EXPERIMENTAL, QUASI-EXPERIMENTAL, AND NONEXPERIMENTAL DESIGNS

part 1

Experimental research

Experimental research is concerned with cause–and-effect relationships.allexperimental studies involves manipulation or control of the independent variable(cause) and measurement of the dependent variable (effect).

Validity of the experimental designs

Study **validity concerns with the extent to which appropriate inferences can be** made. **Threats to validity are reasons that an inference could be wrong.**

Internal validity of an experimental design concerns the degree to which changes in the dependent variable(effect)can be attributed to the independent variable (cause).

External validity concerns the degree to which study results can be generalized to other people and settings.

Six threats to internal validity

Threats to internal validity are factors other than the independent variable that influence the dependent variables.

1. Selection bias occurs when the study results are attributed to the experimental treatment but in fact , the results occur because of subject differences before the treatment.
2. History occur when some event besides the experimental treatment occurs during the course of a study, and this event influence the dependent variable.

3- Maturation is threat to internal validity when changes that occur within the subjects during an experimental study influence the study results . people may become older, taller, or sleeper from the time of pretest to the post test

4-The testing threat may occur in studies where the pretest is given or where subjects have knowledge of baseline data , testing refers to influence of the pretest on the post test scores .

5. Instrumentation change, involves difference between pretest and posttest measurement caused by a change in the accuracy of the instrument or the judges' ratings rather than as a result of the experimental treatment. training sessions for judges. Also , if mechanical instruments are used, such as sphygmomanometers, these instruments should be checked for accuracy through out the study.

6- The mortality threat occurs when the subject do not complete the study, dropout rate is different between the experimental and comparison groups, and this difference in dropout rate influences the posttest results . There is no research design that will control for mortality because participants can never be forced to remain in a study .

Three threats to external validity

1-when the study participants respond in a certain manner because they are aware that they are being observed. It might be possible to control this threat by a double-blind experiment.

2- The experimenter effect. A researcher ‘s characteristics or behaviors influence the subject behaviors(facial expression , clothing, age , gender, body build)

3- The reactive effects of the pretest threat, some times called measurement effect, occurs when subjects responses to the experimental treatment are indirectly influenced by the pretest.

Experimental Design:

Experiments (or randomized controlled trials [RCTs]) involve :

1. **Manipulation**(the researcher manipulates the independent variable by introducing a **treatment**

   or **intervention);**

2- Control (including the use of a control group that is not given the intervention and represents the comparative group)

3- Randomization or random assignment (with subjects allocated to experimental and control groups at random to make the groups comparable at the outset).

symbolic presentation of research design

Experimental designs can be explained graphically using symbols to represent features of the design.

In these diagrams, the convention is that

R= random assignment of subjects to groups,

O = observation or measurement of dependent variable

X =experimental treatment or intervention

So, for example, a pretest–posttest design would be depicted as follows:

R O1 X O2 (experimental group)

R O1 O2(comparison group)

Experimental Designs

The pretest–posttest design

The most frequently used experimental design, is the pretest–posttest design, in this design, 1- the subjects are randomly assigned to groups, 2- a pretest is given to both groups 3- the experimental group receives the experimental treatment and the comparison group receives the routine treatment or no treatment and

4- a post test is given to both groups .

R O1 X O2 (experimental group)

R O1 O2(comparison group)

Example

To illustrate, suppose we were investigating the effect of physical exertion on mood in healthy young adults. One experimental design for this research problem is a pretest–posttest design (or before–after design). This design involves the observation of the dependent variable (mood) at two points in time: before and after the treatment.

Participants in the experimental group are subjected to a physically demanding exercise routine, whereas those in the control group undertake a sedentary activity

This design permits us to examine what changes in mood were caused by the exertion because only some people were subjected to it, providing an important comparison.

