CHAPTER

8 Quantitative Methods

We turn now from the introduction, the purpose, and the questions and hypotheses to the method section of a proposal. This chapter presents essential steps in designing quantitative methods for a research proposal or study, with specific focus on survey and experimental designs. These designs reflect postpositivist philosophical assumptions, as discussed in Chapter 1. For example, determinism suggests that examining the relationships between and among variables is central to answering questions and hypotheses through surveys and experiments. In one case, a researcher might be interested in evaluating whether playing violent video games is *associated with* higher rates of playground aggression in kids, which is a correlational hypothesis that could be evaluated in a survey design. In another case, a researcher might be interested in evaluating whether violent video game playing *causes* aggressive behavior, which is a causal hypothesis that is best evaluated by a true experiment. In each case, these quantitative approaches focus on carefully measuring (or experimentally manipulating) a parsimonious set of variables to answer theory-guided research questions and hypotheses. In this chapter, the focus is on the essential components of a method section in proposals for a survey or experimental study.

Defining Surveys and Experiments

A **survey design** provides a quantitative description of trends, attitudes, and opinions of a population, or tests for associations among variables of a population, by studying a sample of that population. Survey designs help researchers answer three types of questions: (a) descriptive questions (e.g., What percentage of practicing nurses support the provision of hospital abortion services?); (b) questions about the relationships between variables (e.g., Is there a positive association between endorsement of hospital abortion services and support for implementing hospice care among nurses?); or in cases where a survey design is repeated over time in a longitudinal study; (c) questions about predictive relationships between variables over time (e.g., Does Time 1 endorsement of support for hospital abortion services predict greater Time 2 burnout in nurses?).

An **experimental design** systematically manipulates one or more variables in order to evaluate how this manipulation impacts an outcome (or outcomes) of interest. Importantly, an experiment isolates the effects of this manipulation by holding all other variables constant. When one group receives a treatment and the other group does not (which is a manipulated

variable of interest), the experimenter can isolate whether the treatment and *not* other factors influence the outcome. For example, a sample of nurses could be randomly assigned to a 3-week expressive writing program (where they write about their deepest thoughts and feelings) or a matched 3-week control writing program (writing about the facts of their daily morning routine) to evaluate whether this expressive writing manipulation reduces job burnout in the months following the program (i.e., the writing condition is the manipulated variable of interest, and job burnout is the outcome of interest). Whether a quantitative study employs a survey or experimental design, both approaches share a common goal of helping the researcher make inferences about relationships among variables, and how the sample results may generalize to a broader population of interest (e.g., all nurses in the community).

Components of a Survey Study Method Plan

The design of a survey method plan follows a standard format. Numerous examples of this format appear in scholarly journals, and these examples provide useful models. The following sections detail typical components. In preparing to design these components into a proposal, consider the questions on the checklist shown in Table 8.1 as a general guide.

Table 8.1 A Checklist of Questions for Designing a Survey Study Plan

_____	Is the purpose of a survey design stated?
_____	What type of design will be used and what are the reasons for choosing the design mentioned?
_____	Is the nature of the survey (cross-sectional vs. longitudinal) identified?
_____	Is the population and its size mentioned?
_____	Will the population be stratified? If so, how?
_____	How many people will be in the sample? On what basis was this size chosen?
_____	What will be the procedure for sampling these individuals (e.g., random, nonrandom)?
_____	What instrument will be used in the survey? For each instrument, who developed it, how many items does it contain, does it have acceptable reliability and validity, and what are the scale anchors?
_____	What procedure will be used to pilot or field-test the survey?
_____	What is the timeline for administering the survey?
_____	How will the measures be scored and converted into variables?
_____	How will the variables be used to test your research questions?

What specific steps will be taken in data analysis to do the following:

(a) _____ Analyze returns?

(b) _____ Check for response bias?

(c) _____ Conduct a descriptive analysis?

(d) _____ Combine items into scales?

(e) _____ Check for reliability of scales?

(f) _____ Run inferential statistics to answer the research questions or assess practical implications of the results?

_____ How will the results be interpreted?

The Survey Design

The first parts of the survey method plan section can introduce readers to the basic purpose and rationale for survey research. Begin the section by describing the rationale for the design. Specifically:

- Identify the purpose of survey research. The primary purpose is to answer a question (or questions) about variables of interest to you. A sample purpose statement could read: "The primary purpose of this study is to empirically evaluate whether the number of overtime hours worked predicts subsequent burnout symptoms in a sample of emergency room nurses."
- Indicate why a survey method is the preferred type of approach for this study. In this rationale, it can be beneficial to acknowledge the advantages of survey designs, such as the economy of the design, rapid turnaround in data collection, and constraints that preclude you from pursuing other designs (e.g., "An experimental design was not adopted to look at the relationship between overtime hours worked and burnout symptoms because it would be prohibitively difficult, and potentially unethical, to randomly assign nurses to work different amounts of overtime hours.").
- Indicate whether the survey will be cross-sectional—with the data collected at one point in time—or whether it will be longitudinal—with data collected over time.
- Specify the form of data collection. Fowler (2014) identified the following types: mail, telephone, the Internet, personal interviews, or group administration (see also Fink, 2016; Krueger & Casey, 2014). Using an Internet survey and administering it online has been discussed extensively in the literature (Nesbary, 2000; Sue & Ritter, 2012). Regardless of the form of data collection, provide a rationale for the procedure, using arguments based on its strengths and weaknesses, costs, data availability, and convenience.

The Population and Sample

In the method section, follow the type of design with characteristics of the population and the sampling procedure. Methodologists have written excellent discussions about the underlying logic of sampling theory (e.g., Babbie, 2015; Fowler, 2014). Here are essential aspects of the population and sample to describe in a research plan:

