UNIT 4 OTHER DESIGNS (CORRELATIONAL DESIGN AND COMPARATIVE DESIGN)

Structure

4.0 INTRODUCTION

The experimental designs which we discussed in first two units provide the most powerful means of studying the behaviour. As you know the important features of experimental design is manipulation of independent variable and control over the experiment. The researcher has enough control over the situation to decide which participant receives which condition at which time. Sometimes the researchers are interested in some variables which cannot be manipulated by the experimenter, where researcher does not have control over the who, what, when, where and how. For example if we are interested to study:

a) Whether scholastic achievement depended upon the general intelligence of a child?

b) Does there exist gender difference in aggression?

c) Is there any relationship between the sise of the skull and the general intelligence of the individual?

Many such questions may arise from time to time for which we may try to find answers through research. To answer such research questions we have to use

non-experimental research design. The most commonly used non-experimental research designs are correlational research design and causal comparative research design. Correlational research design involves correlation between two variables and causal comparative research design involves comparing two groups in order to explain existing differences between them on some variable or variables of interest. In this unit we will learn about correlational research design and causal comparative research design.

4.1 OBJECTIVES

After studying this unit, you will be able to:

- Define correlational design;
- Enumerate the types of correlational design;
- Describe the advantages and limitations of correlational design;
- Define causal comparative design;
- Differentiate between causal and correlation designs; and
- Enumerate the advantages and limitations of causal comparative design.

4.2 DEFINITION OF CORRELATIONAL RESEARCH DESIGN

Correlational research designs are founded on the assumption that reality is best described as a network of interacting and mutually causal relationship. Everything affects and is affected by everything else. This web of relationship is not linear. Thus, the dynamics of a system, that is how each part of the whole system affects each other part is more important than causality. The correlational investigations attempt to compare the level of one variable with those of another to see if a relationship exists between the two. The correlational design is a quantitative design.

According to Singh, (1998), Correlational design is one in which the researcher collects two or more sets of data from the same group of subjects so that the relationship between the two subsequent sets of data can be determined.

Correlational research design is one which studies relationship among variables, none of which may be the actual cause of the other (Mcburney & White, 2007).

On the basis of above definitions it can be stated that correlational design is one which have two or more quantitative variables from the same group of subjects and which shows the relationship between the two variable.

The correlational design may be diagrammed as follows :

X1	X2
O1	P1
O2	P2
O3	P3
.	.
.	.
.On	Pn

The relationship indicated by the symbol r will be the relationship between the observations (O1 ….On) of X1 and (P1….Pn) of X2

4.3 TYPES OF CORRELATIONAL RESEARCH DESIGN

Correlational designs can be broadly categorised in two broad divisions:

1) Those that measure the degree of association between variables and (2) Those that are used to Predict the score on one variable using knowledge about the one or more variables.

   Within the former, that is those that measure the degree of association between variables, we have (a) Association between two variables and (b) Association amongst more than 2 variables. These are being presented below.

   For example let us say a researcher wants to study the relationship between academic stress and academic achievement of college students. For this let us say that the researcher randomly selects 100 college students and administers the measure of academic stress and subsequently a test of academic achievement. Thus the researcher will have two sets of data.

   a) **Association between two variables**

   A correlation coefficient can be calculated from those 100 pairs of numbers. Theoretically it could take a positive or negative absolute value between -1.00 to 0.00 to +1.00. The larger the coefficient, whether positive or negative, the more consistent the relationship between the two variables.

   If the coefficient takes a positive value it means the individual who is higher on one variable (X1) will higher on second variable (X2). This is sometimes referred to as a *direct relationship*. If the coefficient takes a negative value between 0 and -1.00, it would indicate that those who have obtained higher scores on X1 will have lower scores on X2. In our above example if the correlation is negative it means that those who scored high on academic stress will have low academic achievement. This is some time referred to as an *inverse relationship.*

   b) **Association between more than two variables**

   So what if academic stress and academic achievement have significant correlation ? And what if study habits, intelligence and other factors were also associated with academic achievement. We could measure the association between all these variables in the same group of children. We administer tests for the measurement of study habit and intelligence and obtain scores on the same group of subjects and find out the multiple correlation.

2) Those that are used to pedict the score on one variable using knowledge about the one or more variables.

If there is a correlation between two variables, and we know the score on one, the second score can be predicted. In this type of situation there are two variables, one variable that is used to make a forecast about an outcome is known as *predictor variable* and the other variable, is what we are trying to predict is known as *criterion variable.*

By way of regression analysis we can make this prediction. For example there is a relationship between stress and health. If we know the stress score, by way of regression analysis we can predict the future health status score.