In this example, we met the first criterion of a true experiment by manipulating physical exertion, the independent variable. This example also meets the second requirement for experiments, the use of a control group

posttest-only control group design(or

The most basic experimental design involves randomizing subjects to different groups and then measuring the dependent variable. In this design,1- subjects are randomly assigned to groups 2- the experimental group receives the experimental treatment, 3-the comparison group receive the ordinary treatment or no treatment and 4- a posttest is given to both groups

R X O1 (experimental group)

R O1(comparison group)

QUASI-EXPERIMENTS

Quasi-experiments designs are those in which there is either no comparison group or subjects are not randomly assigned to groups.

1- Nonequivalent Control Group Design

is similar to the pretest- post test control group design except there is no random assignment of subjects to experimental and comparison group.

O1X O2(experimental group)

O1 O2(comparison group)

Example

A researcher might choose a group of patients with diabetes on one hospital floor for the experimental group and a group of patients with diabetes on another floor for comparison group . the experimental treatment would be administered to the experimental group ;the comparison group would receive no treatment or some alterative treatment.

2-Time Series Designs

In a time–series design, the researcher periodically observes or measures the subjects, the experimental treatment is administered between two of observations. there is no comparison group; information on the dependent variable is collected over a period of time before and after the treatment.

$O_1\ O_2\ O_3\ X\ O_4\ O_5 O_6$

Example

A researcher might assess the pain levels of a group of clients with low back pain. After 3 weeks of pain assessment ($O_1\ O_2\ O_3$), subjects could be taught a special exercise to alleviate low back pain. During the next 3 weeks, pain levels would again be measured ($O_4\ O_5 O_6$)

3-One- shot case study

in one shot case study , a single group is exposed to an experimental treatment and observed after the treatment. XO

A group of patients with diabetes might attend a diabetic education class (X) and be tested on their knowledge of diabetes (O) after the class is completed. There is no way to determine if the level of knowledge about diabetes was the result of the class. The patient could have already possessed this knowledge before the class.

It is the weakest of all the experimental designs

4- One- group pretest- post test

It provides a comparison between a group of subjects before and after the experimental treatment. O_1XO_2

A group of patients with diabetes could be given a pretest of their knowledge concerning diabetes(O_1).this group would then attend a diabetic education class (X) and post test (O_2)at the end of the class.

part 2

NONEXPERIMENTAL RESEARCH

Many research questions—cannot be addressed with an experimental or quasi-experimental design.

Example:

if we posed this prognosis question: Do birth weights under 1,500 grams cause developmental delays in children? Clearly, we cannot manipulate birth weight, the independent variable. Babies' weights are neither random nor subject to research control. When researchers do not intervene by manipulating the independent variable, the study is non experimental, or, in the medical literature, observational

Reasons for Undertaking Nonexperimental Research:

1- One reason for using a non experimental design is that a vast number of human characteristics are inherently not subject to experimental manipulation (e.g., blood type, personality, health beliefs, medical diagnosis);the effects of these characteristics on other phenomena cannot be studied experimentally.

2- A second issue is that in nursing research, as in other fields, there are many variables that could technically be manipulated but could not be manipulated ethically. If manipulating the independent variable could cause physical or mental harm to subjects, then the variable should not be controlled experimentally. For example, if we were studying the effect of prenatal care on infant mortality, it would be unethical to provide such care to one group of pregnant women while deliberately depriving a second group.

3- Third, there are many research situations in which it is simply not practical to conduct a true experiment . Limitations might involve insufficient time, lack of administrative approval, excessive inconvenience to patients or staff, or lack of adequate funds.

4- Fourth, there are some research questions for which an experimental design is not appropriate.

This is especially true for descriptive studies, which seek to document the characteristics, prevalence, intensity, or full nature of phenomena.

Types of non experimental (observational) :

1-Correlational studies that examine relationships among variables but involve no manipulation of the independent variable . and

2-Descriptive research—studies that summarize the status of phenomena

There are two major correlational designs:

1-Retrospective designs involve collecting data about an outcome in the present and then looking back in time for possible causes or antecedents (e.g., a case-control design).

2- Prospective designs, researchers begin with a possible cause, and then subsequently collect data about outcomes.