- *The population.* Identify the population in the study. Also state the size of this population, if size can be determined, and the means of identifying individuals in the population. Questions of access arise here, and the researcher might refer to availability of sampling frames—mail or published lists—of potential respondents in the population.
- *Sampling design.* Identify whether the sampling design for this population is single stage or multistage (called clustering). Cluster sampling is ideal when it is impossible or impractical to compile a list of the elements composing the population (Babbie, 2015). A single-stage sampling procedure is one in which the researcher has access to names in the population and can sample the people (or other elements) directly. In a multistage or clustering procedure, the researcher first identifies clusters (groups or organizations), obtains names of individuals within those clusters, and then samples within them.
- *Type of sampling.* Identify and discuss the selection process for participants in your sample. Ideally you aim to draw a *random sample,* in which each individual in the population has an equal probability of being selected (a systematic or probabilistic sample). But in many cases it may be quite difficult (or impossible) to get a random sample of participants. Alternatively, a *systematic sample* can have precision-equivalent **random sampling** (Fowler, 2014). In this approach, you choose a random start on a list and select every *X* numbered person on the list. The *X* number is based on a fraction determined by the number of people on the list and the number that are to be selected on the list (e.g., 1 out of every 80th person). Finally, less desirable, but often used, is a nonprobability sample (or *convenience sample*), in which respondents are chosen based on their convenience and availability.
- *Stratification.* Identify whether the study will involve *stratification* of the population before selecting the sample. This requires that characteristics of the population members be known so that the population can be stratified first before selecting the sample (Fowler, 2014). Stratification means that specific characteristics of individuals (e.g., gender—females and males) are represented in the sample and the sample reflects the true proportion in the population

of individuals with certain characteristics. When randomly selecting people from a population, these characteristics may or may not be present in the sample in the same proportions as in the population; stratification ensures their representation. Also identify the characteristics used in stratifying the population (e.g., gender, income levels, education). Within each stratum, identify whether the sample contains individuals with the characteristic in the same proportion as the characteristic appears in the entire population.

- *Sample size determination.* Indicate the number of people in the sample and the procedures used to compute this number. Sample size determination is at its core a tradeoff: A larger sample will provide more accuracy in the inferences made, but recruiting more participants is time consuming and costly. In survey research, investigators sometimes choose a sample size based on selecting a fraction of the population (say, 10%) or selecting a sample size that is typical based on past studies. These approaches are not optimal; instead sample size determination should be based on your analysis plans (Fowler, 2014).

- *Power analysis.* If your analysis plan consists of detecting a significant association between variables of interest, a power analysis can help you estimate a target sample size. Many free online and commercially available power analysis calculators are available (e.g., G*Power; Faul, Erdfelder, Lang, & Buchner, 2007; Faul, Erdfelder, Buchner, & Lang 2009). The input values for a formal power analysis will depend on the questions you aim to address in your survey design study (for a helpful resource, see Kraemer & Blasey, 2016). As one example, if you aim to conduct a cross-sectional study measuring the correlation between the number of overtime hours worked and burnout symptoms in a sample of emergency room nurses, you can estimate the sample size required to determine whether your correlation significantly differs from zero (e.g., one possible hypothesis is that there will be a significant positive association between number of hours worked and emotional exhaustion burnout symptoms). This power analysis requires just three pieces of information:

  1. An estimate of the size of correlation (r). A common approach for generating this estimate is to find similar studies that have reported the size of the correlation between hours worked and burnout symptoms. This simple task can often be difficult, either because there are no published studies looking at this association or because suitable published studies do not report a correlation coefficient. One tip: In cases where a published report measures variables of interest to you, one option is to contact the study authors asking them to kindly provide the correlation analysis result from their dataset, for your power analysis.

2. A two-tailed alpha value (α). This value is called the Type I error rate and refers to the risk we want to take in saying we have a real non-zero correlation when in fact this effect is not real (and determined by chance), that is, a false positive effect. A commonly accepted alpha value is .05, which refers to a 5% probability (5/100) that we are comfortable making a Type I error, such that 5% of the time we will say that there's a significant (non-zero) relationship between number of hours worked and burnout symptoms when in fact this effect occurred by chance and is not real.
3. A beta value (β). This value is called the Type II error rate and refers to the risk we want to take in saying we do not have a significant effect when in fact there is a significant association, that is, a false negative effect. Researchers commonly try to balance the risks of making Type I versus Type II errors, with a commonly accepted beta value being .20. Power analysis calculators will commonly ask for estimated power, which refers to 1 – beta (1 – .20 = .80).

- You can then plug these numbers into a power analysis calculator to determine the sample size needed. If you assume that the estimated association is $r = .25$, with a two-tailed alpha value of .05 and a beta value of .20, the power analysis calculation indicates that you need at least 123 participants in the study you aim to conduct.
- To get some practice, try conducting this sample size determination power analysis. We used the G*Power software program (Faul et al., 2007; Faul et al., 2009), with the following input parameters:
  - Test family: Exact
  - Statistical test: Correlation: Bivariate normal model
  - Type of power analysis: A priori: Compute required sample size
  - Tails: Two
  - Correlation ρ H1: .25
  - α err prob: .05
  - Power (1 – β err prob): .8
  - Correlation ρ H0: 0
- This power analysis for sample size determination should be done during study planning prior to enrolling any participants. Many scientific journals now require researchers to report a power analysis for sample size determination in the Method section.

Instrumentation

As part of rigorous data collection, the proposal developer also provides detailed information about the actual survey instruments to be used in the study. Consider the following:

- *Name the survey instruments used to collect data.* Discuss whether you used an instrument designed for this research, a modified instrument, or an instrument developed by someone else. For example, if you aim to measure perceptions of stress over the last month, you could use the 10-item Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983) as your stress perceptions instrument in your survey design. Many survey instruments, including the PSS, can be acquired and used for free as long as you cite the original source of the instrument. But in some cases, researchers have made the use of their instruments proprietary, requiring a fee for use. Instruments are increasingly being delivered through a multitude of online survey products now available (e.g., Qualtrics, Survey Monkey). Although these products can be costly, they also can be quite helpful for accelerating and improving the survey research process. For example, researchers can create their own surveys quickly using custom templates and post them on websites or e-mail them to participants to complete. These software programs facilitate data collection into organized spreadsheets for data analysis, reducing data entry errors and accelerating hypothesis testing.
- *Validity of scores using the instrument.* To use an existing instrument, describe the established validity of scores obtained from past use of the instrument. This means reporting efforts by authors to establish **validity in quantitative research**—whether you can draw meaningful and useful inferences from scores on the instruments. The three traditional forms of validity to look for are (a) content validity (Do the items measure the content they were intended to measure?), (b) predictive or concurrent validity (Do scores predict a criterion measure? Do results correlate with other results?), and (c) **construct validity** (Do items measure hypothetical constructs or concepts?). In more recent studies, construct validity has become the overriding objective in validity, and it has focused on whether the scores serve a useful purpose and have positive consequences when they are used in practice (Humbley & Zumbo, 1996). Establishing the validity of the scores in a survey helps researchers to identify whether an instrument might be a good one to use in survey research. This form of validity is different from identifying the threats to validity in experimental research, as discussed later in this chapter.
- *Reliability of scores on the instrument.* Also mention whether scores resulting from past use of the instrument demonstrate acceptable

reliability. Reliability in this context refers to the consistency or repeatability of an instrument. The most important form of reliability for multi-item instruments is the instrument's **internal consistency**—which is the degree to which sets of items on an instrument behave in the same way. This is important because your instrument scale items should be assessing the same underlying construct, so these items should have suitable intercorrelations. A scale's internal consistency is quantified by a Cronbach's alpha (α) value that ranges between 0 and 1, with optimal values ranging between .7 and .9. For example, the 10-item PSS has excellent internal consistency across many published reports, with the original source publication reporting internal consistency values of α = .84–.86 in three studies (Cohen, Kamarck, and Mermelstein, 1983). It can also be helpful to evaluate a second form of instrument reliability, its test-retest reliability. This form of reliability concerns whether the scale is reasonably stable over time with repeated administrations. When you modify an instrument or combine instruments in a study, the original validity and reliability may not hold for the new instrument, and it becomes important to establish validity and reliability during data analysis.

