Chapter 11

Pre- and True Experimental Research Designs

CHAPTER OBJECTIVES – STUDENTS SHOULD BE ABLE TO:

- Explain why experimental designs are so important.
- Identify and summarize examples of pre-experimental and true experimental designs.
- Discuss the major difference between pre-experimental and true experimental designs and how this impacts the ability to determine causality.
- Discuss the importance of randomization to the experimental design.
CHAPTER OBJECTIVES – STUDENTS SHOULD BE ABLE TO:

- Distinguish between internal and external validity in research design.
- List and provide examples of the threats to internal validity.
- List and explain the threats to external validity.
- Discuss how researchers control for extraneous variables.
CHAPTER OVERVIEW

- Experimental Designs
- Internal and External Validity and Experimental Design
- Controlling Extraneous Variables
EXPERIMENTAL DESIGNS
TRUE EXPERIMENTAL RESEARCH METHODS

- Allow statements about cause and effect
  - By controlling potential sources of variance
- The simplest experimental design
  - Randomly selects subjects from population
  - Experimental group—receives treatment
  - Control group—does not receive treatment
# Experimental Designs

<table>
<thead>
<tr>
<th></th>
<th>Pre-Experimental Design</th>
<th>True Experimental Design</th>
<th>Quasi-Experimental Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of a control group?</td>
<td>In some cases, but usually not</td>
<td>Always</td>
<td>Often</td>
</tr>
<tr>
<td>Random selection of subjects from a population?</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Random assignment of subjects to groups?</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Random assignment of treatments to groups?</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Degree of control over extraneous variables?</td>
<td>None</td>
<td>Yes</td>
<td>Some</td>
</tr>
</tbody>
</table>
# ONE-SHOT CASE STUDY DESIGN

<table>
<thead>
<tr>
<th>Participants are assigned to one group</th>
<th>Treatment</th>
<th>Post-Test</th>
</tr>
</thead>
</table>

- No randomization
ONE GROUP PRETEST POST-TEST DESIGN

Compare same subjects before and after treatment

<table>
<thead>
<tr>
<th>Participants are assigned to one group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Post-Test</th>
</tr>
</thead>
</table>

- No randomization
- No control group

- Little ability to infer cause and effect
TRUE EXPERIMENTAL DESIGNS

- Characteristics
  - Random assignment
  - Control group
- Three typical designs
  - Pretest post-test control group design
  - Post-test only control group design
  - Solomon four-group design
PRETEST POST–TEST CONTROL GROUP DESIGN

Random Assignment of Participants to Control Group
Pretest No Treatment Post-test

Random Assignment of Participants to Experimental or Treatment Group
Pretest Treatment Post-test

- Groups should be equivalent at beginning SO
- Observed differences must result from treatment
POST–TEST ONLY CONTROL GROUP DESIGN

<table>
<thead>
<tr>
<th>Random Assignment of Participants to Control Group</th>
<th>No Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Assignment of Participants to Experimental or Treatment Group</td>
<td>Treatment</td>
<td>Post-test</td>
</tr>
</tbody>
</table>

- **Use when**
  - Sample is sufficient (≥ 30/group)
  - Pre–testing is not possible

- **Disadvantages**
  - If randomization is not effective, groups may not be equivalent
  - Cannot use pretest to assign to groups

SOLOMON FOUR–GROUP DESIGN

- Random Assignment to Experimental or Treatment Group
  - Pretest
  - Treatment
  - Post-test

- Random Assignment to Control Group 1
  - Pretest
  - No Treatment
  - Post-test

- Random Assignment to Control Group 2
  - No Pretest
  - Treatment
  - Post-test

- Random Assignment to Control Group 3
  - No Pretest
  - No Treatment
  - Post-test

Many different comparisons are possible
INTERNAL AND EXTERNAL VALIDITY AND EXPERIMENTAL DESIGN
INTERNAL AND EXTERNAL VALIDITY AND EXPERIMENTAL DESIGN

- Internal validity—The accuracy in concluding that the outcome of an experiment is due to the independent variable
- External validity—The extent to which the results of an experiment can be generalized
THREATS TO INTERNAL VALIDITY

- **History**—Uncontrolled outside influences on participants during an experiment
- **Maturation**—Changes due to natural development
- **Selection**—Biased selection of participants
- **Testing**—Sensitization due to pretest
- **Instrumentation**—Biases due to testing procedures
- **Regression**—The tendency for extreme scorers to move toward more typical performance when retested
- **Mortality**—Changes in group composition because some participants have left the study
THREATS TO EXTERNAL VALIDITY

- **Multiple treatment interference**—Several treatments occur simultaneously
- **Reactive arrangements (Hawthorne effect)**—Knowledge about the experiment
- **Experimenter effects**—Effects due to the presence of the experimenter
- **Pretest sensitization**—Sensitization due to pretest
INCREASING INTERNAL AND EXTERNAL VALIDITY

- Increasing internal validity
  - Randomly select participants
  - Randomly assign to groups
  - Use a control group

- Increasing external validity
  - Careful adherence to good experimental practices!
INTERNAL OR EXTERNAL VALIDITY: A TRADE-OFF?

- Too much control reduces ability to generalize
- Too little control reduces ability to make causal statements
- Attempt to find a good balance
CONTROLLING EXTRANEOUS VARIABLES
CONTROLLING EXTRANEOUS VARIABLES

- Variables that are not accounted for can confound an experiment
- Controlling extraneous variables
  - Ignore them if they are unrelated to the dependent variable
  - Randomizing helps ensure that groups are equivalent
MATCHING

- Ensures that subjects in each group
  - Are equivalent on some characteristic
  - Should be related to the dependent measure

- Disadvantages
  - Expensive and time-consuming
  - May not be possible
  - Matching on some variables establishes equivalence on others
USE OF HOMOGENEOUS GROUPS

- Select sample from a population whose members are alike on critical factors
ANALYSIS OF COVARIANCE (ANCOVA)

- A statistical tool that equalizes any initial differences that might exist:
  - Between groups
  - On a covariate (a potential matched variable)
HAVE WE MET THE OBJECTIVES? CAN YOU:

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