

Step 4: Selecting and Justifying Your Research Design

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Introduction

Before any great building is constructed, the builder analyses the situation and chooses building type. Once the type of building is identified, the builder begins sketching out the plans, setting a schedule, and obtaining the needed permits and materials. Consider Frank Lloyd Wright's Fallingwater. Wright didn't just start stacking bricks upon bricks and arrive at his creation, the construction of Fallingwater. He analyzed the various landforms, identified the type of building he desired to build, and designed the building on paper prior to the first stone being laid. That is, the genius of the building had already been realized prior to construction.

Similarly, prior to conducting research, you need to identify a design or structure and then "sketch" the plan out (e.g. sampling, method of data collection, etc.). A research design guides decisions that need to be made about conducting the research, for example:

- when and how often to collect data
- what data to gather and from whom
- how to analyze the data

Here we talk about several different quantitative research designs. We discuss when and why a design is chosen. You will then identify the design that is most appropriate for your research and justify why it is the best choice. You do however need to read research texts to fully understand research designs and justify your choice. Some research studies use mixed designs, so more than one design can be chosen.

A mixed method approach, that is using both a quantitative and qualitative design, may also be chosen. A mixed methods approach requires that you conduct a full quantitative and a full qualitative study. In essence, if this approach is chosen, you are committing to conduct two studies. Here we will only focus on quantitative research designs.

Topical Discussion: Research Designs

There are two primary types of quantitative research, descriptive, which asks, "What is going on?" and explanatory, which asks, "Why is it going on?" As such, there are research designs that are descriptive and explanatory. Since researchers have posed numerous quantitative research designs, both descriptive and explanatory, and they are too numerous to cover, we will focus our attention primarily on the major designs proposed by both Campbell and Stanley (1963) and Crowl (1993). We will examine the purpose of each design and reasons why educational researchers choose specific designs. Figure 1 below overviews the different designs.

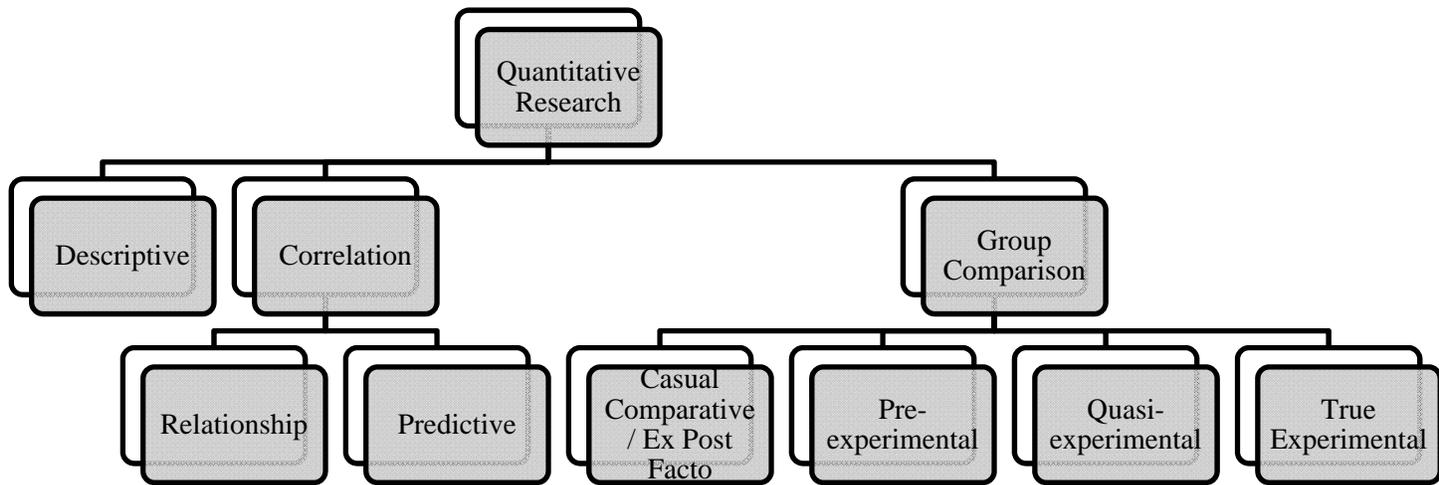


Figure 1. Research designs.