- *Sample items.* Include sample items from the instrument so that readers can see the actual items used. In an appendix to the proposal, attach sample items or the entire instrument (or instruments) used.
- *Content of instrument.* Indicate the major content sections in the instrument, such as the cover letter (Dillman, 2007, provides a useful list of items to include in cover letters), the items (e.g., demographics, attitudinal items, behavioral items, factual items), and the closing instructions. Also mention the type of scales used to measure the items on the instrument, such as continuous scales (e.g., *strongly agree* to *strongly disagree*) and categorical scales (e.g., yes/no, rank from highest to lowest importance).
- *Pilot testing.* Discuss plans for pilot testing or field-testing the survey and provide a rationale for these plans. This testing is important to establish the content validity of scores on an instrument; to provide an initial evaluation of the internal consistency of the items; and to improve questions, format, and instructions. Pilot testing all study materials also provides an opportunity to assess how long the study will take (and to identify potential concerns with participant fatigue). Indicate the number of people who will test the instrument and the plans to incorporate their comments into final instrument revisions.
- *Administering the survey.* For a mailed survey, identify steps for administering the survey and for following up to ensure a high

response rate. Salant and Dillman (1994) suggested a four-phase administration process (see Dillman, 2007, for a similar three-phase process). The first mail-out is a short advance-notice letter to all members of the sample, and the second mail-out is the actual mail survey, distributed about 1 week after the advance-notice letter. The third mail-out consists of a postcard follow-up sent to all members of the sample 4 to 8 days after the initial questionnaire. The fourth mail-out, sent to all nonrespondents, consists of a personalized cover letter with a handwritten signature, the questionnaire, and a preaddressed return envelope with postage. Researchers send this fourth mail-out 3 weeks after the second mail-out. Thus, in total, the researcher concludes the administration period 4 weeks after its start, providing the returns meet project objectives.

Variables in the Study

Although readers of a proposal learn about the variables in purpose statements and research questions/hypotheses sections, it is useful in the method section to relate the variables to the specific questions or hypotheses on the instrument. One technique is to relate the variables, the research questions or hypotheses, and sample items on the survey instrument so that a reader can easily determine how the data collection connects to the variables and questions/hypotheses. Plan to include a table and a discussion that cross-reference the variables, the questions or hypotheses, and specific survey

Table 8.2 Variables, Research Questions, and Items on a Survey

Variable Name	Research Question	Item on Survey
Independent Variable 1: Prior publications	**Descriptive research Question 1: How many publications did the faculty member produce prior to receipt of the doctorate?**	**See Questions 11, 12, 13, 14, and 15: publication counts for journal articles, books, conference papers, book chapters published before receiving the doctorate**
Dependent Variable 1: Grants funded	**Descriptive research Question 2: How many grants has the faculty member received in the past 3 years?**	**See Questions 16, 17, and 18: grants from foundations, federal grants, state grants**
Control Variable 1: Tenure status	**Descriptive research Question 3: Is the faculty member tenured?**	**See Question 19: tenured (yes/no)**
Relating the Independent Variable 1: Prior publications to the Dependent Variable: Grants funded	**Inferential Question 4: Does prior productivity influence the number of grants received?**	**See Questions 11,12,13,14,15 to Questions 16, 17, 18**

items. This procedure is especially helpful in dissertations in which investigators test large-scale models or multiple hypotheses. Table 8.2 illustrates such a table using hypothetical data.

Data Analysis

In the proposal, present information about the computer programs used and the steps involved in analyzing the data. Websites contain detailed information about the various statistical analysis computer programs available. Some of the more frequently used programs are the following:

- *IBM SPSS Statistics 24 for Windows and Mac (www.spss.com).* The SPSS Grad Pack is an affordable, professional analysis program for students based on the professional version of the program, available from IBM.
- *JMP (www.jmp.com).* This is a popular software program available from SAS.
- *Minitab Statistical Software 17 (minitab.com).* This is an interactive software statistical package available from Minitab Inc.
- *SYSTAT 13 (systatsoftware.com).* This is a comprehensive interactive statistical package available from Systat Software, Inc.
- *SAS/STAT (sas.com).* This is a statistical program with tools as an integral component of the SAS system of products available from SAS Institute, Inc.
- *Stata, release 14 (stata.com).* This is a data analysis and statistics program available from StataCorp.

Online programs useful in simulating statistical concepts for statistical instruction can also be used, such as the Rice Virtual Lab in Statistics found at http://onlinestatbook.com/rvls.html, or SAS Simulation Studio for JMP (www.jmp.com), which harnesses the power of simulation to model and analyze critical operational systems in such areas as health care, manufacturing, and transportation. The graphical user interface in SAS Simulation Studio for JMP requires no programming and provides a full set of tools for building, executing, and analyzing results of simulation models (Creswell & Guetterman, in press).

We recommend the following **research tip**—presenting data analysis plans as a series of steps so that a reader can see how one step leads to another:

Step 1. Report information about the number of participants in the sample who did and did not return the survey. A table with numbers and percentages describing respondents and nonrespondents is a useful tool to present this information.

Step 2. Discuss the method by which **response bias** will be determined. Response bias is the effect of nonresponses on survey estimates (Fowler, 2014). *Bias* means that if nonrespondents had responded, their responses would have substantially changed the overall results. Mention the procedures used to check for response bias, such as wave analysis or a respondent/nonrespondent analysis. In wave analysis, the researcher examines returns on select items week by week to determine if average responses change (Leslie, 1972). Based on the assumption that those who return surveys in the final weeks of the response period are nearly all nonrespondents, if the responses begin to change, a potential exists for response bias. An alternative check for response bias is to contact a few nonrespondents by phone and determine if their responses differ substantially from respondents. This constitutes a respondent-nonrespondent check for response bias.

Step 3. Discuss a plan to provide a **descriptive analysis** of data for all independent and dependent variables in the study. This analysis should indicate the means, standard deviations, and range of scores for these variables. Identify whether there is missing data (e.g., some participants may not provide responses to some items or whole scales), and develop plans to report how much missing data is present and whether a strategy will be implemented to replace missing data (for a review, see Schafer & Graham, 2002).

