hypothesis being true.

Output from a computer program would include the information in Table 11.4.

Table 11.4 Output From an Independent Samples ANOVA					
SOURCE OF VARIABILITY	DEGREES OF FREEDOM (<i>df</i>)	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
Between groups	1	60.75	60.75	5.50	0.023
Within groups (error)	46	508.50	11.05		
Total	47	569.25			

As in the analysis using the t test, the probability of the F -ratio (0.023) is less than the alpha level (.05), so the decision would be to reject the null hypothesis and conclude that the independent variable had a significant effect on the dependent variable. Specifically, children who watched a TV program with violence showed significantly more aggressive behaviors than children who watched a TV program without violence, $F(1,46) = 5.50, p = 0.023$.

We hope that you get the sense that the independent samples design with two groups is a relatively simple, yet powerful, design that requires a relatively simple analysis. We arrived at a conclusion without too much effort. But let's take a closer look at our conclusion.

Comparing More Than Two Groups

Based on the above experiment, we concluded that children who watched a TV program with violence showed significantly more aggressive behaviors than children who watched a TV program without violence. We bet that you are thinking the TV violence increased aggressive behaviors. We bet that most people would think that and naturally conclude that violence on TV is “bad.” But is there another possible interpretation of the results? Is it possible that the children who watched *Beast Wars* showed normal levels of aggression and the children who watched *Mister Rogers* showed unusually low levels of aggression? In other words, it could be that *Beast Wars* had no effect and *Mister Rogers* actually caused a decrease in aggression. In fact, there is yet a third possibility: that *Beast Wars* increased aggression and *Mister Rogers* decreased aggression. This is a very important distinction and one that cannot be answered with the design that we have used.

To help us distinguish among these possibilities, we could add a third group of children to our experimental design. The experimental procedures would be the same as previously described with the exception that there is an additional group of children who watch no TV program in the 30 minutes prior to the observation period. This third group will serve as something of a baseline with which we can compare the other two groups. Let’s add this third group to our hypothetical data set (see Table 11.5; note that the number in each cell represents the score of a single participant).

VIOLENCE			NO VIOLENCE			NO TV		
8	8	6	10	5	2	7	5	9
9	8	5	2	7	4	7	8	9
0	6	5	2	2	6	10	2	11
10	12	9	2	0	4	4	11	7
4	8	9	0	2	7	3	12	10
7	4	15	1	6	7	12	3	4
3	4	12	3	8	9	6	3	5
2	5	3	3	11	5	6	5	4
$n = 24; M = 6.75; SD = 3.52$			$n = 24; M = 4.50; SD = 3.12$			$n = 24; M = 6.79; SD = 3.11$		

An inspection of the group means suggests that it may be the *Mister Rogers* program that reduced aggression in that group. We need to conduct analyses to tell us whether there are any significant differences, and if so, where they are. A *t* test is not an option because it is restricted to the comparison of two groups. Therefore, an independent samples ANOVA is the appropriate analysis. Output from a computer program would include the information in Table 11.6.

Table 11.6 Output From an Independent Samples ANOVA

SOURCE OF VARIABILITY	DEGREES OF FREEDOM (<i>df</i>)	SUM OF SQUARES	MEAN SQUARES	<i>F</i> RATIO	<i>F</i> PROBABILITY
Between groups	2	82.53	41.26	3.90	0.025
Within groups (error)	69	730.46	10.59		
Total	71	812.99			

This output tells us that there is a significant difference among the three group means, $F(2,69) = 3.90$, $p = 0.025$. Because there are more than two groups, we cannot be sure where the differences are. To determine this, we need to conduct a **post hoc specific comparison test** (such as Tukey HSD, Bonferroni, or Sheffé). Output from a Tukey HSD showed that the means for Group 1 (TV Violence) and Group 3 (No TV) are significantly higher than the mean for Group 2 (No Violence). Therefore, we can now conclude that watching *Mister Rogers* for 30 minutes significantly reduced aggressive behavior when compared to watching either *Beast Wars* or no TV.

