RESEARCH METHODS

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Topic 8

Research Approach: Quantitative Approach
Qualitative

Quantitative

Mixed-Method (Quali + Quanti)

3 Research Approaches
Quantitative Research
A type of research in which the researcher:
• Decides what to study.
• Ask specific, narrow questions.
• Collect quantifiable data from participants.
• Analyzes these numbers using statistics.
• Conducts the inquiry in an unbiased, objective manner.

Qualitative Research
A type of research in which the researcher:
• Relies on the views of participants.
• Ask broad, general questions.
• Collects data consisting largely of words from participants.
• Describes and analyzes these words for themes.
• Conducts the inquiry in a subjective, biased manner.
Quantitative Study Design

- Specific
- Well structured
- Have been tested for their validity & reliability
- Explicitly defined & recognized
- Deductive

Qualitative Study Design

- Less specific & precise
- Do not have the same structural depth
- Inductive
- Flexible & emergent in nature
Research Process of Quantitative vs Qualitative Approaches

**QUANTITATIVE**

- Major role
- Justification for a research problem & specification for the need for the study
- Specific & narrow
- Measureable, observable data
- Pre-determined instrument
- Numeric data
- Sample: large number of respondent
- Statistical analysis
- Describe trends, compare groups/relationship among variables
- A comparison of result with predictions & past studies
- Standard & fixed
- Objective & unbiased

**QUALITATIVE**

- Minor role
- Justification for a research problem
- General & broad
- Participants experiences
- General, emerging form
- Text/image data
- Sample: small number of respondents
- Text analysis
- Description, analysis & thematic development
- The larger meaning of findings
- Flexible & emerging
- Reflexive & bias

**QUANTITATIVE**

- Identifying the research problem
- Review of literature
- Specifying a purpose
- Collecting data
- Analyzing & interpreting data
- Reporting & evaluating research

**QUALITATIVE**

- Exploratory & understanding oriented
- Review of literature
- Specifying a purpose
- Collecting data
- Analyzing & interpreting data
- Reporting & evaluating research
QUANTITATIVE RESEARCH DESIGN

- Experimental design
- Correlational design
- Survey design
Experimental design

➢ To establish the existence of cause and effect relationship between two variables.

➢ The simplest experimental design
  - Randomly selects subjects from population
  - Experimental group – receives treatment
  - Control group – does not receive treatment

➢ When to use experimental procedures??
  * used to establish cause & effect
    - between IV and DV
    - control for all variables that might influence the outcome
  * used when comparing two or more group
Characteristic of experimental design

- Random assignment – assign individual to random groups.
- Control over extraneous variables that might influence the relationship – influence in participant selection, procedures, statistics, or the design likely to affect the outcome.
- Manipulation the treatment conditions – manipulate the IV to determine the effect on the outcome.
- Outcome measures – assess whether the treatment conditions influence an outcome (DV).
- Group comparisons – compare scores for different treatment
- Guard against threats to validity – guard against false conclusion.
The experimental manipulation of a treatment group

**Independent Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>(cannot manipulate)</td>
</tr>
<tr>
<td>Gender</td>
<td>(cannot manipulate)</td>
</tr>
<tr>
<td>Types of instruction</td>
<td>(can manipulate)</td>
</tr>
<tr>
<td>a. Lecture</td>
<td>(control)</td>
</tr>
<tr>
<td>b. Lecture + hazard instruction</td>
<td>(comparison)</td>
</tr>
<tr>
<td>c. Lecture + hazard instruction + slide of damage lungs</td>
<td>(experiment)</td>
</tr>
</tbody>
</table>

**Dependent Variable**

Frequency of smoking
Group comparison in an experiment

**Phase 1: Relationship Picture**

Error Correction Treatment

**Phase 2: Timeline Picture**

- Class A: Regular Spelling Practice (control)
- Class B: Reduced Word List (comparison)
- Class C: Error Correction (experimental)

**Phase 3: Statistical Comparisons**

<table>
<thead>
<tr>
<th></th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test 1</td>
<td>10.3</td>
<td>10.8</td>
<td>9.9</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(3.6)</td>
<td>(4.3)</td>
<td>(3.9)</td>
<td></td>
</tr>
<tr>
<td>Test 2</td>
<td>10.7</td>
<td>10.6</td>
<td>13.9</td>
<td>4.90*</td>
</tr>
<tr>
<td></td>
<td>(3.3)</td>
<td>(3.8)</td>
<td>(4.2)</td>
<td></td>
</tr>
<tr>
<td>Test 3</td>
<td>11.1</td>
<td>10.3</td>
<td>13.1</td>
<td>3.31*</td>
</tr>
<tr>
<td></td>
<td>(3.3)</td>
<td>(3.6)</td>
<td>(3.8)</td>
<td></td>
</tr>
</tbody>
</table>
## Threats to internal validity

**INTERNAL VALIDITY**: The observed changes that took place are a result of your intervention or your program and are not the result of other causes.