Step 4. If the proposal contains an instrument with multi-item scales or a plan to develop scales, first evaluate whether it will be necessary to reverse-score items, and then how total scale scores will be calculated. Also mention reliability checks for the internal consistency of the scales (i.e., the Cronbach alpha statistic).

Step 5. Identify the statistics and the statistical computer program for testing the major inferential research questions or hypotheses in the proposed study. The **inferential questions or hypotheses** relate variables or compare groups in terms of variables so that inferences can be drawn from the sample to a population. Provide a rationale for the choice of statistical test and mention the assumptions associated with the statistic. As shown in Table 8.3, base this choice on the nature of the research question (e.g., relating variables or comparing groups as the most popular), the number of independent and dependent variables, and the variables used as covariates (e.g., see Rudestam & Newton, 2014). Further, consider whether the variables will be measured on an instrument as a continuous score (e.g., age from 18 to 36) or as a categorical score (e.g., women = 1, men = 2). Finally, consider whether the scores from the sample might be normally distributed in a bell-shaped curve if plotted out on a graph or non-normally distributed. There are additional ways to determine if the scores are normally distributed (see Creswell, 2012). These factors, in combination, enable a researcher to determine what statistical test will be suited for answering the research question or hypothesis. In Table 8.3, we show how the factors, in combination, lead to the selection of a number of common statistical tests. For additional

types of statistical tests, readers are referred to statistics methods books, such as Gravetter and Wallnau (2012).

Step 6. A final step in the data analysis is to present the results in tables or figures and interpret the results from the statistical test, discussed in the next section.

Interpreting Results and Writing a Discussion Section

An **interpretation in quantitative research** means that the researcher draws conclusions from the results for the research questions, hypotheses, and the larger meaning of the results. This interpretation involves several steps:

- Report how the results addressed the research question or hypothesis. The *Publication Manual of the American Psychological Association* (American Psychological Association [APA], 2010) suggests that the most complete meaning of the results come from reporting extensive description, **statistical significance testing**, confidence intervals, and effect sizes. Thus, it is important to clarify the meaning of these last three reports of the results. The statistical significance testing reports an assessment as to whether the observed scores reflect a pattern other than chance. A statistical test is considered to be significant if the results are unlikely by chance to have occurred, and the null hypothesis of "no effect" can be rejected. The researcher sets a rejection level of "no effect," such as $p = 0.001$, and then assesses whether the test statistic falls into this level of rejection. Typically results will be summarized as "the analysis of variance revealed a statistically significant difference between men and women in terms of attitudes toward banning smoking in restaurants $F\ (2, 6) = 8.55$, $p = 0.001$."
- Two forms of *practical evidence* of the results should also be reported: (a) the effect size and (b) the confidence interval. A **confidence interval** is a range of values (an interval) that describes a level of uncertainty around an estimated observed score. A confidence interval shows how good an estimated score might be. A confidence interval of 95%, for example, indicates that 95 out of 100 times the observed score will fall in the range of values. An **effect size** identifies the strength of the conclusions about group differences or the relationships among variables in quantitative studies. It is a descriptive statistic that is not dependent on whether the relationship in the data represents the true population. The calculation of effect size varies for different statistical tests: it can be used to explain the variance between two or more variables or the differences among means for groups. It shows the practical significance of the results apart from inferences being applied to the population.

Table 8.3 Criteria for Choosing Select Statistical Tests

Nature of Question	Number of Independent Variables	Number of Dependent Variables	Number of Control Variables (covariates)	Type of Score Independent/ Dependent Variables	Distribution of Scores	Statistical Test	What the Test Yields
Group comparison	**1**	**1**	**0**	**Categorical/ continuous**	**Normal**	***t* test**	**A comparison of two groups in terms of outcomes**
Group comparison	**1 or more**	**1**	**0**	**Categorical/ continuous**	**Normal**	**Analysis of variance**	**A comparison of more than two groups in terms of outcomes**
Group comparison	**1 or more**	**1**	**1**	**Categorical/ continuous**	**Normal**	**Analysis of covariance (ANCOVA)**	**A comparison of more than two groups in terms of outcomes, controlling for covariates**
Association between groups	**1**	**1**	**0**	**Categorical/ categorical**	**Non-normal**	**Chi-square**	**An association between two variables measured by categories**
Relate variables	**1**	**1**	**0**	**Continuous/ continuous**	**Normal**	**Pearson product moment correlation**	**Tells you the magnitude and direction of association between two variables measured on an interval (or ratio) scale**
Relate variables	**2 or more**	**1**	**0**	**Continuous/ continuous**	**Normal**	**Multiple regression**	**Learn about the relationship between several predictor or independent variables and an outcome variable. It provides the relative prediction of one variable among many in terms of the outcome**

- The final step is to draft a discussion section where you discuss the implications of the results in terms of how they are consistent with, refute, or extend previous related studies in the scientific literature. How do your research findings address gaps in our knowledge base on the topic? It is also important to acknowledge the implications of the findings for practice and for future research in the area. It may also involve discussing theoretical and practical consequences of the results. It is also helpful to briefly acknowledge potential limitations of the study, and potential alternative explanations for the study findings.

Example 8.1 is a survey method plan section that illustrates many of the steps just mentioned. This excerpt (used with permission) comes from a journal article reporting a study of factors affecting student attrition in one small liberal arts college (Bean & Creswell, 1980, pp. 321–322).

Example 8.1 A Survey Method Plan

Methodology

The site of this study was a small (enrollment 1,000), religious, coeducational, liberal arts college in a Midwestern city with a population of 175,000 people. *[Authors identified the research site and population.]*

The dropout rate the previous year was 25%. Dropout rates tend to be highest among freshmen and sophomores, so an attempt was made to reach as many freshmen and sophomores as possible by distribution of the questionnaire through classes. Research on attrition indicates that males and females drop out of college for different reasons (Bean, 1978, in press; Spady, 1971). Therefore, only women were analyzed in this study.

During April 1979, 169 women returned questionnaires. A homogeneous sample of 135 women who were 25 years old or younger, unmarried, full-time U.S. citizens, and Caucasian was selected for this analysis to exclude some possible confounding variables (Kerlinger, 1973).