It is important to note that post hoc specific comparison tests are only applied when there are more than two groups and the *F*-statistic in the ANOVA is significant. Sometimes, the researcher plans comparisons between specific groups before the experiment is conducted. In these situations, the experimenter can apply an **a priori specific comparison test** (planned comparisons) even if the *F*-statistic in the ANOVA is not significant (see an advanced statistics book for a complete discussion of specific comparison tests).

Although the independent samples design seems simple and easy to identify, it possesses important characteristics that require a critical evaluation. Practice your skills by considering research that studied video games (see *Thinking Critically About Everyday Information*).

Thinking Critically About Everyday Information: Can Video Games Sharpen Your Mind?

CBS News reported on a set of studies that examined the relationship between playing video games and skills in processing visual information. Portions of the report are shown below:

Study: Video Games Hone the Mind

All those hours spent playing video games may not be wasted time after all: A new study suggests action-packed video games like “Grand Theft Auto III” and “Counter-Strike” may sharpen your mind.

Researchers at the University of Rochester found that young adults who regularly played video games full of high-speed car chases and blazing gun battles showed better visual skills than those who did not. For example, they kept better track of objects appearing simultaneously and processed fast-changing visual information more efficiently.

In the Rochester study, 16 men ages 18 to 23 took a series of tests that measured their ability to locate the position of a blinking object, count the number of simultaneous objects on a screen and pick out the color of an alphabet letter. Those who played video games for the previous six months (self-report on a questionnaire) performed better in all those tests than those who did not.

Before we read about the next study that was reported, think about the following:

- How many groups were compared?
- Did the researchers use an independent samples design?
- Although the report suggests a causal link between video gaming and visual perception skills, what is an alternative interpretation for the results?
- How might you design a true experiment to answer the same research question?

Now that you’ve thought about these questions, let’s continue with the report:

To rule out the possibility that visually adept people are simply drawn toward video games, the researchers conducted a second experiment. They found that people who do not normally play video games but were trained to play them developed enhanced visual perception.

In a separate test, a group of 17 who never played video games were trained to play the military game “Medal of Honor” and the puzzle game “Tetris.” After playing for 10 days, those who learned “Medal of Honor” scored better on the performance tests than those who didn’t.

Let’s return to some critical thinking questions:

- The researchers understood that there was an alternative interpretation for the first study. Based on the description in the last paragraph, did the researcher do a good job of resolving the issue? Do you believe that the second study represents a true experiment?
- Although the second study represents a research design similar to what will be discussed in the next chapter (thus, you may not be familiar with the issues involved), do believe that the second study convincingly demonstrates an effect of video gaming on visual perception? Can you think of an alternative explanation?

SOURCE: Retrieved June 30, 2003, online at

<http://www.cbsnews.com/stories/2003/05/28/tech/main555921.shtml>

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Quasi-experiments

The studies discussed so far in this chapter represent true experiments that included manipulation of the independent variable and random assignment of participants to conditions. Many studies closely mimic a true experiment but lack one or more essential characteristics. In some cases, the investigator may manipulate the independent variable but be unable to randomly assign participants to conditions. Such designs are termed **quasi-experiments** and are very similar to true experiments except for the important feature of random assignment. It is important to distinguish between a true experiment and a quasi-experiment because the conclusions that may be drawn from the research depend upon this distinction. The degree of risk in inferring causal relationships is much greater with quasi-experiments.

Let's look at an example of a quasi-experiment that resembles a true experiment. To investigate the effect of TV violence, a researcher selects two day-care centers to participate in the study. In one day-care center, the experimenter presents *Mister Rogers*; in the other day-care center, the experimenter presents *Beast Wars*. In both day-care centers, the researcher observes the number of aggressive behaviors during a play period following the TV programs. Assume that the data collected are identical to those for the first study in this chapter (see Table 11.7).