Descriptive Designs.

Purpose: The aim of descriptive studies is to understand what is in a specific situation with an identified population.

For example, an educational researcher may want to know, What is the attitude of school counselors about the use of Response to Intervention (RtI)? Or What responsibilities do school counselors have in RtI as implemented in their school? The researcher does not attempt to manipulate or exert control over the phenomenon being studied, rather he or she observes and measures it as it occurs. The researcher does not seek to examine a causal relationship between variables; thus, there are no independent or dependent variables in a descriptive study. Descriptive studies are often used to gain knowledge to identify a problem for further, more sophisticated research. Descriptive studies vary in rigor; thus, if conducting research for a thesis or dissertation, it is important to know the university policy on the use of descriptive studies for such endeavors.

There are two types of descriptive studies. These types are often referred to as survey or observational research:

- **Longitudinal designs** include the study a population over a period of time. This includes trend studies, cohort studies, and panel studies.
- **Cross sectional designs** include the study of individuals (usually an attitude or belief) at one point in time.

Ex Post Facto Designs.

Purpose: To examine the possible cause and effect relationship between variables that exist.

A casual comparative design is an ex post facto research, non-experimental design that is often used in educational research for exploratory purposes. A phenomena is studied after the fact; that is, after it occurred naturally or was already manipulated. For example, a researcher may want to examine male and female differences or drop out and non-drop out differences. The researcher may ask, is there a difference in male and female university students' social presence while participating in a 8 week online course? So, like descriptive studies, the researcher does not attempt to manipulate or exert control over the phenomenon being studied. However, unlike descriptive studies, the researcher does seek to examine a possible cause and effect relationship between variables; thus, there is an independent or dependent variable. Note that I said "possible" cause and effect. Due to the fact that extraneous variables are not controlled for in this design, the results of the research can only suggest that one variable may cause another. A more rigorous experimental design is needed to verify the results.

A casual comparative design is usually chosen by a researcher in order to gain information about a phenomena in which little is known. It also used when the researcher finds it too difficult, unethical, or impossible to manipulate the independent variable. And, although you will note that a causal-comparative design, is almost identical to a pre-experimental design, it is considered more creditable as long as selection threats to validity are addressed and different groups that are studied are as homogeneous as possible on all variables except the one under study.

Correlational Designs.

Purpose: Correlational research examines the extent to which two or more variables relate to one another.

For example, a researcher may desire to know if a relationship exists between high school GPA and College Board SAT scores or if SAT scores can predict college GPA. Some researchers consider correlational research, observational research as the researcher does not manipulate any variables. In the example, the researcher would only need to collect students' GPA and SAT scores to conduct his or her study.

As the questions imply, correlational research designs include both prediction studies and relationship studies. The variables in a prediction study are referred to as the predictor and criterion, and the researcher is concerned with whether one or more variables can predict another variable. The variables in a relationship study are referred to as variables of interest, and researcher is concerned with how the variables understudy relate.

The researcher who chooses to conduct correlational research is simply examining if a relationship between or among variables exists. The researcher cannot make statements about any cause and effect relationships because he or she does not know the direction of the cause and cannot guarantee that another variable in not influencing the relationship between variables.

Researchers often choose to conduct correlational research as exploratory or beginning research to determine if more rigorous research is warranted. If a correlational design is chosen, the

researcher needs to ensure that a theoretical or conceptual rationale for each variable under study is presented. The results of a correlational study demonstrate whether or not the variables relate. Experimental research is needed to determine if a cause and effect relationship exists.

Before discussing experimental designs, it is noteworthy to mention that some research texts refer to or group correlational and causal comparative research designs with in their discussion of observational designs. Sometimes these designs are also discussed using different terminology.