Of these women, 71 were freshmen, 55 were sophomores, and 9 were juniors. Of the students, 95% were between the ages of 18 and 21. This sample is biased toward higher-ability students as indicated by scores on the ACT test. *[Authors presented descriptive information about the sample.]*

Data were collected by means of a questionnaire containing 116 items. The majority of these were Likert-like items based on a scale from "a very small extent" to "a very great extent." Other questions asked for factual information, such as ACT scores, high school grades, and parents' educational level. All information used in this analysis was derived from questionnaire data. This questionnaire had been developed

and tested at three other institutions before its use at this college. *[Authors discussed the instrument.]*

Concurrent and convergent validity (Campbell & Fiske, 1959) of these measures was established through factor analysis, and was found to be at an adequate level. Reliability of the factors was established through the coefficient alpha. The constructs were represented by 25 measures—multiple items combined on the basis of factor analysis to make indices—and 27 measures were single item indicators. *[Validity and reliability were addressed.]*

Multiple regression and path analysis (Heise, 1969; Kerlinger & Pedhazur, 1973) were used to analyze the data. In the causal model . . . , intent to leave was regressed on all variables which preceded it in the causal sequence. Intervening variables significantly related to intent to leave were then regressed on organizational variables, personal variables, environmental variables, and background variables. *[Data analysis steps were presented.]*

Components of an Experimental Study Method Plan

An experimental method plan follows a standard form: (a) participants and design, (b) procedure, and (c) measures. These three sequential sections generally are sufficient (often in studies with a few measures, the procedure and measures sections are combined into a single procedure section). In this section of the chapter, we review these components as well as information regarding key features of experimental design and corresponding statistical analyses. As with the section on survey design, the intent here is to highlight key topics to be addressed in an experimental method plan. An overall guide to these topics is found by answering the questions on the checklist shown in Table 8.4.

Participants

Readers need to know about the selection, assignment, and number of participants who will take part in the experiment. Consider the following suggestions when writing the method section plan for an experiment:

- Describe the procedures for recruiting participants to be in the study, and any selection processes used. Often investigators aim to recruit a study sample that shares certain characteristics by formally stating specific inclusion and exclusion study criteria when designing their study (e.g., inclusion criterion: participants must be English language speaking; exclusion criterion: participants must not be children under the age of 18). Recruitment approaches are

Table 8.4 A Checklist of Questions for Designing an Experimental Study Plan

_____	Who are the participants in the study?
_____	How were the participants selected? Name specific study inclusion and exclusion criteria.
_____	How and when will the participants be randomly assigned?
_____	How many participants will be in the study?
	What experimental research design will be used? What would a visual model of this design look like?
_____	What are the independent variables and how are they operationalized?
_____	What are the dependent variables (i.e., outcome variables) in the study? How will they be measured?
_____	Will variables be included as manipulation checks or covariates in the experiment? How and when will they be measured?
_____	What instruments will be used to measure the dependent variables (outcomes) in the study? Why were they chosen? Who developed these measures? Do they have established validity and reliability?
_____	What are the sequential steps in the procedure for administering the experimental study to participants?
_____	What are potential threats to internal and external validity for the experimental design and procedure? How will they be addressed?
_____	How will pilot testing of materials and procedures be conducted prior to formal data collection?
_____	What statistics will be used to analyze the data (e.g., descriptive and inferential)?
_____	How will the results be interpreted?

wide-ranging, and can include random digit dialing of households in a community, posting study recruitment flyers or e-mails to targeted communities, or newspaper advertisements. Describe the recruitment approaches that will be used and the study compensation provided for participating.

- One of the principal features distinguishing an experiment from a survey study design is the use of random assignment. Random assignment is a technique for placing participants into study conditions of a manipulated variable of interest. When individuals are randomly assigned to groups, the procedure is called a **true experiment.** If random assignment is used, discuss how and when the study will *randomly assign* individuals to treatment groups, which in experimental studies are referred to as levels of an independent variable. This means that of the pool of participants, Individual 1 goes to Group 1, Individual 2 to Group 2, and so forth so that there is no

systematic bias in assigning the individuals. This procedure eliminates the possibility of systematic differences among characteristics of the participants that could affect the outcomes so that any differences in outcomes can be attributed to the study's manipulated variable (or variables) of interest (Keppel & Wickens, 2003). Often experimental studies may be interested in both randomly assigning participants to levels of a *manipulated* variable of interest (e.g., a new treatment approach for teaching fractions to children versus the traditional approach) while also *measuring* a second predictor variable of interest that cannot utilize random assignment (e.g., measuring whether the treatment benefits are larger among female compared to male children; it is impossible to randomly assign children to be male or female). Designs in which a researcher has only partial (or no) control over randomly assigning participants to levels of a manipulated variable of interest are called **quasi-experiments**.

- Conduct and report a power analysis for sample size determination (for a helpful resource, see Kraemer & Blasey, 2016). The procedures for a sample size power analysis mimic those for a survey design, although the focus shifts to estimating the number of participants needed in each condition of the experiment to detect significant group differences. In this case, the input parameters shift to include an estimate of the effect size referencing the estimated differences between the groups of your manipulated variable(s) of interest and the number of groups in your experiment. Readers are encouraged to review the power analysis section earlier in the survey design portion of this chapter and then consider the following example:
    - Previously we introduced a cross-sectional survey design assessing the relationship between number of overtime hours worked and burnout symptoms among nurses. We might decide to conduct an experiment to test a related question: Do nurses working full time have higher burnout symptoms compared to nurses working part time? In this case, we might conduct an experiment in which nurses are randomly assigned to work either full time (group 1) or part time (group 2) for 2 months, at which time we could measure burnout symptoms. We could conduct a power analysis to evaluate the sample size needed to detect a significant difference in burnout symptoms between these two groups. Previous literature might indicate an effect size difference between these two groups at $d = .5$, and as with our survey study design, we can assume a two-tailed alpha = .05 and beta = .20. We ran the calculation again using the G*Power software program (Faul et al., 2007; Faul et al., 2009) to estimate the sample size needed to detect a significant difference between groups:

Test family: *t* tests

Statistical test: Means: difference between two independent means (two groups)

Type of power analysis: A priori: Compute required sample size

Tails: Two

Effect size *d*: .5

α err prob: .05

Power ($1 - \beta$ err prob): .8

Allocation ratio N2/N1: 1

- With these input parameters, the power analysis indicates a total sample size of 128 participants (64 in each group) is needed in order to detect a significant difference between groups in burnout symptoms.

- At the end of the participants section, it is helpful to provide a formal experimental design statement that specifies the independent variables and their corresponding levels. For example, a formal design statement might read, "The experiment consisted of a one-way two-groups design comparing burnout symptoms between full-time and part-time nurses."

Variables

The variables need to be specified in the formal design statement and described (in detail) in the procedure section of the experimental method plan. Here are some suggestions for developing ideas about variables in a proposal:

- Clearly identify the independent variables in the experiment (recall the discussion of variables in Chapter 3) and how they will be manipulated in the study. One common approach is to conduct a 2 × 2 between-subjects factorial design in which two independent variables are manipulated in a single experiment. If this is the case, it is important to clarify how and when each independent variable is manipulated.

