Causal-Comparative (Ex-Post Facto) Research

Consider the following situations. In which would a researcher be most likely to use a causal-comparative research design?

1. Mr. Ruiz, a school psychologist, would like to know how teachers view the consultation services he provides. How can he improve the process?

2. Miss Cass, a fourth grade teacher, has noticed that one reading group in her class has made considerable gains in comparison to the other reading groups. Is this due to the new reading strategy that she has implemented?

3. Mrs. Williams, a high school principal, has asked one of the teachers on her staff, Ms. Smith, to begin this academic school year by teaching the freshman in her class study skills. Ms. Williams randomly assigns students to Ms. Smith's class. Ms. Williams plans to collect data to determine whether freshmen who are taught study skills early in their high school career earn higher grades at the end of their first semester in comparison to their peers who are not taught study skills.

4. Mr. Johnston, a tenth grade math teacher, has noticed that students who earn lower grades on the homework assignments in his class often share that they spend hours each night on social networking websites. Mr. Johnston wonders what the relationship is between the scores students earn in his class on their homework assignments and the amount of time they spent each week on social networking websites.

If you think the situation proposed in option 2 seemed to be the likely one in which a researcher would use a causal-comparative research design, you are correct! The other situations would most likely require a researcher to employ the following research methods: 1. descriptive research, 3. experimental research, and 4. correlational research.

For those of you who selected option 2, you must be familiar with some of the key characteristics of causal-comparative research.

Types of Causal-Comparative Research Designs

There are two types of causal-comparative research designs: *retrospective causal-comparative research* and *prospective causal-comparative research*. Retrospective causal-comparative research requires that a researcher begins investigating a particular question when the effects have already occurred and the researcher attempts to determine whether one variable may have influenced another variable. Prospective causal-comparative research occurs when a researcher initiates a study beginning with the causes and is determined to investigate the effects of a condition. By far, retrospective causal-comparative research designs are much more common than prospective causal-comparative designs (Gay et al., 2006).

Characteristics of Causal-Comparative Research

Often, researchers decide to study particular variables with causal-comparative research as a variable is involved that cannot be manipulated for ethical and practical reasons. For instance, there is no way that researchers can ethically assign an individual to a group in order to study the effects of grade retention or the impact of abuse. Or, as in the Miss Cass' situation, researchers are unable to manipulate a variable because the effect of the variable has already occurred (Lodico et al., 2006). For this reason, another key characteristic of causal-comparative research is that individuals are not randomly assigned to groups as the study is involving an event or situation that has already occurred with groups that are already formed.

Some people erroneously believe that causal-comparative research is in some way "better" than correlational research. This may be related to people's understanding that correlational research does not allow researchers to determine what variable *causes* another variable. Rather, correlational research allows researchers to determine the relationship or association between two or more variables. Regardless, it is important to understand that neither correlational nor causal-comparative research produce experimental data (Gay et al., 2006). Instead, both research methods are considered nonexperimental methods of data collection (Lodico et al., 2006).

Steps for Conducting a Causal-Comparative Study

While causal-comparative research appears simple, potential researchers and research consumers should beware as the design and procedure of causal-comparative research only look deceptively easy. The following steps, as described by Lodico et al. (2006), should be adhered to by researchers conducting a causal-comparative study.

Step One: Select a Topic
As discussed earlier, topics studied with causal-comparative research designs typically catch a researcher's attention based on experiences or situations that have occurred in the real world. This experience or situation becomes interesting to a researcher as the researcher realizes that knowledge on the event might impact his/her future behaviors. For instance, a teacher might be motivated to conduct a causal-comparative study when he notes that one of his sections of American History seem to consistently earn higher test scores than another class. Could the mini-lesson during which he taught the one section test-taking strategies have influenced the students' test scores?

A special education consultant has noticed that, of the past five consultation cases that she has participated in with teachers, three of the five teachers have continued to integrate the teaching strategies the consultant shared during the cases into classroom lessons for three consecutive academic years. The consultant wonders whether the amount of time the teacher continue to uses the teaching strategy shared during the consultation process is influenced by the amount of the time the original consultation case spanned.

Step Two: Identify Variables
Reviewing published literature on a specific topic of interest is especially important when conducting causal-comparative research as such a review can assist a researcher in determining which extraneous variables may exist in the situation that they are considering studying. After reviewing published literature on a topic, researchers can then identify an independent variable

(the experience or characteristic that differs between the groups studied that cannot be manipulated) and the dependent variable (the variable that is impacted in some way by the independent variable). Most importantly, the independent variable must be defined in a way that is both explicit and operationalizable. For example, if a researcher were conducting a causal-comparative study to gain understanding involving the possible impact of childhood neglect on academic performance, the researcher would be required to further define what constitutes neglect for the purposes of the study.

Step Three: Develop a Research Hypothesis
Hypotheses developed for causal-comparative research are similar to hypotheses developed for experimental research as both types of research include the identification of independent and dependent variables. Causal-comparative research hypotheses should describe the expected impact of the independent variable on the dependent variable. Consider the following research hypothesis for a causal-comparative study:

It is hypothesized that students in Miss Cass's class who received instruction with the new reading strategy that Miss Cass has implemented have made increased gains in fluency.