Some time the researchers have more than one predictor variable and one criterion variable. The combination gives us more power to make accurate predictions. for example if we have stress scores as well as health behaviour score and past health score then one can make more accurate prediction of health status. Here we have three predictors, stress, health behaviour and previous health status and one criterion variable future health.

4.4 EVALUATION OF CORRELATIONAL DESIGN

The advantages and disadvantages of the correlational designs are presented in the following section. First we deal with advantage and then the disadvantages.

4.4.1 Advantages

The correlational designs are used in many cases because available data makes it easy to use. Some more careful researchers use the result of correlational studies to formulate new hypothesis which they can test later using more rigorous research design rather than test hypothesis about cause and effect directly.

Correlational design is used as the foundation for other designs that permit more certain causal inferences to be drawn from results.

It usually does not involve repeated administration of a behavioural measure, thus avoiding pretest sensitisation.

It usually uses very realistic measurements of behaviour and its possible causes as well.

Correlational research thus avoids the problem of non-representative research context. It also permits the use of large carefully chosen sample thus avoiding the threat of non representative sample of participant.

4.4.2 Disadvantages

The major disadvantage of correlational designs is that they leave the actual reason for the association found quite unclear. For example there is a positive correlation between exposure to violent program on television and violence on the playground. If we find the correlation rather positive and high, we may be tempted to conclude that exposure to violent television causes children to be aggressive and violent. But such a conclusion is completely unwarranted.

Rarely does a correlational study allow inferences about cause and effect. In this case, there are many other possible explanations for the relationship. For example, perhaps children with parents who neglect and physically abuse them just pop them in front of the TV at night, when the violent shows tend to be on. These children may have learned from the parent's abuse and neglect, that aggression and violence are acceptable ways of relating to others, and so they do it on their own around their classmates. In such a case, the obtained association between exposure to violent television and actual violent behaviour may be spurious. That is, a third variable parental neglect and abuse cause them both.

Another possible explanation is that children who tend to be violent, for whatever reason, tend to prefer watching violent television shows. It is not that the violent television causes the violent behaviour. Instead, some children are dispositionally violent (that is, due to personality or genetics also other variables) and it is this that determines both the preference for violent TV shows and the playground aggressiveness.

Correlational designs have directional problem. The causation is reversed from the expected direction. The designation of one of the variables as the independent variable and one as the dependent variable is arbitrary, compared to a true experiment, in which the independent variable is manipulated by the researcher. Children may watch violent television program because they behave aggressively rather than the other way round. Television program may validate their choice of activities by showing others who do the same, or children may watch to learn more about how to behave violently.

Hence, the internal validity of the correlational design is very low.

4.5 WHAT ARE THE STANDARD OF QUALITY USED WHEN ASSESSING CORRELATIONAL DESIGN

Researchers must choose the variables to use within a correlational analysis with great care. A sound theory that takes alternative explanations into account should be used to determine which variables are of immediate interest.

Correlation is based on the assumption that the variables in question are related linearly and do not suffer from multicollinearity.

Care must be taken to ensure that artificially restricted distributions, missing data, and deviant cases or outliers are addressed.

Correlational studies can be made more powerful by using statistical techniques that themselves allow for the partial control of third variables, when those variables can be measured. Correlational statistics such as hierarchical multiple regression, path analysis, and structural equation modeling all fall into this category. These statistics, in essence, allow the correlation between two variables to be recalculated after the influence of other key variables are removed. Thus these types of correlational statistics and designs help to rule out certain causal hypotheses, even if they cannot demonstrate the true causal relation definitely.

The most important thing to look for in a correlational study, when determining its validity, is the controls that the researcher puts into place to control the extraneous variables influence.

4.6 CAUSAL COMPARATIVE RESEARCH DESIGN

There are many occasions while conducting research in psychology, where the researcher is unable to control the independent variable. Or it may be that the researcher finds it rather unethical to control the independent variable, or it could also be that it is too difficult to control the independent variable. To cite an example, let us say that the researcher wants to study “the effect of gender on aggression”, here the independent variable is gender and dependent variable is

aggression. Researcher cannot manipulate independent variable i.e. gender. Another example is that if the researcher is interested in studying the effect of diet (vegetarian V/s. non-vegetarian) on mental health, here again the independent variable which is cannot be manipulated, as it is unethical to manipulate the diet from vegetarian to non vegetarian as there are people who are purely vegetarians. In these types of situation the researcher uses a causal comparative research design rather than an experimental design for the research.