Table 11.7 Number of Aggressive Behaviors Recorded

TV PROGRAM WITH VIOLENCE (EXPERIMENTAL)			TV PROGRAM WITHOUT VIOLENCE (CONTROL)		
8	8	6	10	5	2
9	8	5	2	7	4
0	6	5	2	2	6
10	12	9	2	0	4
4	8	9	0	2	7
7	4	15	1	6	7
3	4	12	3	8	9
2	5	3	3	11	5
$n = 24; M = 6.75; SD = 3.52$			$n = 24; M = 4.50; SD = 3.12$		

The results from the t test or ANOVA would again show the difference between the two group means to be significant. Can we conclude that the manipulation of the independent variable (level of TV violence) caused a change in the dependent variable (aggressive behavior)? The answer is no. The difference in aggressiveness may be due to differences that already existed between the children in the two day-care centers. It is likely that these two day-care centers differ in many ways other than the type of TV program that was presented. They may differ in quality of the staff, types of activities, typical TV programming, income level of the children's parents, educational level of the children's parents, and many other factors. The differences that were observed in the children's aggressiveness could be due to

one or more of these other factors rather than to the type of TV program presented by the researcher. Unfortunately, we cannot choose among these alternative interpretations. On the other hand, if this study had used random assignment of participants, alternative interpretations would have been eliminated and strong, confident conclusions could have been drawn.

Other examples of quasi-experiments are **cross-sectional research** designs. Developmental psychologists are often interested in how the behaviors of individuals may change across portions of the life span or across the entire life span. We could ask the question “Do people’s responses to violence on TV change as they develop from young children to school-age children to teenagers?” An approach using a cross-sectional design might involve testing children of different specific age groups and then making comparisons across the age groups. Once again, notice that the researcher can manipulate the independent variable (level of TV violence) but does not use random assignment to form the age groups. The different age groups are preexisting groups.

When quasi-experiments are conducted using an experimental group and a comparison group, there is always concern about the equality of the two (or more) groups because random assignment is absent. Any differences between the two groups could be due to the treatment that only the experimental group received or to differences between participants in the two groups (perhaps brighter, healthier, or more motivated in one group than the other). Researchers conducting quasi-experiments may try to minimize participant differences by selecting participants as similar as possible for the two groups, but this is very difficult. There is no way to be sure that the composition of participants in the two groups will be equal, but a random assignment procedure comes closest to achieving this goal.

As we have just discussed, quasi-experiments involve manipulation of an independent variable but lack random assignment. Other studies may lack both manipulation of the independent variable and random assignment. Common examples include many typical undergraduate studies that involve comparisons of gender, race, socioeconomic status, fraternity/sorority status, and other preexisting characteristics. Because these are not true experiments, strong cause–effect conclusions cannot be made. These types of studies will be discussed further in Chapter 15.

Case Analysis

One important area of behavioral research involves attempts to reduce the occurrence of risky sexual behaviors in teenagers. A recent study showed that a high school program taught by teachers was more effective in the long term than a similar program taught by peers (Fisher, Fisher, & Bryan, 2002). You decide to determine whether the same principle applies to drug education. Using three high schools, you implement a teacher-based program in one school, a peer-based program in a second school, and no program in a third school. For the dependent variable, you ask students to anonymously report the number of times they have used drugs in the previous month. You measure level of drug use at the beginning of the school year and at the end of the school year and calculate a “change” score by subtracting one from

the other. Thus, a score of 0 would indicate no change, a positive score would indicate an increase in drug use, and a negative score would indicate a decrease in drug use. From the samples tested in each high school, you obtain the statistics shown in Tables 11.8–11.10.

Table 11.8 Descriptive Statistics

PROGRAM	<i>n</i>	MEAN	STANDARD DEVIATION
Teacher-based	60	−2.68	2.68
Peer-based	58	−1.83	2.90
None	65	2.37	2.58

Table 11.9 Output From an Independent Samples ANOVA

SOURCE OF VARIABILITY	DEGREES OF FREEDOM (<i>df</i>)	SUM OF SQUARES	MEAN SQUARES	<i>F</i> RATIO	<i>F</i> PROBABILITY
Between groups	2	920.82	460.41	62.39	<.001
Within groups (error)	180	1328.40	7.38		
Total	182	2249.23			