- Include a manipulation check measure that evaluates whether your study successfully manipulated the independent variable(s) of interest. A **manipulation check measure** is defined as a measure of the intended manipulated variable of interest. For example, if a study aims to manipulate self-esteem by offering positive test feedback (high self-esteem condition) or negative test feedback (low self-esteem condition) using a performance

task, it would be helpful to quantitatively evaluate whether there are indeed self-esteem differences between these two conditions with a manipulation check measure. After this self-esteem study manipulation, a researcher may include a brief measure of state self-esteem as a manipulation check measure prior to administering the primary outcome measures of interest.

- Identify the dependent variable or variables (i.e., the outcomes) in the experiment. The dependent variable is the response or the criterion variable presumed to be caused by or influenced by the independent treatment conditions. One consideration in the experimental method plan is whether there are multiple ways to measure outcome(s) of interest. For example, if the primary outcome is aggression, it may be possible to collect multiple measures of aggression in your experiment (e.g., a behavioral measure of aggression in response to a provocation, self-reported perceptions of aggression).
- Identify other variables to be measured in the study. Three categories of variables are worth mentioning. First, include measures of participant demographic characteristics (e.g., age, gender, ethnicity). Second, measure variables that may contribute noise to the study design. For example, self-esteem levels may fluctuate during the day (and relate to the study outcome variables of interest) and so it may be beneficial to measure and record time of day in the study (and then use it as a covariate in study statistical analyses). Third, measure variables that may be potential confounding variables. For example, a critic of the self-esteem manipulation may say that the positive/negative performance feedback study manipulation also unintentionally manipulated rumination, and it was this rumination that is a better explanation for study results on the outcomes of interest. By measuring rumination as a potential confounding variable of interest, the researcher can quantitatively evaluate this critic's claim.

Instrumentation and Materials

Just like in a survey method plan, a sound experimental study plan calls for a thorough discussion about the instruments used—their development, their items, their scales, and reports of reliability and validity of scores on past uses. However, an experimental study plan also describes in detail the approach for manipulating the independent variables of interest:

- Thoroughly discuss the materials used for the manipulated variable(s) of interest. One group, for example, may participate in a special computer-assisted learning plan used by a teacher in a classroom. This plan might involve handouts, lessons, and special written instructions to help students in this experimental group learn how to study a subject using computers. A pilot test of these materials may also be discussed, as well as any training required to administer the materials in a standardized way.
- Often the researcher does not want participants to know what variables are being manipulated or the condition they have been assigned to (and sometimes what the primary outcome measures of interest are). It is important, then, to draft a *cover story* that will be used to explain the study and procedures to participants during the experiment. If any deception is used in the study, it is important to draft a suitable debriefing approach and to get all procedures and materials approved by your institution's IRB (see Chapter 4).

Experimental Procedures

The specific experimental design procedures also need to be identified. This discussion involves indicating the overall experiment type, citing reasons for the design, and advancing a visual model to help the reader understand the procedures.

- Identify the type of experimental design to be used in the proposed study. The types available in experiments are pre-experimental designs, quasi-experiments, and true experiments. With pre-experimental designs, the researcher studies a single group and implements an intervention during the experiment. This design does not have a control group to compare with the experimental group. In quasi-experiments, the investigator uses control and experimental groups, but the design may have partial or total lack of random assignment to groups. In a *true experiment,* the investigator randomly assigns the participants to treatment groups. A **single-subject design** or *N* of 1 design involves observing the behavior of a single individual (or a small number of individuals) over time.
- Identify what is being compared in the experiment. In many experiments, those of a type called between-subject designs, the investigator compares two or more groups (Keppel & Wickens, 2003; Rosenthal & Rosnow, 1991). For example, a factorial design

experiment, a variation on the between-group design, involves using two or more treatment variables to examine the independent and simultaneous effects of these treatment variables on an outcome (Vogt & Johnson, 2015). This widely used experimental design explores the effects of each treatment separately and also the effects of variables used in combination, thereby providing a rich and revealing multidimensional view. In other experiments, the researcher studies only one group in what is called a within-group design. For example, in a repeated measures design, participants are assigned to different treatments at different times during the experiment. Another example of a within-group design would be a study of the behavior of a single individual over time in which the experimenter provides and withholds a treatment at different times in the experiment to determine its impact. Finally, studies that include both a between-subjects and a within-subjects variable are called mixed designs.

- Provide a diagram or a figure to illustrate the specific research design to be used. A standard notation system needs to be used in this figure. As a **research tip**, we recommend using the classic notation system provided by Campbell and Stanley (1963, p. 6):
    - *X* represents an exposure of a group to an experimental variable or event, the effects of which are to be measured.
    - *O* represents an observation or measurement recorded on an instrument.
    - *X*s and *O*s in a given row are applied to the same specific persons. *X*s and *O*s in the same column, or placed vertically relative to each other, are simultaneous.
    - The left-to-right dimension indicates the temporal order of procedures in the experiment (sometimes indicated with an arrow).
    - The symbol *R* indicates random assignment.
    - Separation of parallel rows by a horizontal line indicates that comparison groups are not equal (or equated) by random assignment. No horizontal line between the groups displays random assignment of individuals to treatment groups.

In Examples 8.2–8.5, this notation is used to illustrate pre-experimental, quasi-experimental, true experimental, and single-subject designs.

Example 8.2 Pre-experimental Designs

One-Shot Case Study

This design involves an exposure of a group to a treatment followed by a measure.

Group A X_____O

One-Group Pretest-Posttest Design

This design includes a pretest measure followed by a treatment and a posttest for a single group.

Group A O1————X————O2

Static Group Comparison or Posttest-Only With Nonequivalent Groups

Experimenters use this design after implementing a treatment. After the treatment, the researcher selects a comparison group and provides a posttest to both the experimental group(s) and the comparison group(s).

Group A X_____O

Group B _____O

Alternative Treatment Posttest-Only With Nonequivalent Groups Design

This design uses the same procedure as the Static Group Comparison, with the exception that the nonequivalent comparison group received a different treatment.

Group A X1_____O

Group B X2_____O

Example 8.3 Quasi-experimental Designs

Nonequivalent (Pretest and Posttest) Control-Group Design

In this design, a popular approach to quasi-experiments, the experimental Group A and the control Group B are selected without random assignment. Both groups take a pretest and posttest. Only the experimental group receives the treatment.

Group A O————X————O

_____

Group B O————————O

Single-Group Interrupted Time-Series Design

In this design, the researcher records measures for a single group both before and after a treatment.