The basic design of a causal-comparative research study is to select a group that has the independent variable (the experimental group) and then select another group of subjects that does not have the independent variable (the control or comparison group). The two groups are then compared on the dependent variable. For example, in school, some of the seventh grade math classes use hand held calculators. We want to find the effect of calculator use on mathematics grades at the end of the year. So we select a group of students from the classes which use calculators and then select another group of the same sise from the classes who do not use calculators and then compare the two groups at the end of the year on their final math grades. Another variant of this study would be to take the students from one class that uses calculators and compare them with another class that does not use calculators. Both these studies would be causal comparative research studies.

Instead of using an experimental group and a control group as in the study considered above, we could have a causal comparative research study in which two or more groups differ in some variable that constitutes the independent variable for the study. For example in a study researcher might wish to compare students at four different age levels (or grade levels) on their amount of participating in extra-curricular activities. The researcher could look at the number of extra-curricular activities participated in by four groups of students. The first group would be students in grades 1-3, the second group students in grades 4-6, the third group students in grades 7-9, and the fourth group students in grades 10-12. The independent variable in this study would be grade placement and the dependent variable would be participating in extra-curricular activities. Thus the research would focus on the effect of grade levels on participation in extra-curricular activities for public school students grades 1-12.

Causal comparative research attempts to identify a causative relationship between an independent variable and a dependent variable. However this relationship is more suggestive than proven as the researcher does not have complete control over independent variable.

Causal comparative design compares two or more groups on one variable. Causal comparative design is used to determine the cause for or consequences of existing differences in groups of individuals. For example the researcher may be interested in finding out the differences in performances of students taught by inquiry teaching method and by lecture teaching method.

Self Assessment Questions

1) Given below are statements, state whether statement are true or false :

   i) Correlational design is a quantitative design of research.

   ii) Causal comparative research design is an experimental design.

iii) Correlational design avoids the threat of non-representative sample of participation.

iv) Causal comparative research design attempt to identify a causative relationship between an independent variable and dependent variable.

v) In causal comparative design researcher manipulate the independent variable.

2) Fill in the blanks :

i) Correlational design studies the ..... between the variables.

ii) Coefficient of correlation expresses the ..... and ..... of relationship between the variables.

iii) Causal comparative research looks at ..... between the groups.

iv) Correlational design and causal comparative design both are ..... research design.

v) When it is possible to manipulate the independent variable then we use ..... design.

Answers:

1) i) T ii) F iii) T iv) T v) F

2) i) relationship ii) degree, direction
iii) comparison iv) non-experimental
v) experimental

4.7 COMPARISON BETWEEN CAUSAL-COMPARATIVE AND CORRELATIONAL DESIGNS

4.7.1 Similarity

Both are non-experimental methods because they lack manipulation of an independent variable which is under the control of the experimenter and hence in both the cases, random assignment of participants is not possible. This means among other things the variable must be observed as they occur in the natural setting.

In both the designs, techniques used for controlling confounding variables is the same. In both the methods matching or quota sampling techniques are used to control confounding extraneous variables.

In both the research the most common type of independent variable used are called attribute variable (Kerlinger, 1986). They cannot be manipulated by the researcher, they represent characteristics or attributes of different persons.

Like correlational research, causal comparative research is sometimes treated as a type of descriptive research since it too describes conditions that already exist.

4.7.2 Differences

Causal comparative research involves comparing two groups in order to explain existing differences between them on some variables of interest. In causal comprehensive research the groups being compared have already been formed and if any treatment (if there was a treatment), it also has already been applied.

Correlational research on the other hand does not look at differences between groups. Rather it looks for relationship within a single group.

Causal comparative research compares groups but the correlational research looks at one group having nothing to do with establishing evidence of causality.

In correlational research some, independent variable is labelled as predictor variable but not in causal comparative research.

Both designs differ on the scaling of the independent and/or dependent variables. Causal comparative researches include at least one categorical variable. The correlational research includes only quantitative variables. i.e. intelligence, attitude, age, income, job satisfaction etc.

4.8 COMPARISON BETWEEN CAUSAL COMPARATIVE AND EXPERIMENTAL DESIGN

Causal comparative and experimental research both attempt to establish cause effect relationship and both involve comparison. But there are difference between two methods.

In experimental design researcher select a random sample and then randomly divide the sample into two or more groups. Groups are assigned to the treatment and the study is carried out.