<table>
<thead>
<tr>
<th>Threat</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>History</td>
<td>Uncontrolled outside influences on participants during an experiment</td>
</tr>
<tr>
<td>Maturation</td>
<td>Changes due to natural development</td>
</tr>
<tr>
<td>Selection</td>
<td>Biased selection of participants</td>
</tr>
<tr>
<td>Testing</td>
<td>Sensitization due to pretest</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>Biases due to testing procedures</td>
</tr>
<tr>
<td>Regression</td>
<td>The tendency for extreme scores to move toward more typical performance when retested</td>
</tr>
<tr>
<td>Mortality</td>
<td>Changes in group composition because some participants have left the study</td>
</tr>
<tr>
<td>Multiple treatment interference</td>
<td>Several treatments cur simultaneously</td>
</tr>
<tr>
<td>Reactive arrangements (Hawthorne effect)</td>
<td>Knowledge about the experiment</td>
</tr>
<tr>
<td>Experimenter effects</td>
<td>Effect due to the presence of the experimenter</td>
</tr>
<tr>
<td>Pretest sensitization</td>
<td>Sensitization due to pretest</td>
</tr>
</tbody>
</table>
Threats to external validity

EXTERNAL VALIDITY: The degree to which the findings are generalizable to a population

- Interaction of selection and treatment
- Interaction of setting and treatment
- Interaction of history and treatment
Types of Experiment: Between Groups

- **True experiments**
  - Characteristic:
    - Random assignment
    - Control group
  - Three typical design:
    - Pretest post-test control group design
    - Post-test only control group design
    - Solomon four-group design

- **Quasi-experiments**
  - Pose more threat to internal validity than true experiment
  - Pretest and posttest
  - Factorial design – different treatment to different groups
# Experimental design

<table>
<thead>
<tr>
<th></th>
<th>True experimental design</th>
<th>Quasi-experimental design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of a control group?</td>
<td>Always</td>
<td>Often</td>
</tr>
<tr>
<td>Random selection of subjects from a population?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Random assignment of subjects to group?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Random assignment of treatments to groups?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Degree of control over extraneous variables?</td>
<td>Yes</td>
<td>Some</td>
</tr>
</tbody>
</table>
- **Pretest post-test control group design**

<table>
<thead>
<tr>
<th>Random assignment of participants to control group</th>
<th>Pretest</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>Pretest</td>
<td>Treatment</td>
<td>Post-test</td>
</tr>
</tbody>
</table>

- Group should be equivalent at beginning
- 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

<table>
<thead>
<tr>
<th>Random assignment to experimental or treatment group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random assignment to control group 1</td>
<td>Pretest</td>
<td>No treatment</td>
<td>Post-test</td>
</tr>
<tr>
<td>Random assignment to control group 2</td>
<td>No pretest</td>
<td>Treatment</td>
<td>Post-test</td>
</tr>
<tr>
<td>Random assignment to control group 3</td>
<td>No pretest</td>
<td>No treatment</td>
<td>Post-test</td>
</tr>
</tbody>
</table>

* Many different comparisons are possible
Types of Experiment: Within Group

**Time series experiments**
- Interrupted
- Uninterrupted

**Repeated measures experiments**

**Single-subject experiments**
- A/B design
- Multiple baseline design
- Alternating treatment
Steps in Conducting Experimental Research

1. Choose a type of experimental design
2. Select experimental unit & identify study participants
3. Select an experimental treatment & introduce it
4. Form cause/effect hypotheses
5. Conduct the experiment
6. Organize & analyze the data
7. Develop an experimental research report

Decide if an experimental design fits research problem
Correlation design

- Researcher use the correlational statistical test to describe and measure the degree of association (or relationship) between two/more variables or sets of scores.
- Statistic that expresses linear relationships is the Pearson product moment correlation coefficient.
- Bivariate correlation.
- E.g. Study the relationship between student self-efficacy and academic achievement.
- Do not imply a cause-and-effect relationship.
- Do imply that variables share something in common.
When to use correlational design

To examine the relationship between two / more variables.

