

Quantitative Research Methods



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Overview

- Research Process
- Quantitative Methods
- Designs
- Validity and Research Designs

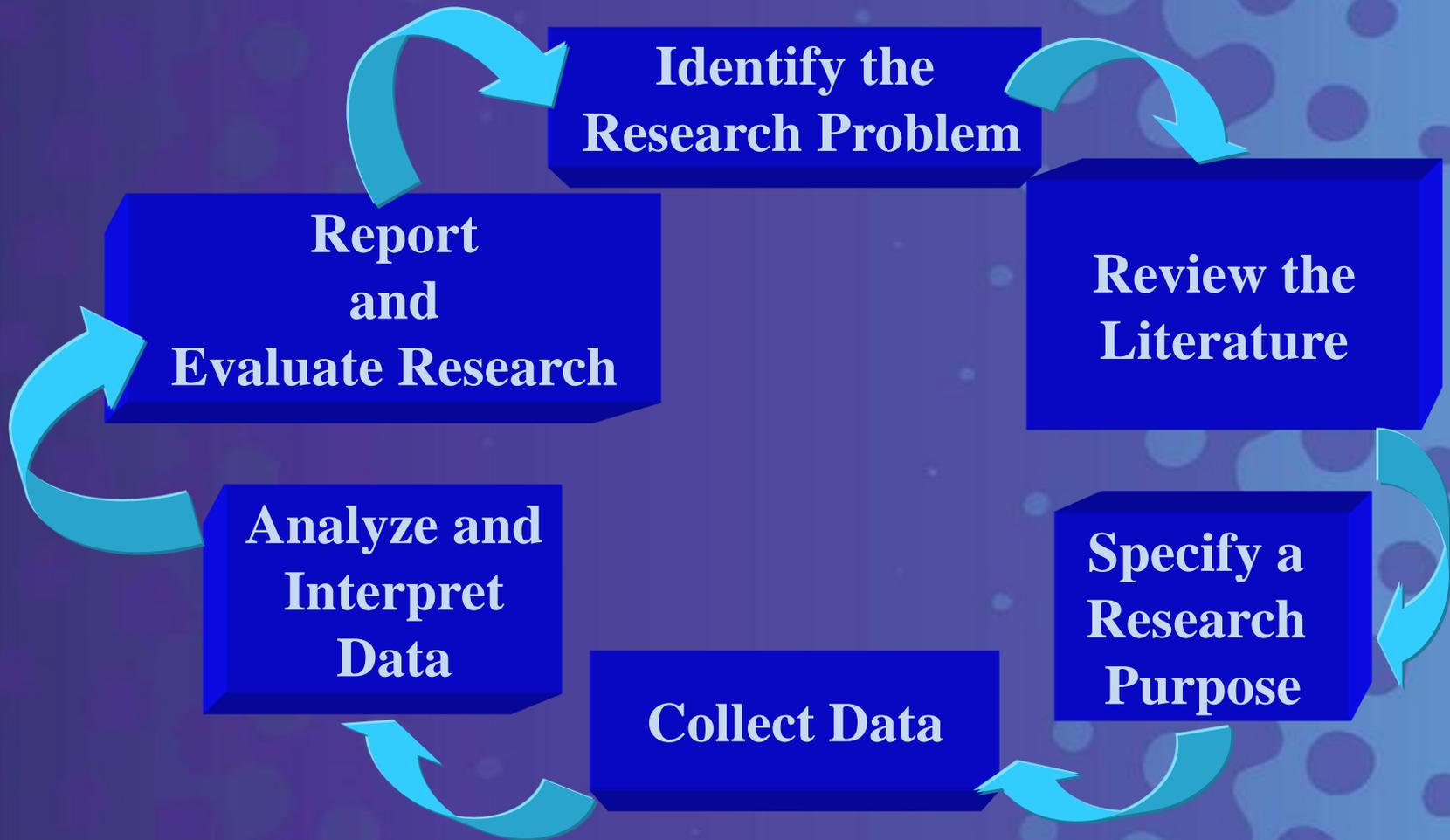
A Definition of Research

Research is a process of steps used to collect and analyze information in order to increase our understanding of a topic or issue.