Group A O—O—O—O—X—O—O—O—O

Control-Group Interrupted Time-Series Design

This design is a modification of the Single-Group Interrupted Time-Series design in which two groups of participants, not randomly assigned, are observed over time. A treatment is administered to only one of the groups (i.e., Group A).

Group A O—O—O—O—X—O—O—O—O

_____

Group B O—O—O—O—O—O—O—O—O

Example 8.4 True Experimental Designs

Pretest–Posttest Control-Group Design

A traditional, classical design, this procedure involves random assignment of participants to two groups. Both groups are administered both a pretest and a posttest, but the treatment is provided only to experimental Group A.

Group A R——O——X——O

Group B R——O——O

Posttest-Only Control-Group Design

This design controls for any confounding effects of a pretest and is a popular experimental design. The participants are randomly assigned to groups, a treatment is given only to the experimental group, and both groups are measured on the posttest.

Group A R——X——O

Group B R——O

Solomon Four-Group Design

A special case of a 2 × 2 factorial design, this procedure involves the random assignment of participants to four groups. Pretests and treatments are varied for the four groups. All groups receive a posttest.

Group A R——O——X——O

Group B R——O——O

Group C R——X——O

Group D R——O

Example 8.5 Single-Subject Designs

A-B-A Single-Subject Design

This design involves multiple observations of a single individual. The target behavior of a single individual is established over time and is referred to as a baseline behavior. The baseline behavior is assessed, the treatment provided, and then the treatment is withdrawn.

Baseline A Treatment B Baseline A

O–O–O–O–O–O–X–X–X–X–X–X–O–O–O–O–O–O–O

Threats to Validity

There are several threats to validity that will raise questions about an experimenter's ability to conclude that the manipulated variable(s) of interest affect an outcome and not some other factor. Experimental researchers need to identify potential threats to the internal validity of their experiments and design them so that these threats will not likely arise or are minimized. There are two types of threats to validity: (a) internal threats and (b) external threats.

- **Internal validity threats** are experimental procedures, treatments, or experiences of the participants that threaten the researcher's

ability to draw correct inferences from the data about the population in an experiment. Table 8.5 displays these threats, provides a description of each one of them, and suggests potential responses by the researcher so that the threat may not occur. There are those involving participants (i.e., history, maturation, regression, selection, and mortality), those related to the use of an experimental treatment that the researcher manipulates (i.e., diffusion, compensatory and resentful demoralization, and compensatory rivalry), and those involving procedures used in the experiment (i.e., testing and instruments).

Table 8.5 Types of Threats to Internal Validity

Type of Threat to Internal Validity	Description of Threat	In Response, Actions the Researcher Can Take
History	Because time passes during an experiment, events can occur that unduly influence the outcome beyond the experimental treatment.	The researcher can have both the experimental and control groups experience the same external events.
Maturation	Participants in an experiment may mature or change during the experiment, thus influencing the results.	The researcher can select participants who mature or change at the same rate (e.g., same age) during the experiment.
Regression to the mean	Participants with extreme scores are selected for the experiment. Naturally, their scores will probably change during the experiment. Scores, over time, regress toward the mean.	A researcher can select participants who do not have extreme scores as entering characteristics for the experiment.
Selection	Participants can be selected who have certain characteristics that predispose them to have certain outcomes (e.g., they are brighter).	The researcher can select participants randomly so that characteristics have the probability of being equally distributed among the experimental groups.
Mortality (also called study attrition)	Participants drop out during an experiment due to many possible reasons. The outcomes are thus unknown for these individuals.	A researcher can recruit a large sample to account for dropouts or compare those who drop out with those who continue—in terms of the outcome.
Diffusion of treatment (also called cross contamination of groups)	Participants in the control and experimental groups communicate with each other. This communication can influence how both groups score on the outcomes.	The researcher can keep the two groups as separate as possible during the experiment.
Compensatory/ resentful demoralization	The benefits of an experiment may be unequal or resented when only the experimental group receives the treatment (e.g., experimental group receives therapy and the control group receives nothing).	The researcher can provide benefits to both groups, such as giving the control group the treatment after the experiment ends or giving the control group some different type of treatment during the experiment.

Type of Threat to Internal Validity	Description of Threat	In Response, Actions the Researcher Can Take
Compensatory rivalry	Participants in the control group feel that they are being devalued, as compared to the experimental group, because they do not experience the treatment.	The researcher can take steps to create equality between the two groups, such as reducing the expectations of the control group or clearly explaining the value of the control group.
Testing	Participants become familiar with the outcome measure and remember responses for later testing.	The researcher can have a longer time interval between administrations of the outcome or use different items on a later test than were used in an earlier test.
Instrumentation	The instrument changes between a pretest and posttest, thus impacting the scores on the outcome.	The researcher can use the same instrument for the pretest and posttest measures.

Source: Adapted from Creswell (2012).

- Potential threats to external validity also must be identified and designs created to minimize these threats. **External validity threats** arise when experimenters draw incorrect inferences from the sample data to other persons, other settings, and past or future situations. As shown in Table 8.6, these threats arise because of the characteristics of individuals selected for the sample, the uniqueness of the setting, and the timing of the experiment. For example, threats to external validity arise when the researcher generalizes beyond the groups in the experiment to other racial or social groups not under study, to settings not examined, or to past or future situations. Steps for addressing these potential issues are also presented in Table 8.6.
- Other threats that might be mentioned in the method section are the threats to **statistical conclusion validity** that arise when experimenters draw inaccurate inferences from the data because of inadequate statistical power or the violation of statistical assumptions. Threats to construct validity occur when investigators use inadequate definitions and measures of variables.

Practical **research tips** for proposal writers to address validity issues are as follows:

- Identify the potential threats to validity that may arise in your study. A separate section in a proposal may be composed to advance this threat.
- Define the exact type of threat and what potential issue it presents to your study.

- Discuss how you plan to address the threat in the design of your experiment.
- Cite references to books that discuss the issue of threats to validity, such as Cook and Campbell (1979); Shadish, Cook, & Campbell (2001); and Tuckman (1999).

The Procedure

A researcher needs to describe in detail the sequential step-by-step procedure for conducting the experiment. A reader should be able to clearly understand the cover story, the design being used, the manipulated variable(s) and outcome variable(s), and the timeline of activities. It is also important to describe steps taken to minimize noise and bias in the experimental procedures (e.g., "To reduce the risk of experimenter bias, the experimenter was blind to the participant's study condition until all outcome measures were assessed.").

- Discuss a step-by-step approach for the procedure in the experiment. For example, Borg and Gall (2006) outlined steps typically used in the procedure for a pretest-posttest control group design with matching participants in the experimental and control groups:
  1. Administer measures of the dependent variable or a variable closely correlated with the dependent variable to the research participants.