To predict an outcome:
- look at how the variables co-vary together
- use one variable to predict the score on another variable

Forms of data collection is similar to survey design.
Types of Correlational Design: Explanatory Design

• Correlate two/more variables.
• Collect data at one point in time.
• Analyze all participants as a single group.
• Obtain at least two scores for each individual in the group – one for each variable.
• Report the correlation statistic – Pearson Product Moment Correlation Coefficient
• Interpretation based on statistical test result indicate that the changes in one variable are reflected in changes in the other.
Conducting a Correlational Study

Determine if a correlational study best addresses the research problem.
Identify the individuals in the study.
Identify two/more measures for each individual in the study.
Collect data and monitor potential threats.
Analyze the data and represent the results.
Interpret the results.
Correlation Coefficient

Expresses degree of linear relatedness between two variables.

Varies between -1.00 and +1.00

Strength of relationship is
- indicated by absolute value of coefficient
- stronger as shared variance increases
## Two Types of Correlation

<table>
<thead>
<tr>
<th>If X…</th>
<th>And Y…</th>
<th>The correlation is…</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increases in value</td>
<td>Increases in value</td>
<td>Positive or direct</td>
<td>The taller one gets (X), the more one weights (Y).</td>
</tr>
<tr>
<td>Decreases in value</td>
<td>Decreases in value</td>
<td>Positive or direct</td>
<td>The fewer mistakes one makes (X), the fewer hours of remedial work (Y) one participates in.</td>
</tr>
<tr>
<td>Increases in value</td>
<td>Decreases in value</td>
<td>Negative or inverse</td>
<td>The better one behaves (X), the fewer in-class suspensions (Y) one has.</td>
</tr>
<tr>
<td>Decreases in value</td>
<td>Increases in value</td>
<td>Negative or inverse</td>
<td>The less time one spends studying (X), the more errors one makes on the test (Y).</td>
</tr>
</tbody>
</table>
What correlation coefficients look like

• Pearson product moment correlation
  - \( r_{xy} \)
  - correlation between variables \( x \) and \( y \)

• Scattergram representation
  1. Set up \( x \) and \( y \) axes
  2. Represent one variables on \( x \) axis and one on \( y \) axis
  3. Plot each pair of \( x \) and \( y \) coordinates
- When points are closer to a straight line, the correlation becomes stronger.
- As slope of line approaches 45°, correlation becomes stronger.
Survey design

Researcher administer a survey to a sample or to the entire population of people in order to describe the attitudes, opinions, behaviors, or characteristics of the population.

Seeks to describe trends in a large population of individuals
* does not explain cause and effect.
* may examine correlation between variables (like correlational design) but the focus is on the population.

Used to:
* to assess trends – ‘Rukun Tetangga’ trend among housing estates
* to assess opinions, beliefs, and attitude – opinion about 1Malaysia concept
* for follow-up analyses – graduate tracer study
* for evaluation – evaluate the success of teaching Science & Math in English
Types of Survey Design

TIME OF DATA COLLECTION

Study over time
- Longitudinal
  - Trends in the same population over time: Trend
  - Changes in a subpopulation group identified by a common characteristic over time: Cohort
  - Changes in the same people over time: Panel

Study at one point in time
- Cross-sectional
  - Attitude & practices
  - Group comparison
  - Community needs
    - National assessment
    - Program evaluation
Key characteristics of Survey Research

- Sampling from a population
- Collecting data through questionnaires or interviews
- Designing instruments for data collection
- Obtaining a high response rate
Forms of Data Collection

**Who completes or records the data?**

- **Participant**
  - Mailed questionnaire
  - Electronic questionnaire
  - Group administered questionnaire
  - Drop & collect questionnaire

- **Researcher**
  - One on one
    - Individual interview
  - To a group
    - Focus group interview
  - Over telephone
    - Telephone interview
Steps in conducting Survey Research

1) Decide if a survey is the best design to use.
2) Identify the research questions or hypotheses.
3) Identify the population, the sampling frame, and the sample.
4) Determine the survey design and data collection procedures.
5) Develop or locate an instrument.
6) Administer the instrument.
7) Analyzes the data to address the research questions or hypotheses.
8) Write the report.
Population, Target Population, Sampling Frame and Sample

The Population
The group of individuals having one characteristic that distinguishes them from other groups.

The Target Population or Sampling Frame
The actual list of sampling units from which the sample is selected.

The Sample
The group of participants in a study selected from the target population from which the researcher generalizes to the target population.
E.g. The Wellington Regional Council is interested in the attitudes of Wellington residents to a proposed new highway development out of Wellington, called the Transmission Gully project. The population would consist of all adult residents in the Wellington region (about 300 000 people) and the sampling frame might be the Wellington telephone directory. The sample would consist of 383 people.