For example, Kazdin (2003) delineates between experimental and observational studies. He purports that the distinguishing characteristic between these two types of study is manipulation. In an experimental study, a researcher manipulates a variable of interest; whereas, in an observational study, a researcher observes the variable of interest and its associations.

Kazdin (2003) discusses two types of observational studies:

- **Case-control design** is defined as design in which a researcher studies a variable of interest by forming groups who vary on that variable. For example, a researcher may want to examine male and female differences or drop out and non-drop out differences. The researcher may ask, Is there a difference in male and female university students' social presence while participating in an 8-week online course? This design is extremely useful in to gain information about a phenomena in which little is known. It often used when the researcher finds it too difficult, unethical, or impossible to manipulate the variable of interest. However, it is important to note that due to the presence of extraneous variables not controlled for in this design, the results of the research can only suggest possible cause and effect or association. Strong inference cannot be drawn. A more rigorous experimental design is needed to verify the results. Kazdin (2003) discusses a two primary variations of case-control designs.
 - **Cross-sectional** – a study in which participants are selected assessed on a current or present variable of interest. “The goal of a cross-sectional case-control study is to examine factors that are associated with a particular characteristic of interest” (Kazdin, 2003, p.236)
 - **Retrospective** - a study in which participants are selected assessed on a past variable of interest (e.g. birth-order, attachment, etc). “designed to draw inference about some antecedent condition, that has resulted in, or is associated with, the outcome” (Kazdin, 2003, p.581)
- **Cohort design** is defined as a study that examines intact groups over a period (also referred to a longitudinal study). These designs are beneficial in studying the relationship between an antecedent phenomena and a corresponding outcome. There are three primary variations of this design:

- a. **Single –group cohort design-** a study that identifies a group of participants and assesses them at minimum at two periods in time (e.g. 3 months and one year)
- b. **Mutigroup cohort design** - a study that identifies two or more groups of participants and assesses them at minimum at two periods in time
- c. **Accelerated, mutigroup cohort design** - a study that examines two or more cohorts, each exemplifying a time frame of interest (e.g. adolescents, young adults, middle aged adults).

Experimental Deigns.

Campbell and Stanley (1963) purported that there are 3 types of experimental studies:

- Pre-experimental
- True experimental
- Quasi-experimental

The distinguishing characteristic of all experimental designs is the researcher's manipulation of the independent variable.

In the examples below, the following key will be used: This is the key commonly used in research texts and is taken from Campbell and Stanley (1963):

- X reflects exposure to treatment
- O reflects the observation or measurement
- Multiple rows reflect multiple groups.
- R reflects that the group(s) are were randomly assigned

Pre-experimental Designs

Purpose: To obtain preliminary research data to determine the effectiveness of an intervention or treatment.

Pre-experimental designs are distinguished as separate from quasi experimental design in some research texts and not in other. For example, Campbell and Stanly (1963) identify them as a type of experimental design, but Borg, Borg, and Gall (2003) do not.

Pre experimental designs are weak in structure and control. In fact, Campbell and Stanley (1963) say that these designs have little value. Their primary value is to gather data about a variable of interest in which little is known so that the researcher can develop and implement a more robust study. At most universities, pre- experimental designs are not considered rigorous enough for the purpose of a dissertation study. A research desiring to conduct a pre-experimental design may ask, Does parents' scores on the Parenting Skill Assessment increase after participation in the Successful Parenting Program?

Example pre-experimental designs include:

- One shot Case Study
 - X O
- One Group Pretest-Post
 - O X O
- Post Test only Non-equivalent Group Design
 - X O
 - O

Quasi-experimental Designs

Purpose: To determine the causality of an intervention or treatment with the target population.