Table 8.6 Types of Threats to External Validity

Types of Threats to External Validity	Description of Threat	In Response, Actions the Researcher Can Take
Interaction of selection and treatment	Because of the narrow characteristics of participants in the experiment, the researcher cannot generalize to individuals who do not have the characteristics of participants.	The researcher restricts claims about groups to which the results cannot be generalized. The researcher conducts additional experiments with groups with different characteristics.
Interaction of setting and treatment	Because of the characteristics of the setting of participants in an experiment, a researcher cannot generalize to individuals in other settings.	The researcher needs to conduct additional experiments in new settings to see if the same results occur as in the initial setting.
Interaction of history and treatment	Because results of an experiment are time-bound, a researcher cannot generalize the results to past or future situations.	The researcher needs to replicate the study at later times to determine if the same results occur as in the earlier time.

Source: Adapted from Creswell (2012).

2. Assign participants to matched pairs on the basis of their scores on the measures described in Step 1.
3. Randomly assign one member of each pair to the experimental group and the other member to the control group.
4. Expose the experimental group to the experimental treatment and administer no treatment or an alternative treatment to the control group.
5. Administer measures of the dependent variables to the experimental and control groups.
6. Compare the performance of the experimental and control groups on the posttest(s) using tests of statistical significance.

Data Analysis

Tell the reader about the types of statistical analyses that will be implemented on the dataset.

- Report the descriptive statistics. Some descriptive statistics that are commonly reported include frequencies (e.g., how many male and female participants were in the study?), means and standard deviations (e.g., what's the mean age of the sample; what are the group means and corresponding standard deviation values for the primary outcome measures?).
- Indicate the inferential statistical tests used to examine the hypotheses in the study. For experimental designs with categorical information (groups) on the independent variable and continuous information on the dependent variable, researchers use *t* tests or univariate analysis of variance (ANOVA), analysis of covariance (ANCOVA), or multivariate analysis of variance (MANOVA—multiple dependent measures). (Several of these tests are mentioned in Table 8.3, which was presented earlier.) In factorial designs where more than one independent variable is manipulated, you can test for main effects (of each independent variable) and interactions between independent variables. Also, indicate the practical significance by reporting effect sizes and confidence intervals.
- For single-subject research designs, use line graphs for baseline and treatment observations for abscissa (horizontal axis) units of time and the ordinate (vertical axis) target behavior. Researchers plot each data point separately on the graph, and connect the data points with lines (e.g., see Neuman & McCormick, 1995). Occasionally, tests of statistical significance, such as *t* tests, are used to compare the pooled mean of the baseline and the treatment phases, although such procedures may violate the assumption of independent measures (Borg & Gall, 2006).

Interpreting Results and Writing a Discussion Section

The final step in an experiment is to interpret the findings in light of the hypotheses or research questions and to draft a discussion section. In this interpretation, address whether the hypotheses or questions were supported or whether they were refuted. Consider whether the independent variable manipulation was effective (a manipulation check measure can be helpful in this regard). Suggest why the results were significant, or why they were not, linking the new evidence with past literature (Chapter 2), the theory used in the study (Chapter 3), or persuasive logic that might explain the results. Address whether the results might have been influenced by unique strengths of the approach, or weaknesses (e.g., threats to internal validity), and indicate how the results might be generalized to certain people, settings, and times. Finally, indicate the implications of the results, including implications for future research on the topic.

Example 8.6 is a description of an experimental method plan adapted from a value affirmation stress study published by Creswell and colleagues (Creswell et al., 2005).

Example 8.6 An Experimental Method Plan

This study tested the hypothesis that thinking about one's important personal values in a self-affirmation activity could buffer subsequent stress responses to a laboratory stress challenge task. The specific study hypothesis was that the self-affirmation group, relative to the control group, would have lower salivary cortisol stress hormone responses to a stressful performance task. Here we highlight a plan for organizing the methodological approach for conducting this study. For a full description of the study methods and findings, see the published paper (Creswell et al., 2005).

Method

Participants

A convenience sample of eighty-five undergraduates will be recruited from a large public university on the west coast, and compensated with course credit or $30. This sample size is justified based on a power analysis conducted prior to data collection with the software program G*Power (Faul et al., 2007; Faul et al., 2009), based on [specific input parameters described here for the power analysis]. Participants will be eligible to participate if they meet the following study criteria [list study inclusion and exclusion criteria here]. All study procedures have been approved by the University of California, Los Angeles Institutional Review Board, and participants will provide written informed consent prior to participating in study related activities.

The study is a 2 × 4 mixed design, with value affirmation condition as a two-level between subjects variable (condition: value affirmation or

control) and time as a four-level within-subjects variable (time: baseline, 20 minutes post-stress, 30 minutes post-stress, and 45 minutes post-stress). The primary outcome measure is the stress hormone cortisol, as measured by saliva samples.

Procedure

To control for the circadian rhythm of cortisol, all laboratory sessions will be scheduled between the hours of 2:30 pm and 7:30 pm. Participants will be run through the laboratory procedures one at a time. The cover story consists of telling participants that the study is interested in studying physiological responses to laboratory performance tasks.

Upon arrival all participants will complete an initial values questionnaire where they will rank order five personal values. After a 10-minute acclimation period, participants will provide a baseline saliva sample, for the assessment of salivary cortisol levels. Participants will then receive instructions on the study tasks and then will be randomly assigned by the experimenter (using a random number generator) to either a value affirmation or control condition, where they will be asked to [description of the value affirmation independent variable manipulation here, along with the subsequent manipulation check measure]. All participants will then complete the laboratory stress challenge task [description of the stress challenge task procedures for producing a stress response here]. After the stress task, participants will complete multiple post-stress task questionnaire measures [describe them here], and then provide saliva samples at 20, 30, and 45 minutes post-stress task onset. After providing the last saliva sample, participants will be debriefed, compensated, and dismissed.

SUMMARY

This chapter identified essential components for organizing a methodological approach and plan for conducting either a survey or an experimental study. The outline of steps for a survey study began with a discussion about the purpose, the identification of the population and sample, the survey instruments to be used, the relationship between the variables, the research questions, specific items on the survey, and steps to be taken in the analysis and the interpretation of the data from the survey. In the design of an experiment, the researcher identifies participants in the study, the variables—the manipulated variable(s) of interest and the outcome variables—and the instruments used. The design also includes the specific type of experiment, such as a pre-experimental, quasi-experimental, true experiment, or single-subject design. Then the researcher draws a figure to illustrate the design, using appropriate notation. This is followed by comments about potential threats to internal and external validity (and possibly statistical and construct validity) that relate to the experiment, the statistical analyses used to test the hypotheses or research questions, and the interpretation of the results.