In causal comparative design individuals are not randomly assigned to treatment groups because they already were assigned into groups before the research began.

In experimental research the independent variable is manipulated by the researcher whereas in causal comparative research the groups are already firmed and already different on the independent variable. Independent variable in causal comparative cannot be manipulated by the researcher.

4.9 DATA ANALYSIS FOR CAUSAL COMPARATIVE RESEARCH DESIGN

An inferential statistic used in both causal comparative and experimental research designs is the t-test. Where the subjects in the two groups are independent of one another, that is no matching of subjects or other control procedures were used, the independent t-test is used to test the significance of a difference between the means of the two groups in the study.

In research designs where the influence of an extraneous variable has been controlled, or in designs utilising a pre-test-post-test procedure, the appropriate t-test to use to compare the two group would be the dependent t-test.

When we have three or more groups to compare, the appropriate inferential statistic to use would be one-way analysis of variance. This statistics shows the significance of differences in the means of three or more groups of subjects.

In cases where we are using frequency counts for the dependent variable, the appropriate inferential statistic to use would be the chi-square test. This statistic tests the significance of differences between two or more groups (independent variable) in frequencies for the dependent variable. For example, a high school social studies teacher wants to see if the major party political affiliation for students is similar to or different from that of the registered voters in the country where the high school is located. The teacher would ask the students (anonymously) to indicate whether they would support the democratic party or the republican party. The proportion of students selecting the democratic or republican parties would be compared with the country's proportions of democratic and republican voters.

4.10 EVALUATION OF CAUSAL COMPARATIVE RESEARCH DESIGN

4.10.1 Advantage

For the behavioural science causal comparative research is more fruitful than experimental study. Because there are number of organismic variables such as age, gender etc. cannot be manipulated by the researcher similarly sometime the nature of the independent variable is such that it may cause physical or mental harm to participants if it is manipulated by the researcher. For such type of variables the causal comparative research design is more fruitful.

Experimental studies are more costly than causal comparative studies. Causal comparative studies help to identify variable worthy of experimental investigation.

Causal comparative research do permit investigation of variables that cannot, or should not be investigated experimentally, facilitate decision making, providing guidance for experimental studies and are less costly on all dimensions.

But despite many key advantages causal comparative research does have serious limitation.

4.10.2 Limitation

Since the independent variable has already occurred the same kind of control cannot be exercised as in experimental study.

In causal comparative research manipulation of independent variable is not done by the researcher, the alleged cause of an observed effect may in fact be the effect itself, or there may be third variable that influence both cause and effect. For example a research hypothesised that self concept is a determinant of reading achievement. For this researcher administered a self concept test on a group of subjects and identify two groups with one group having high self esteem and one group having low self esteem. If the high self esteem group shows high reading achievement, we conclude that self esteem influence reading achievement. Here it is difficult to establish whether self esteem causes achievement or vice versa. Because both the independent variable and dependent variable would have already occurred, it would not to be possible to determine which came first. It

would be possible that some third variable, such as parental attitude might be the main influence on self esteem and achievement. Therefore caution must be exercised in attributing cause effect relationship based on causal comparative research.

In causal comparative research the researcher cannot assign participant to treatment groups because they are already in those groups.

One of the problems with causal comparative research is that since the pupil are not randomly placed in the groups, the groups can differ on other variables that may have an effect on the dependent variable. In experimental research we can assume that these other variables cancel out among the study groups by the process of randomisation.

4.11 LET US SUM UP

The correlational designs are used when we have two or more quantitative variables from the same group of subjects and we are interested to determine if there is a relationship between two variables. Correlation does not show a causal relation, it can be used for prediction.

Causal comparative design compare two or more groups on one variable. This design does permit investigation of variables that cannot or should not be investigated experimentally. Correlational design and causal comparative design both are non-experimental designs. But one studies the relationship between variables and the other studies the difference between variables.

4.12 UNIT END QUESTIONS

1) When to use correlational and causal comparative research design.

2) Write down the advantage and limitation of correlational design.

3) What are the similarities and differences between correlational and causal comparative research.

4) What are the advantage and limitation of causal comparative design.

4.13 GLOSSARY

Correlational design : Correlational research design is one which studied relationship among variables none of which may be the actual cause of other.

Coefficient of correlation : Degree and direction of relationship among variables. The coefficient of correlation usually expressed as number between -1 to +1.

Causal comparative design : Research design compare two or more groups on one variable.

4.14 SUGGESTED READINGS

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