Quasi-experimental designs allow the researcher to control the treatment, but they do not include the random assignment of participants. Quasi-experimental designs use existing groups; thus, they are often more convenient and less disruptive than a true experimental design. Researchers often choose to conduct this design when it is impossible to conduct a true experimental design. A researcher conducting a quasi-experimental design may ask, What effect does participation in a math lesson developed using problem based pedagogy have on second grade students' math achievement scores when compared to participation in a math lesson developed using traditional pedagogy? Mrs. Smith class, which has been formed, would receive a lesson developed using problem based pedagogy. Mr. Jones' class, which has been formed, would receive a lesson developed using traditional pedagogy

Since a quasi experimental design uses groups that have been previously formed, a researcher needs to ensure that the groups are relatively similar to one another (e.g. Mrs. Smith's and Mr. Jones' classes are similar in terms of students' gender, ethnicity, and classification for special education services.), extraneous variables identified and controlled, and that results about causal relationships are discussed with caution.

Example quasi-experimental designs include:

- Interrupted time-series design (with and without control)
 - O O X O O
 - O O O O
- Nonequivalent group design
 - O X O
 - O O
- Counterbalanced design
 - X(1)O X(2)O X(3)O
 - X(2)O X(3)O X(1)O
 - X(3)O X(2)O X(1)O

True Experimental Designs

True experimental designs are characterized by 3 things:

1. **Manipulation**- The researcher manipulates the independent variable or implements the intervention and observes the effect on the dependent variable.
2. **Control** – A control or comparison group is any group that does not serve as the treatment group or does not receive the experimental treatment. Their performance on the dependent variable serves as a comparison basis for the experimental group's performance on the dependent variable. Their purpose is to control for threats to validity. A control group is important as scientific evidence requires at least one comparison (Campbell & Stanley, 1963).

There are different types of control groups. Kazdin (2003) list the following types of control groups:

- No-treatment control groups
- Waiting-list control groups
- No-contact control groups
- Non-specific treatment control groups
- Routine or standard treatment control groups
- Yoked control groups
- Nonequivalent control groups

The type of group you choose to use in your research study, if you are doing a group comparison design, depends upon three factors (Kazdin, 2003, p. 200): (a) the intent of the research study, (b) previous research, and (c) ethical and practical considerations. The researcher's purpose in conducting the study informs the precise type of group that should be chosen. For example, if the intent of the study is to determine the effectiveness of a treatment and simply control for threats to internal validity, a no-treatment control group or wait-list control group may be chosen. Where as, if the research desires to understand what about a specific treatment influence the outcome as well as control for threats to internal validity, a non-specific treatment control group may be used. Previous research may demonstrate that the presence of a control group is or is not necessary. Additionally, practical issues such as procuring participants and drop out need to be considered. For example, participants in a wait-list control, knowing they will receive treatment, may be less likely to drop out than no-treatment control group participants who are not waiting for a treatment. Ethical issues are also a concern. Ethical concerns include withholding treatment, deception, etc. For example, in a study about depression, providing no treatment or delayed treatment for individuals who have been identified as severely depressed is not ethical.

Kazdin (2003) provides a discussion that outlines how to match the intent of the study with the type of control or comparison group needed. He discussed this in terms of treatment strategies and questions related to each treatment strategy. If you plan to complete a group comparison study, Kazdin (2003) is a good resource to read.

3. **Randomization** – Participants are assigned to groups on a random basis, meaning that every participant has an equal chance of being assigned to any group. Randomization allows you to assume group equivalence; however, without a pretest, group equivalence is not certain. The introduction of a pretest can introduce threats to internal validity. Since Campbell and Stanley purport that group equivalence is likely and is safe to assume with random assignment; however, other sources recommend a pretest. This is one of the many considerations that you as a researcher will need to make if you decide to conduct a true experimental design.

The element of randomization is what distinguishes a true experimental design from a quasi-experimental design. The purpose of a true experimental design is to examine the cause and effect relationship between variables. According to Campbell and Stanley (1963), the experimental design controls for most threats to internal validity. It is considered the most rigorous design.