Problems With Research Today

- Contradictory or vague findings
- Questionable data
- Unclear statements about the intent of the study
- Lack of full disclosure of the data-collection procedure
- Inarticulate rendering of the research problem

The Process of Research



The Process of Research: Identify the Research Problem

- Specify a problem
- Justify a problem
- Suggest a need to study the problem for audiences

The Process of Research: Review the Literature

- Locate resources
 - Books
 - Journals
 - Electronic resources
- Select resources
 - Determine the relevant resources for the topic
 - Organize the resources by developing a “Literature Map”
- Summarize the resources in a literature review

The Process of Research: Specify a Research Purpose

- Identify the purpose statement
 - The major intent of the study
 - The participants in the study
 - The site of the study
- Narrow the purpose statement
 - Quantitative: Write research questions and/or hypothesis
 - Qualitative: Identify a central phenomenon and write subquestions

The Research Process: Collect Data

- Determine the data-collection method
- Select the individuals to study
- Design or select data-collection instruments and outline data-collection procedures
- Obtain permissions
- Gather data

The Research Process: Analyze and Interpret Data

- Take the data apart to look at individual responses
- Represent the data in tables, figures, and pictures
- Explain conclusions from the data that address the research questions

Ethical Considerations in Research

- Respect the rights of the participants
- Honor the requests and restrictions of the research site
- Report the research fully and honestly

Definitions of Quantitative and Qualitative Research

Quantitative Research

A type of educational research in which the researcher decides what to study; asks specific, narrow questions; collects quantifiable data from participants; analyzes these numbers using statistics; and conducts the inquiry in an unbiased, objective manner.

Characteristics of Quantitative Research

- An emphasis on collecting and analyzing information in the form of numbers
- An emphasis on collecting scores that measure distinct attributes of individuals and organizations
- An emphasis on the procedures of comparing groups or relating factors about individuals or groups in experiments, correlational studies, and surveys

Characteristics of Quantitative Methods in the Process of Research



Quantitative Methods

Intervention Research

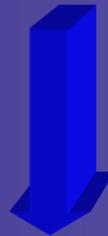
Explaining whether an intervention influences an outcome for one group as opposed to another group



**Experimental Research:
Between-Subjects
Approach**

Nonintervention Research

Associating or relating variables in a predictable pattern for one group of individuals



**Nonexperimental Research:
Correlational Approach**

Describing trends for the population of people



**Nonexperimental Research:
Survey Approach**

Method, Research, Approach and Design

(Edmonds & Kennedy, 2012)

Level	Explanation
METHOD₁	The <i>method</i> is the theoretical, philosophical, and data analytic perspective. The method can be quantitative, qualitative, or mixed (e.g., a quantitative method ₁).
▼	▼
RESEARCH₂	<i>Research</i> refers to the systematic process of group assignment, selection, and data collection techniques. Research can be experimental, quasi-experimental, or non-experimental (e.g., a quantitative method ₁ and experimental research ₂).
▼	▼
APPROACH₃	The <i>approach</i> is the first step to creating structure to the design, and it details (a) a theoretical model of how the data will be collected, and (b) if one case, one group, or multiple groups will be associated with the process (e.g., a quantitative method ₁ , experimental research ₂ with a between-subjects approach ₃).
▼	▼
DESIGN₄	The <i>design</i> is the actual structure or framework that indicates (a) the time frame(s) in which data will be collected or how and when the data will be analyzed using qualitative methods, (b) when the treatment will be implemented (or not), and (c) the exact number of groups that will be involved (e.g., a quantitative method ₁ , experimental research ₂ with a between-subjects approach ₃ and a pre- and posttest control group design ₄).

Experimental research utilizing a between-subjects approach with a pre- and posttest control group design

Research Question: Does active parent engagement in selecting and using routine-based activities have a positive effect on children's language and appropriate behavior development?