In this hypothesis, the independent variable is the new reading strategy that Miss Cass implemented earlier in the year. The dependent variable (the variable that is hypothesized to be impacted by the independent variable) is the students' fluency rate. While the process of developing a hypothesis seems straight-forward, for researchers conducting causal-comparative studies selecting a research hypothesis can become a complex process of disentangling possible causes of an observed effect or characteristic. Often, researchers erroneously assume that any related event that has occurred prior to the dependent variable (the characteristic for which the groups differ) is the cause. Instead of assuming that one variable is the cause of another simply due to the order in which events occur, a researcher must also consider other explanations such as reverse causation. Reverse causation would occur if a teacher assumed that a student's test anxiety was the cause of low test grades the student had earned. Instead, perhaps the student's low test grades led to increased test anxiety (Cohen, Manion, & Morrison, 2007).

Step Four: Select Participants
As discussed earlier, causal-comparative research differs in that, unlike experimental research, in causal-comparative research participants are already organized in groups. These groups, defined by Gay et al. (2006) as *comparison groups*, are selected because one group does not possess a characteristic or experience possessed by the second group (this characteristic or experience is the independent variable that the researcher plans to study) or the two groups differ in the amount of a characteristic that they share (this, once again, is the independent variable being studied).

Researchers interested in conducting causal-comparative studies must be cautious when selecting groups to study as it must be determined that the groups only differ based on the independent variable. In situations in which two groups differ in a variety of characteristics, researchers cannot be certain whether the independent variable affected the groups or whether the groups were impacted more so by extraneous variables. Researchers conducting causal-comparative studies can employ a variety of methods to control for extraneous variables. Such methods, often

used for experimental research, include matching, compare groups that are homogenous with regards to the extraneous variable, creating subgroups, and the use of a statistical procedure called an analysis of covariance (ANCOVA) to analyze study data. Using such controls require that researchers obtain measures of specific extraneous variables of concern. The most common method employed to account for extraneous variables in causal-comparative research is the usage of statistical tests such as *multiple regression* (link to stats site).

Step Five: Select Instruments to Measure Variables & Collecting Data
As with all of types of quantitative research, causal-comparative research requires that researchers select instruments that are *reliable* and allow researchers to draw *valid* conclusions (link to reliability and validity portion of site). After a researcher has selected a reliable and valid instrument, data for the study can be collected. Of course, with causal-comparative studies researchers are not required to implement a treatment as the treatment has already occurred.

Step Six: Analyze and Interpret Results
Typically, in causal-comparative studies data is reported as a mean or frequency for each group. Inferential statistics are then used to determine whether the means "for the groups are significantly different from each other" (Lodico et al., 2006, p. 214). When reporting results, researchers who have used causal-comparative research methods must be cautious when stating that the independent variable has *caused* a specific effect to occur. Since casual-comparative research cannot definitively determine that one variable has *caused* something to occur, researchers should instead report the findings of causal-comparative studies as a *possible effect* or *possible cause* of an occurrence. Hypotheses regarding causality can be strengthened when multiple causal-comparative studies have been conducted by a variety of researchers "working with different samples in different settings and consistent results emerge from these studies" (p. 214).

Limitations of Causal-Comparative Research

Several serious limitations are associated with causal-comparative research. Results from causal-comparative research should always be interpreted with extreme caution as causal-comparative research is similar to correlational research; just because a relationship between two or more variables is identified, does not necessarily mean that a causal connection between the variables can be established. There could be several reasons why multiple variables are related or influence one another. The change of one variable may actually be caused by another variable or an additional, unaccounted for variable may be responsible for influencing both a cause and effect of other variables (Gay et al., 2006).

When researchers begin causal-comparative studies in which the effect and cause have already occurred, it is sometimes impossible for researchers to determine which occurred first and how the variables influenced one another. The only research method that can truly establish whether a cause-and-effect relationship exist between variables is an experimental research design. Thus, causal-comparative research is often employed to determine whether certain variables are worth studying with an experimental research design as experimental research is expensive both in terms of cost and time for researchers. Instead, causal-comparative designs should be used to "permit investigation of variables that cannot or should not be investigated experimentally,

facilitate decision making, and provide guidance for experimental studies" Gay et al., 2006, p. 220).

Several other limitations are associated with causal-comparative research. Since random assignment is often impossible in causal-comparative research (because the event has already occurred when the researcher decides to study the variables that may have influenced the condition of another variable), the groups may differ in another way that may actually be responsible for the difference between groups that the researcher is attempting to study. Variables that are unaccounted for that influence the difference noted by researchers between two groups are called *extraneous variables.* A variety of methods can be employed by researchers to control for extraneous variables including: matching, compare groups that are homogenous with regards to the extraneous variable, creating subgroups, and the use of a statistical procedure called an analysis of covariance (ANCOVA) to analyze study data (Gay et al., 2006).

References

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