Pre-experimental Designs for Description

Y520
Strategies for Educational Inquiry

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Research Methodology

- Is concerned with how the design is implemented and how the research is carried out. The methodology used often determines the quality of the data set generated. Methodology specifies:
  - When and how often to collect data
  - Construction of data collection measures
  - Identification of the sample or test population
  - Choice of strategy for contacting subjects
  - Selection of statistical tools
  - Presentation of findings
Pre-Experimental Research Designs

- Pre-experimental research is needed because there are many independent variables that we cannot manipulate, either ethically, or practically.
- Example: Randomly sample and randomly assign 500 infants to experimental and comparison groups. The experimental group must smoke cigarettes; the comparison group does not.

Pre-Experimental Research Designs

- Pre-experimental research **lacks** the manipulation of an independent variable by the researcher.
- The researcher investigates conditions that naturally occur or that have already occurred.
- The researcher studies how variables are related.
- These designs **cannot** be used as the basis for cause and effect relationships.
“Independent” Variables in Pre-Experimental Research

- Categorical variables that cannot be manipulated:
  - gender
  - parenting style
  - learning style
  - ethnicity
  - retention in grade
  - personality type
  - drug use

- Quantitative variables that cannot be manipulated:
  - age
  - intelligence
  - grade point average
  - personality traits
  - retention in grade
### Pre-Experimental Designs for Description

- Descriptive research provides data for monitoring and evaluating policies and programs. These designs are concerned with how to answer such questions as:
  - How many?
  - How much?
  - How efficient?
  - How effective?
  - How adequate?

### Case study design
- Focus groups
- Meta-Analysis

### Static group comparison design (cross-sectional study)

### One group pre-test / post-test design
- Longitudinal Designs
  - Time Series Designs
  - Panel Designs
Case Study Design

- Case studies examine, in depth, people (e.g., principalship), programs, policies, decisions, organizations. Case studies are useful for learning about:
  - Policies or programs with remarkable successes
  - Policies or programs with ambiguous or unexpected outcomes
  - Situations where actors have discretionary behavior

- Case studies weave together data from documents, archives, interview, participation, observation, artifacts, videos, etc. Case studies usually attempt to describe not only “what” but also the “why.”

<table>
<thead>
<tr>
<th>Treatment</th>
<th>X</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>(No Control)</td>
<td></td>
<td></td>
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</table>

- No control group
- Cannot tell if “treatment” had any effect.
Case Study: Advantages & Disadvantages

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Includes data from multiple perspectives</td>
<td>• Need direct access to subjects</td>
</tr>
<tr>
<td>• Combines data from different sources</td>
<td>• Insiders can be biased</td>
</tr>
<tr>
<td></td>
<td>• Outsiders can be naïve</td>
</tr>
<tr>
<td></td>
<td>• Need skills in many techniques</td>
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<tr>
<td></td>
<td>• Need diverse sources of information</td>
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</tbody>
</table>

Case Study Design:
Campbell & Stanley (1963)

- “As has been pointed out (e.g., Boring, 1954; Stouffer, 1949) such studies have such a total absence of control as to be of almost no scientific value” (p. 6).
- Basic to scientific evidence (and to all knowledge-diagnostic processes including the retina of the eye) is the process of comparison, of recording differences, or of contrast. Any appearance of absolute knowledge, or intrinsic knowledge about singular isolated objects, is found to be illusory upon analysis. Securing scientific evidence involves making at least one comparison” (p. 6).
Case Study Design:
Campbell & Stanley (1963)

- “It seems well-nigh unethical . . . to allow, as theses or dissertations in education, case studies of this nature (i.e., involving a single group observed at one time only)” (p. 7).

Focus Groups

- A method of group interviewing for obtaining qualitative data (note: Frank Luntz obtains quantitative data from focus groups).
  - Not a research design; rather a data collection method.
Meta-Analysis

- A quantitative analysis of existing research studies on a particular topic.
- Is used to draw conclusions about the topic from a range of studies; for example, the relationship between per pupil expenditures and pupil performance.
- May generate hypotheses for future research.