Example true experimental designs include:

- Post test only design
 - R X O
 - R O
- Pre test Post test equivalent group design
 - RO X O
 - RO O
- Solomon four
 - R X O
 - R O
 - RO X O
 - RO O

There are additional quantitative designs:

- **Instrument Development-** Developing an instrument and conducting statistical analysis for validity and reliability is a quantitative study.
- **Quantitative Content Analysis -** If you desire to analyze communication, such as discussion forums, lesson plans, websites, a quantitative content analysis may be an appropriate choice. It is an empirical method for analyzing communication in a systematic manner. Ole R. Holsti (1969) defines quantitative content analysis as “any technique for making inferences by objectively and systematically identifying specified characteristics of messages.” Bernhard Berelson (1952) defines it as “a research technique for the objective, systematic and quantitative description of the manifest content of communication.” If you are planning to analyze communication Berelson (1952) and Holsti (1969) are two classic references you may want to “check out.”

- **Case studies** –There are two methodological extremes when it comes to case studies. There are the:
 - **Uncontrolled anecdotal case study**, which are cases in which valid inference cannot be drawn (e.g. Little Hans)
 - **Single subject experimental designs**, which are designs in which valid inference can be drawn from because they are set up in a manner to that allows for the control of most threats to internal validity. The subject serves as his or her own control.

If your passion is your small group of special education students or counseling population, you may want to consider the latter, a single subject design. It is a valid research design that is often used when studying a small population. It is typically used when the researcher wants to study a change in behavior as a result of a treatment. For example, Wasson (2003) studies the effect of type of transparencies on reading for a special education population. This design is similar to a time series design and each participant serves as their own control and is observed repeatedly. Usually a baseline is established by observing a participant prior to the treatment. Then treatment is introduced and behavior is observed.

The key characteristics of single subject experimental designs include:

- **Continuous or repeated assessment**- multiple observations over a period. This includes before the intervention is applied, while it is being applied, and after it is applied. These observations are the basis for examining and evaluating the data.
- **Baseline assessment**- the continuous assessment that occurs prior to the implementation of the intervention. It serves two primary functions:
 - **Descriptive** - the extent of the current situation
 - **Predictive** – the predicted level of performance in the near future based on the current performance. (E.g., what would the individual's future performance be without the intervention?)
- **Performance stability or variation**- the variation of the participant's performance over time. The rate is stable when there is little to no variation. This is often determined by analyzing the slope (trend of the performance) of the data; there is usually no slope, an accelerated slope (i.e. increase, or decelerating slope (i.e. decrease)

There are three primary single subject experimental designs exist:

- **ABAB designs**- a design in which continuous assessment is made over a period of time as changes are made in the experimental conditions, more specifically:
 - Baseline (A)
 - Intervention (B)
 - These phases are alternated (e.g. ABA, ABAB, AB1B2AB2) and it is important that a stable level of behavior is maintained at each phase before progressing to the next.
 - The primary challenge to this design is that it requires reversal or reverting back to baseline after the intervention is implemented. Often counselor and education researchers do not desire for individuals to return to baseline after implementation of the intervention.

- **Multiple Baseline designs** – are designs that “demonstrate the effect of an intervention by showing that behavior change accompanies introduction of the intervention at different points in time” (Kazdin, 2003, p.283). In this design, behaviors are observed at baseline. After the baseline is stable, an intervention is implemented in one condition. The other conditions are kept at pretreatment, while the initial response to the intervention under the one condition is measured. Once this response stabilizes, the intervention is applied to the second condition. Three different types of conditions often used in this design: (a) different behaviors of the same individual, (b) different individuals, (c) different environments.
- **Changing-criterion designs** – this design includes the examination of performance after the implementation of the treatment.

If a single subject design is chosen, it is important to note that data analysis for single subject experimental designs is not consistent with the analysis used for most experimental designs (as we will discuss in a latter lesson). Most commonly, a non-statistical analysis, visual inspection is used. However, there are also statistical procedures some single subject researchers use. It is important to read primary text sources on this design if it is used (e.g. Barlow & Hersen, 1984; Kazdin, 1982; Kennedy, 2005; Kratochwill, 1978).