Table 11.10 Results From the Post Hoc Tukey Test

COMPARISON	MEAN DIFFERENCE	SIGNIFICANCE (PROBABILITY)
Teacher-based/Peer-based	−0.856	0.201
Teacher-based/Control	−5.053	< 0.01*
Peer-based/Control	−4.197	< 0.01*

Critical Thinking Questions

1. Based on the ANOVA, is there a significant effect of type of program on drug use?
2. Based on the post hoc analysis, which groups differ from each other?
3. Write a conclusion for the study that includes the direction of the effects.
4. Was this study a true experiment?
5. Can you conclude that the programs caused a change in drug use? Why or why not?
6. Identify at least two variables that were not measured but that may be confounding variables?
7. How could the study be improved so that the conclusion would be stronger?

General Summary

An independent samples design is a true experiment characterized by random assignment of participants to conditions and manipulation of the independent variable. In conjunction with the use of control groups, this design permits cause–effect conclusions and results in fewer alternative interpretations of the data.

Such conclusions are derived from the use of descriptive statistics and inferential statistics (*t* test, ANOVA).

Quasi-experiments are similar to true experiments with the exception that there is no random assignment of participants to conditions. Thus, there is no experimental procedure that adequately equates the groups prior to introduction of the independent variable. Therefore, quasi-experiments do not lend themselves to cause–effect conclusions. Differences between the groups could be due to a host of factors other than the independent variable.

The next chapter will explore true experiments that consist of correlated samples.

Detailed Summary

1. When a research design is a “one-way” design, it involves only one independent variable. When a research design is an “independent samples” design, random assignment is used to place participants into comparison groups.
2. Random assignment is the best method to create initial equality of comparison groups before the independent variable is introduced. Thus, random assignment is designed to eliminate potential confounds. However, the technique does not guarantee equality of groups, and random error due to individual differences is still expected.
3. In a two-group study, the variability of the scores is composed of variability within groups and variability between groups. Variability within groups is the result of extraneous variables. Variability between groups is the result of confounding variables plus the effect of the independent variable.
4. The objective of the researcher is to reduce extraneous variables and confounds so that any effect of the independent variable is revealed.
5. An independent samples design with two groups can be analyzed with either an independent samples *t* test or a one-way independent samples analysis of variance (ANOVA). The *t* tests are restricted to the comparison of two groups while ANOVAs are appropriate when there are two or more groups.
6. The *t*-statistic in a *t* test is a standardized score that reflects the size of the difference between the two group means. The *t*-statistic can be used to determine the probability that the difference was simply due to chance. If that probability is low enough (less than the alpha level, usually .05), then the researcher can reject the null hypothesis and accept the alternative hypothesis—that is, conclude that there was a significant effect.
7. The *F*-ratio in an analysis of variance (ANOVA) is a standardized score that reflects the degree to which the variability between groups is greater than the variability within groups. Like the *t*-statistic, the *F*-ratio is used to determine the probability that the difference between group means is significant.

8. An independent samples design with more than two groups should be analyzed with ANOVA. To determine where differences may exist between specific groups, a priori planned comparisons or post hoc comparisons can be performed.
9. Quasi-experiments are similar to true experiments in that the researcher manipulates the independent variable but different in that the researcher does not randomly assign participants to the comparison groups. Absence of random assignment creates a greater concern that differences between the comparison groups are the result of confounding variables rather than manipulation of the independent variable. Thus, cause–effect conclusions are typically unwarranted and should only be made with great caution.

Key Terms

a priori specific comparison test

cross-sectional research

independent samples t test

one-way independent samples ANOVA

post hoc specific comparison test

quasi-experiment

Review Questions / Exercises

1. Summarize the essential characteristics of a one-way independent samples research design.
2. Briefly describe a true experiment regarding the effectiveness of a particular drug for which an independent samples t test would be the appropriate inferential statistic.
3. Briefly describe a true experiment regarding the effectiveness of a particular drug for which an independent samples ANOVA would be the appropriate inferential statistic.
4. Briefly describe a quasi-experiment regarding the effectiveness of a particular drug for which an independent samples ANOVA would be the appropriate inferential statistic.
5. In your own words, describe the purpose of post hoc specific comparison tests, including a description of when it is appropriate to use them.