Meta-Analysis: Problems

- Locating suitable studies.
- Studies likely do not all have the same dependent variable.
- Usually only studies that report statistically significant results are published.
- Different studies have many dissimilar aspects making comparisons difficult.
Static Group Comparison: Cross-Sectional Designs

<table>
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<tr>
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<th>X</th>
<th>O₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td>O₁</td>
</tr>
</tbody>
</table>

- Intact, existing groups are used.
- No random selection of subjects.
- No random assignment to groups.
- No way to insure equivalence of groups.

Instances of this kind of research include, for example, the comparison of school systems which require the bachelor’s degree of teachers versus those which do not; the comparison of students in classes given speed-reading training versus those not given it; the comparison of those who heard a certain TV program with those who did not, etc” (p. 12).

– Campbell & Stanley (1963)
Static Group Comparison:
Cross-Sectional Designs

- There is “... No formal means of certifying that the groups would have been equivalent had it not been for the X ... If O₁ and O₂ differ, this difference could well have come through the differential recruitment of persons making up the groups: the groups might have differed anyway, without the occurrence of X” (p. 12).

  – Campbell & Stanley (1963)

Static Group Comparison:
Cross-Sectional Designs

- Use: for research that collects data on relevant variables one time only from a variety of subjects.
- Data are collected all at the same time.
- Provides a snapshot of variables in the study, at one particular point in time.
- Reveals how those variables are represented in a cross-section of the population.
- Survey technique often used.
Static Group Comparison:
Cross-Sectional Designs: Advantages

- Data on many variables
- Data from a large number of subjects
- Data from dispersed subjects
- Data on attitudes and behaviors
- Answers questions who, what, where, when
- Good for exploratory research
- Generates hypotheses for future research
- Data useful to many different researchers

Static Group Comparison:
Cross-Sectional Designs: Disadvantages

- Increase chances of error (many variables)
- Increase cost with more subjects
- Increased cost with each location
- Cannot measure change
- Cannot establish cause and effect
- No control of independent variable
- Difficult to rule out rival hypotheses
- Static, time bound
One Group Pre-test / Post-test Design

| Treatment | O₁ | X | O₂ |

- No control group. Changes between pre- and post-test may be due — not to the treatment — but to: history, maturation, instrument decay, data collection characteristics, data collection bias, testing, statistical regression, attitude of subjects, problems with implementation, and so forth.

One Group Pre-test / Post-test Designs

- Longitudinal Designs. Data is collected, repeatedly, over a long period time. Enables researcher to measure change in variables over time. Two different types of longitudinal designs:
  - Time Series Design
  - Panel Designs
Time Series Design

- Collect data on the same variable at regular intervals (weeks, months, years, etc.).

- Data often is an aggregate measure of a population, e.g., NAEP scores, graduation rates, free/reduced lunches, consumer price index, FBI uniform crime rate…

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Time Series Design

\[
\begin{align*}
O_1 & \quad O_2 & \quad O_3 & \quad O_4 & \quad O_5 & \quad X_1 & \quad O_6 & \quad O_7 & \quad O_8 \\
O_9
\end{align*}
\]

“The essence of the time-series design is the presence of a periodic measurement process on some group or individual and the introduction of an experimental change into this time series of measurements, the results of which are indicated by a discontinuity in the measurements recorded in the time series” (p. 37).

— Campbell & Stanley (1963)
Time Series Design

- Time series designs useful for:
  - Establishing a baseline measure
  - Describing changes over time
  - Keeping track of trends
  - Forecasting future short term trends
- Data are nearly always presented in the form of a graph or chart. The horizontal (x) axis is divided into time intervals, and the vertical axis (y) shows values of the dependent variable as they fluctuate over time.

Time Series Design: Advantages

- Data easy to collect
- Results easy to present in graphs
- Ease of interpretation (look for patterns in graph)
- Can forecast short term trends
Time Series Design: Disadvantages

- Data collection method may change over time.
- Difficult to show more than one variable at a time.
- Needs qualitative research to explain fluctuations.
- Assumes present trends will continue unchanged.

Panel Designs

- Collect repeated measurements from the same subjects over time. Reveals changes at the individual level, e.g., teacher turnover, nurse health indicators.
- Can reveal different patterns than do time series aggregate data.
Panel Designs: Advantages

- Reveals individual level changes.
- Establishes time order of variables.
- Can show how relationships emerge.

Panel Designs: Disadvantages

- Difficult to obtain initial sample of subjects.
- Difficult to keep the same subjects over time.
- Repeated measures may influence subjects’ behavior.