Only a brief review of quantitative research designs is presented here. Since an in-depth discussion of quantitative research designs is beyond the scope of this work book, it is recommended that you depth consult research texts such as those written by Campbell and Stanley (1963), Cook and Campbell (1979), Field and Hole (2003), Reichardt & Mark (1998), Boruch (1998), or Borg, Borg, and Gall (2007). Many of these texts not only provide a more in-depth discussion of these designs, but they also extend the design discussion.

Topical Discussion: Choosing and Justifying Your Research Design

When you are choosing a research design, you need to consider the following:

- ▶ Am I concerned with relationship or difference between variables?
- ▶ Will I manipulate the independent variable?
- ▶ Will I use a control group?
- ▶ Will my subjects be randomly assigned?
- ▶ Which design is feasible and best controls for threats to internal validity?
- ▶ What have previous studies used? And, what type of study is previous research recommending?

These questions can assist you in identifying the most appropriate research design. Once your design is chosen, you need to identify it and justify it using appropriate research texts for support. The identification and justification is what you write in the research design section of your research plan.

When you identify your design, you need to be as specific as possible. For example, it is not sufficient to state that a quasi-experimental study was conducted. It would be more appropriate to state that a pretest- posttest non-equivalent control group design was conducted. Remember that the chosen research design(s) should be consistent with the research question and hypothesis. And, sometimes more than one research design is appropriate.

Here are some examples of sentences you might write to identify your design:

“A causal comparative research design will be used to determine if students’ social presence (SP), cognitive presence (CP), teaching presence (TP), and perceived learning differed based upon the type of CMC system used in the online courses.” (Szapkiw, 2009, p.)”

“A quasi-experimental non-equivalent group research design will be used for the study. Two instructors will each teach two classes, one in the morning and one in the afternoon. The assignment of the effort condition will be random by class, so that the two levels of the condition for the book and chapter will be counterbalanced for teacher and time of day. Each instructor will give a high effort assignment to one class for the book and a low effort assignment for the book to the other class. The opposite assignments will be given to each class for the chapter. The second independent variable, high praise or no praise feedback will be administered randomly by student in each of the effort conditions.”

A rationale for why the chosen design(s) is most appropriate for the study is needed. This rationale needs to be supported by research literature. In other words, what is the purpose of the design? When is it used? Why is it the most appropriate choice for the present study?

Here are some examples of how you might justify your design:

Example: “A causal comparative research design will be used to determine if students’ social presence (SP), cognitive presence (CP), teaching presence (TP), and perceived learning differed based upon the type of CMC system used in the online courses. This research design was chosen because it attempts to explore possible causative relationship between an independent variable and a dependent variable on an occasion in which the researcher is unable to control the independent variable. Since the randomization is not possible in a causal-comparative study, the control procedure of comparing homogeneous groups based on collected demographic data will be adopted to help achieve equality of groups (Gall, Gall, & Borg, 2010).” (Rockinson-Szapkiw, 2009, p.)

The Case of Charlie

Charlie begins by considering the following questions as he chooses his design and writes the research design section in his research design proposal:

- ▶ Am I concerned with relationship or difference between variables?
- ▶ Will I manipulate the independent variable?
- ▶ Will I use a control group?
- ▶ Will my subjects be randomly assigned?
- ▶ Which design is feasible and best controls for threats to internal validity?
- ▶ What have previous studies used? And, what type of study is previous research recommending?

Since the research calls for the development and examination of interventions to assist students with GAD transitioning from high school to college, Charlie decides that he wants to design a structured small group intervention based on Aaron Beck's and Mayer, Salovey, and Caruso's Emotional Intelligence work. He plans to compare it with the traditional structured small group interventions that most colleges use as part of freshman orientation to provide support for students like his cousin Mikey who struggle with anxiety, academic, and interpersonal adjustment.

Since the research calls for examination of interventions, Charlie decides to examine that a group comparison design would be most appropriate for his study. He recognizes that he wants to examine the differences between two groups, including a control group. Additionally, he plans to manipulate the independent variable; that is implement a group treatment. Since he plans to manipulate the independent variable, a causal comparative design is not appropriate. He can thus, choose a quasi experimental design or a true experimental design.

