

Topics: Research Design

- Basic issues of research design
- Role of statistics in behavioral research
- Classification of variables
- Quantification of variables (scales of measurement)
- Validity of interpretations of research studies
- Types of research designs

Process of Empirical Research (Revisited)

- Identify and define research problem and questions.
- Formulate hypotheses on basis of theory and prior research.
- **Design research study to collect data bearing on questions.**
- Conduct the research.
- Analyze the data (through statistical methods).
- Interpret the data in light of the research questions.

Research Design Decisions

- What kinds of subjects and how many?
- What will subjects be asked to do?
- How many comparison groups if any?
- What dependent/independent variables to focus on?
- How and when subjects will be measured?
- Where study will be conducted?

Design Issues: Subjects

- Where did subjects come from?
- How many of intended subjects actually supplied data? Were in final analysis?
- If comparison groups, how were they formed?
- How motivated were subjects?

Design Issues: Data

- Instrument quality
- Question/data match
- Independence of observations
- Person/people collecting data

Design Issues: Study Context

- Physical setting
- Pretest sensitization
- Treatment conditions
- Subjects thoughts about the study

Role of Statistics

- In selecting subjects for study
- In assigning subjects to different groups
- Describing the data collected in the study
- Drawing inferences (generalizing) to larger populations than those studied

Descriptive Statistics

- Methods used to obtain indices that characterize or summarize data collected
- Focus is on the sample(s) at hand
- Simple description of:
 - Individuals
 - Collection of individuals
- Used as basis for inferential statistics

Inferential Statistics

- Methods that allow the researcher to generalize the characteristics from a set of sample data to a larger population.
- Concerned with:
 - Describing the population from the sample
 - Testing differences between sample and population, between two samples, between two measures of the same population.

Review of Terms

- **Research:** a systematic approach to finding answers to questions.
- **Research Design:** a plan for gathering data for answering specific research questions.
- **Statistics:** the methods used on the data collected to answer the research questions at hand.

Basic Elements: Hypotheses

- **Hypothesis:** a tentative statement (“educated guess”) about the expected relationship between two or more variables.
 - State expected relationship or difference
 - Be worthy of being tested
 - Be testable
 - Be brief and clear

Basic Elements: Variables

- **Variable:** what is measured or varied. An attribute or characteristic of a person (or object) that can change from person to person.
 - Independent
 - Dependent
 - Control
 - Intervening

Classification of Variables

- **Independent Variable:** a variable that is manipulated, measured or selected by the researcher in order to observe its relation to the subject's "response". An antecedent condition.
- **Dependent Variable:** the variable that is observed and measured in response to an independent variable.

Classification of Variables

(Con't)

- **Control Variable:** any variable that is held constant in a research study by observing only one of its instances or levels.
- **Intervening Variable:** a hypothetical variable that is not observed directly in the research study, but is inferred from the relationship between the independent and dependent variable.

Quantification of Variables

- **Measurement:** the application of rules in assigning numbers to cases so as to represent the presence or absence of quantity of an attribute possessed by each case.
- Four (4) scales of measurement

Scales of Measurement

- Nominal Scale Measurement (Lowest)
 - Ordinal Scale Measurement
 - Interval Scale Measurement
 - Ratio Scale Measurement (Highest)
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- Variables measured at higher levels can be scaled down to lower levels

Identification of Scale of Measurement

- Seeking highest scale of measurement
- Ask set of questions:
 - Nominal Scale
 - Ordinal Scale
 - Interval Scale
 - Ratio Scale

Validity of the Study

- **Can you trust the conclusions of the study?**
- **Internal Validity:** The extent to which the outcomes of the study result from the variables manipulated, measured or selected rather than from other variables not systematically managed.
- **External Validity:** the extent to which the findings of a particular study can be **generalized** to people or situations other than those observed in the study.

Threats to the Internal Validity: “Counter-Interpretations”

- **History**--Co-occurrence with the treatment
- **Maturation**--Developmental process with the treatment
- **Testing**--“Pretest” sensitization effect
- **Instrumentation**--Reliability and validity of measures
- **Selection**--Non-equivalence of comparison groups
- **Statistical Regression**--Extreme groups move toward mean
- **Mortality**--Loss of subjects
- **Stability**--Chance findings that aren’t replicable

Threats to External Validity: “Counter Interpretations”

- **Reactive Effects of Testing**--Pretest used for research purposes only but created effect; treatment won't generalize
- **Reactive Effects of Subject Selection**--Representativeness of sample vis a vis generalization
- **Reactive Effects of Treatment Selection**--Treatments cannot be faithfully implemented in other locations
- **Multiple Treatment Interference**--Difficult to tell which of several treatments caused effect

Counteracting Threats to Internal Validity

- **Control Group:** a group of subjects whose selection and treatment are exactly the same as those of the experimental group except that the control group does not receive the experimental treatment. Note, that doesn't mean "no treatment"
- **Random Assignment:** a method for assigning subjects to control and experimental groups. Not to be confused with random selection (a method for selecting a sample of subjects from a population).
- **Pretests:** When random assignment is impossible or undesirable, pretests can be used to examine the possibility or prior existing differences between groups and to statistically adjust for these differences.

Major Types of Research Studies

- **Experimental:** A type of research used to establish cause-and-effect relationships by manipulating variables/treatments
- **Observational/Correlational:** A type of research that measures two or more variables and looks to see how the variables are related to each other.

Classes of Research Design

- Pre-experimental
- Experimental
- Quasi-experimental
- Ex Post Facto

Pre-Experimental Designs:

No Control Group and/or Randomization

- One-shot case study
- One-group pretest-posttest design
- Intact-group comparison

True Experimental Designs:

Control Group & Randomization

- Posttest-only control-group design
- Pretest-posttest control-group design
- Factorial experimental design

Quasi-Experimental Designs:

Control Group But No Randomization

- Non-equivalent control group design
- Time-series designs
- Others

Ex-Post Facto Designs:

Researcher Arrives After Treatment Is Given

- Correlational designs
 - Simple predictive
 - Causal modeling
- Criterion-group designs