1- Correlational studies with a **retrospective design are ones in** which a phenomenon observed in the present is linked to phenomena occurring in the past.

For example:

In retrospective lung cancer research, researchers begin with some people who have lung cancer and others who do not, and then look for differences in antecedent behaviors or conditions, such as smoking habits. Such a retrospective design is sometimes called a **case-control design—**that is, *cases with a* certain condition such as lung cancer are compared with *controls without.*

2- Correlational studies with a **prospective design (called a cohort design by medical** researchers) start with a presumed cause and then go forward to the presumed effect.

For example

In prospective lung cancer studies, researchers start with samples of smokers and nonsmokers and later compare the two groups in terms of lung cancer incidence.

Prospective studies are more costly, but much stronger, than retrospective studies.

For one thing, any ambiguity(lack of clarity) about the temporal sequence of phenomena is resolved in prospective research (i.e., smoking is known to precede the lung cancer).

In addition, samples are more likely to be representative of smokers and nonsmokers, and investigators may be better able to impose controls to rule out competing explanations for observed effects.

2-Descriptive researches

Types descriptive research:

a-Cross-sectional designs involve the collection of data at one time period.

b-Longitudinal designs involve data collection at two or more times over an extended period.

a- Cross-sectional designs involve the collection of data at one point in time (or multiple times in a short time period, such as 2 hours and 4 hours postoperatively).

All phenomena under study are captured during one data collection period.

Cross sectional designs are especially appropriate for describing the status of phenomena or relationships among phenomena at a fixed point.

Example

we were studying changes in children's health promotion activities between ages 7 and 10.

One way to investigate this would be to interview the children at age 7 and then 3 years later at age 10—a longitudinal design.

On the other hand, we could use a cross-sectional design by interviewing children ages 7 and 10 at one point in time and then comparing their responses.

If 10-year-olds engaged in more health promoting

activities than the 7-year-olds, it might be inferred that children became more conscious of making good health choices as they age.

The main advantage of cross-sectional designs is that they are economical and easy to manage.

There are, however, problems in inferring changes and trends over time using a cross-sectional design. The amount of social and technological change that characterizes our society makes it questionable to assume that differences in the behaviors, attitudes, or characteristics of different age groups are the result of the passage through time rather than cohort or generational differences.

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In the previous example, 7- and 10-year-old children may have different attitudes toward health and health promotion independent of maturational factors. In such cross-sectional studies, there are often alternative explanations for observed differences

b- **Longitudinal design**

Researchers who collect data at more than one point in time over an extended period use a **longitudinal design.**

Longitudinal designs are useful for studying changes over time and for ascertaining the temporal sequencing of phenomena, which is an essential criterion for establishing causality.

Sometimes longitudinal studies involve collecting data from different people in a population to examine trends over time.

In a more typical longitudinal study, the same people provide data at two or more points in time. Longitudinal studies of general (nonclinical) populations are sometimes called *panel studies.* ***Panel studies typically yield more information than***

trend studies because researchers can examine correlates of change. That is, researchers can identify individuals who did and did not change (e.g., ones who did and did not become obese) and then explore characteristics that differentiate the two groups.

Panel studies are appealing(attractive) as a method of studying change but are difficult and expensive to manage.

Follow-up studies are undertaken to determine the subsequent status of subjects with a specified condition or those who received a specified intervention.

For example

patients who have received a particular nursing intervention or clinical treatment may be followed up to ascertain the long-term effects of the treatment.

To take a non experimental example, samples of premature infants may be followed up to assess their subsequent motor development.

In longitudinal studies, the number of data collection points and the time intervals

between them depend on the nature of the study.

When change or development is rapid, numerous data collection points at relatively short intervals may be required to document the pattern and to make accurate prediction of future event or condition

Longitudinal studies are typically expensive, time-consuming, and the most serious challenge in longitudinal studies is the loss of participants (**attrition) over time.**

Subject attrition is problematic because those who drop out of the study often differ in important respects from those who continue to participate , resulting in potential biases, the risk of faulty inferences, and concerns about the generalizability of the findings.