Although Charlie recognizes that a true experimental design would be the strongest research design, it is not possible for him to randomly assign participants.

Charlie identifies a local college counseling and student care center and works with the center counselors and support staff to develop the structured small group intervention based on Aaron Beck's and Mayer, Salovey, and Caruso's Emotional Intelligence work. At this college, the counseling and student care center oversees a 9 -week freshman orientation program. The freshman orientation includes a 1 hour a week transition support group based on Aaron Beck's work. So, Charlie and the staff use the same program model and integrate activities and discussion topic based on Mayer, Salovey, and Caruso's Emotional Intelligence.

To screen students and garner participation, Charlie, with the Institutional Review Board and center's permission, plans to contact all freshman who sign up for the orientation via a letter. This letter will ask them to participate in his study and ask them to complete an informed consent as well as screening inventory, the Beck Anxiety Inventory® (BAI®). Students who have scores on the BAI that indicate high anxiety will be told that they are eligible for the study. They will be asked to visit the center the first week of school to take pre assessments, including the Positive Relations With Others scale (Ryff,1989; Ryff & Keyes, 1995) and a release to access high school transcripts from the registrar to obtain High school grade point average (GPA).

Charlie will then work with the center counselor to set up 8 small group of 10-15 students. Four of the groups will be identified as treatment groups and four will be identified as the control groups. Four of the counselors agree to lead the groups. Two of the counselors agree to lead the treatment groups, and two of the counselors agree to lead the control groups. Once times and days are established for the groups, students will be assigned to groups based on their class and extracurricular schedules. Random assignment will not possible due to students scheduling conflicts.

After the counselors implement the groups for a 9 week period, Charlie will give the participants a battery of post tests, including the Beck Anxiety Inventory® (BAI®), the Positive Relations

With Others scale (Ryff, 1989; Ryff & Keyes, 1995), and a release to access first semester college transcripts from the registrar to obtain a GPA.

Based on this plan, Charlie writes the following in his research plan about his chosen design:

“A quasi-experimental, non-equivalent control group design will be used for this study. This design enables the researcher to compare intact groups when random assignment is not possible (Campbell & Stanley, 1963). Although random assignment would strengthen internal validity, it is often unethical or impossible to do when conducting research in educational settings where classes and schedules have previously established (Gall et al., 2007; Glatthorn & Joyner, 2005). A quasi-experimental is deemed the strongest research design when a true experimental design is not possible. Further, similar studies that have examined anxiety interventions have employed quasi-experimental designs. For example, Steven and Steven (2012) used an experimental design to test an intervention for reducing anxiety. This further attests to the appropriateness of this design for this study.

In this quasi-experimental, non-equivalent control groups design, eight intact freshman orientation small groups comprised of students struggling with anxiety will be examined. Four of the groups will serve as the control group; student in this group will participate in the traditional freshman orientation small group with curriculum based on Aaron Beck’s work. Four of the groups will serve as the treatment group; student in this group will participate in the freshman orientation small group with curriculum based on Aaron Beck’s work with additional components addressing emotional intelligence. A pretest and posttest anxiety, academic achievement, and interpersonal skills measure was given to all participants to determine if the type of freshman orientation affected the academic achievement, and interpersonal skills of the participants. The pretest will be used as a control variable to control for the selection threat to validity.”

Application: Developing My Research Plan

Answer the following questions:

Explain the purpose of your research idea. As you do this, think about the following: Do I want to know, what is or why something is? Do I want to study variables that have already been manipulated? Do I want to study the difference or relationship between variables?

Based on your identified purpose, what research design is most suitable for your research?

Use the following questions as a guide,

- ▶ Am I concerned with relationship or difference between variables?
- ▶ Will I manipulate a variable?
- ▶ Will I use a control group?
- ▶ Will my subjects be randomly assigned?