Assignment	Group	Pretest	Treatment	Posttest
R	1 ($n = 22$)	TELD-3, ECBI	Family-Centered Intervention	TELD-3, ECBI
R	2 ($n = 19$)	TELD-3, ECBI	-	TELD-3, ECBI
Time ►				

Chao, P., Bryan, T., Burstein, K., & Ergul, C. (2006). Family-centered intervention for young children at-risk for language and behavior problems. *Early Childhood Education Journal*, 34(2), 147-153.

Nonexperimental research utilizing a correlational approach with an explanatory design

Research Question: What classroom motivation variables are related to students' sense of belonging?

Variables	Students ($n = 249$)
Motivation	Self, efficacy, instrumentality, goals
Sense of belonging	Sense of belonging survey

Walker, C. O., & Greene, B. A. (2009). The relations between students' motivational beliefs and cognitive engagement in high school. *Journal of Educational Research*, 102(6) 463-471.

Nonexperimental research utilizing a survey approach with a cross-sectional design

Research Question: What evidence exists to demonstrate the prevalence and consequences of recurrent low-back pain in children?

Variable ($N = 500$)	Time point 1
Low-back pain	Low-back pain survey

Jones, M. A., Stratten, G., Reilly, T., & Unnithan, V. B. (2004). A school-based survey of recurrent non-specific low-back pain prevalence and consequences in children. *Health Education Research, 19*(3), 284-289.

Threats to Internal Validity (examples)

Threat	Explanation
History	Any event that occurs during the time of the treatment and the posttest that could affect the outcome (e.g., natural life events such as a death in the family, change in job, or moving).
Maturation	The natural process of changing, growing, and learning over time.
Testing	The effects of practice familiarity in taking the same test more than once (e.g., the participant who takes the same math achievement test twice in the pre- and posttest measures may improve performance simply because of the familiarity with the test)
Instrumentation	The change in a measuring instrument over time (i.e., some instruments undergo revisions).

Threats to External Validity (examples)

Threat	Explanation
Sample Characteristics	The extent to which the sample (i.e., unit) represents the population from which it is drawn (i.e., for a sample to represent a population, the researcher must employ the appropriate sampling procedures and perform random selection).
Stimulus Characteristics and Settings	The unique factors involved in providing the treatment or intervention, such as the setting and researchers (i.e., it is difficult to replicate contrived laboratory conditions to real-life scenarios).
Treatment Variations	Variations in the same treatment or the combination of multiple or partial treatments account for different results.
Outcome Variations	Observing the effect of one type of outcome differs when alternate outcomes are observed.
Context-Dependent Mediation	Mediating variables related to outcomes differ between contexts or settings.

Threats to Construct Validity (examples)

Threat	Explanation
Attention and Contact with Participants	Similar to <i>special treatment</i> , the level of attention, or differentiated attention, between the groups from the experimenter (e.g., the researcher spends more time with Group 1 than Group 2, and the differences observed in the outcome can be explained by the increased amount of attention and not due to the intervention).
Single Operations and Narrow Stimulus Sampling	The impact the researcher has on the development and implementation of the treatment (i.e., researchers deliver treatments differently based on experiences and expertise; therefore, it is difficult to measure the impact the researcher has on the treatment itself).
Experimenter Expectancies	The researchers' expectancies, beliefs, and biases about the results (e.g., if a researcher strongly believes anxiety reduces test performance, then the interaction between the researcher and the participant may influence the outcome because the delivery of instructions and adherence to protocols may change).

Threats to Statistical Conclusion Validity (examples)

Threat	Explanation
Low Statistical Power	Power is the extent to which the results of an analysis accurately reveal a statistically significant difference between groups (or cases) when a statistical difference truly exists.
Assumption Violation of Statistical Tests	Violating the assumptions (depending on the extent of the violation) of statistical tests can lead to over- or underestimation of practical and statistical significance of an outcome.
Error Rate Problem	Statistical significance can be artificially inflated when performing multiple pairwise tests, also referred to as familywise error rate. (i.e., the probability of making a Type I error when performing multiple pairwise analyses).
Restriction of Range	Lack of variability between variables weakens the relationship and lowers statistical power.