Lec 3:
Research methods and techniques

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Research methods and techniques provide a structured approach to scientific inquiry, allowing researchers to systematically investigate questions, test hypotheses, and generate new knowledge across diverse fields.

Technical overview of research methods commonly used in scientific investigations, categorized by their nature and specific methodologies.

1. Experimental Research:

- involves controlled and field experiments to test hypotheses by manipulating variables.

2. Observational Research:

- includes naturalistic observation and case studies to study subjects in their natural settings.

3. Surveys and Questionnaires:

- collect data from samples through cross-sectional and longitudinal methods.

4. Qualitative Methods:

- such as interviews, focus groups, and content analysis, explore complex phenomena and human experiences.

5. Quantitative Methods:

- use statistical techniques to analyze numerical data and test relationships.

6. Mixed-Methods Research:

- combines qualitative and quantitative approaches to provide a comprehensive understanding.

7. Comparative Research:

- compares different groups or systems to identify similarities and differences.

8. Meta-Analysis and Systematic Reviews:

- synthesize findings from multiple studies to draw overarching conclusions.

9. Simulation and Modeling:

- use computational and theoretical models to simulate complex systems.

10. Ethnographic Research:

- involves immersive study of cultures through participant observation and narratives.

11. Historical Research analyses:

- historical documents and oral histories to understand past events.

1. Experimental Research

A. Controlled Experiments

Design and Randomization:

Experimental designs include between subjects, within subjects, and mixed designs. Randomization techniques, such as random assignment, ensure that each participant has an equal chance of being placed in any experimental condition, minimizing selection bias.

Independent and Dependent Variables:

Independent variables are manipulated, while dependent variables are measured. Confounding variables are controlled to prevent them from affecting the dependent variable.

Blinding and Placebo Controls:

Single blind and double-blind procedures are used to reduce bias. Placebo controls help distinguish the treatment's effect from the placebo effect.

B. Field Experiments

Natural Setting:

Conducted in real-world environments, often without the participants' awareness that they are part of an experiment. This approach can increase ecological validity but may sacrifice some control over extraneous variables.

2. Observational Research

A. Naturalistic Observation

Non Intrusive Measurement:

Researchers observe subjects in their natural environment, ensuring minimal interference. This method is often used in behavioral sciences and ecology.

Data Collection Techniques:

Includes systematic observation, video recording, and field notes.

B. Case Studies

In Depth Analysis:

Focused on a single case or a small number of cases, providing detailed qualitative and quantitative data. Case studies often involve triangulation, using multiple data sources (e.g., interviews, archival records) for comprehensive understanding.

3. Surveys and Questionnaires

A. Cross Sectional Surveys

Snapshot of a Population:

Data is collected at a single point in time. The survey's design includes sampling techniques (e.g., stratified, cluster) and question formats (e.g., Likert scales, open ended questions).

B. Longitudinal Surveys

Temporal Data Collection:

Follows the same subjects over an extended period, allowing researchers to study changes and developmental trends. Longitudinal data can be analyzed using growth curve modeling and survival analysis.

4. Qualitative Research Methods

A. Interviews

Structured, Semi Structured, Unstructured:

Structured interviews use predefined questions, semistructured allow for some flexibility, and unstructured interviews are openended. Transcriptions are analyzed using thematic analysis or grounded theory.

B. Focus Groups

Group Dynamics:

Facilitated discussions that gather diverse perspectives. Analysis often involves coding transcripts to identify recurring themes and patterns.

C. Content Analysis

Systematic Coding:

Analyzing textual or media content to quantify and interpret the presence of certain words, themes, or concepts. It involves creating a coding scheme, training coders, and ensuring intercoder reliability.

5. Quantitative Research Methods

A. Statistical Analysis

Descriptive and Inferential Statistics:

Descriptive statistics summarize data (e.g., mean, standard deviation), while inferential statistics (e.g., ttests, ANOVA, regression analysis) test hypotheses and infer conclusions about a population.

B. Surveys and Experiments

Data Quantification:

Numerical data collected can be subjected to statistical testing to examine relationships, differences, or trends. Techniques such as factor analysis, structural equation modeling (SEM), and multivariate analysis are commonly used.

6. Mixed Methods Research

A. Convergent Parallel Design

Concurrent Data Collection:

Collecting qualitative and quantitative data simultaneously and then integrating the results to provide comprehensive insights.

B. Explanatory Sequential Design

Quantitative Followed by Qualitative:

Initial quantitative results are used to inform the subsequent qualitative phase, exploring findings in more depth.

7. Comparative Research

A. Cross-cultural Studies

Cultural Comparisons:

Comparing different cultures or social groups to understand variations in behavior, attitudes, or practices. Methods include ethnographic studies and surveys.

B. Comparative Politics

Political Systems Analysis:

Examining different political systems, policies, or historical events to draw generalizations and understand systemic differences.

8. **Metanalysis and Systematic Reviews**

A. Metanalysis

Quantitative Synthesis:

Combining statistical results from multiple studies to estimate the overall effect size. Involves calculating effect sizes, conducting a weighted average, and assessing publication bias.

B. Systematic Review

Comprehensive Literature Review:

Using rigorous methods to identify, select, and critically appraise research on a specific topic. The process involves formulating research questions, defining inclusion/exclusion criteria, and synthesizing findings.

9. Simulation and Modelling

A. Computational Models

Simulation of Complex Systems:

Using algorithms and mathematical models to simulate biological, social, or physical systems. Examples include agent based modelling, cellular automata, and finite element analysis.

B. Theoretical Models

Hypothetical Constructs:

Developing conceptual frameworks to explain phenomena and predict future occurrences. These models are tested through empirical research and simulation.

10. Ethnographic Research

A. Participant Observation

Immersive Fieldwork:

Researchers engage with the community being studied, often over an extended period. Data collection includes field notes, interviews, and artefact analysis.

B. Ethnographic Narratives

Cultural Descriptions:

Producing rich, descriptive accounts of a community's way of life, practices, and social structures.

11. Historical Research

A. Archival Research

Document Analysis:

Examining historical documents, records, and artifacts to study past events, trends, and societal changes. Methods include content analysis, historiography, and interpretative analysis.

B. Oral Histories

Interviews with Witnesses:

Collecting first-hand accounts from individuals who experienced historical events. These narratives are analysed for accuracy, context, and significance.