

Research Methodology

Paper I- Types and Methods of Research

Pre PhD Course Work

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Syllabus

- Foundations of Research: What is Research? Objectives of Research, Scientific Research, Research and Theory, Conceptual and Theoretical Models, Importance of research methodology in scientific research, Types and Methods of Research, Literature Survey and Problem
- Planning of Research: Selection of a Problem for Research, Formulation of the Selected Problems, Hypothesis formation, Measurements, Research Design/Plan.

OBJECTIVES OF RESEARCH

The purpose of research is to discover answers to questions through the application of scientific procedures. The main aim of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

1. To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as exploratory or formulative research studies);
2. To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as descriptive research studies);
3. To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as diagnostic research studies);
4. To test a hypothesis of a causal relationship between variables (such studies are known as hypothesis-testing research studies).

Planning of Research

- Selection of Research Topic
- Formulation of Selected problem
- Hypothesis Formation
- Measurements
- Research Design/ Plan

Research Topic

- Broad subject matter being investigated in a study. May include many research problems to be delineated
 - Focuses study to a defined manageable level
 - Provides structure to steps in scientific methods
 - Include
 - *Research Problem/ Gap*
 - *Research Question*
 - *Research Need*

Research Problem/ Gap

- Area or condition that is unsatisfactory, needs improvement, requires new answers/ contradiction/ conflicting theory, insufficient studies or research papers (eg, geographical, people (low income/high income, gender)
 - Helps define clearly the research topic so that dedicated and focussed efforts area made on relevant areas
 - Research Problem has a purpose-focus and specific
 - Provides a situation/ circumstance that requires a solution to be described, invented, explained or predicted
 - Not all problems are researchable – need empirical investigation, value based concerns



How to write a Research Problem Statement

Concise statement of research problem or issue that is being addressed

1. Context: What do we already know
2. Precise Issue: What do we need to know
3. Relevance: Why do we need to know it
4. Set Aims and Objective

An increase in antibiotic resistance amongst pathogenic organisms has necessitated the exploration of alternative treatment modalities

Aim and Objectives in Research

Aim are broad statement of intent stating the purpose of the research project

Objectives divides research Aim into several parts with definition of how its will be achieved/executed

Research Process

Research process consists of series of actions or steps necessary to effectively carry out research and the desired sequencing of these steps.

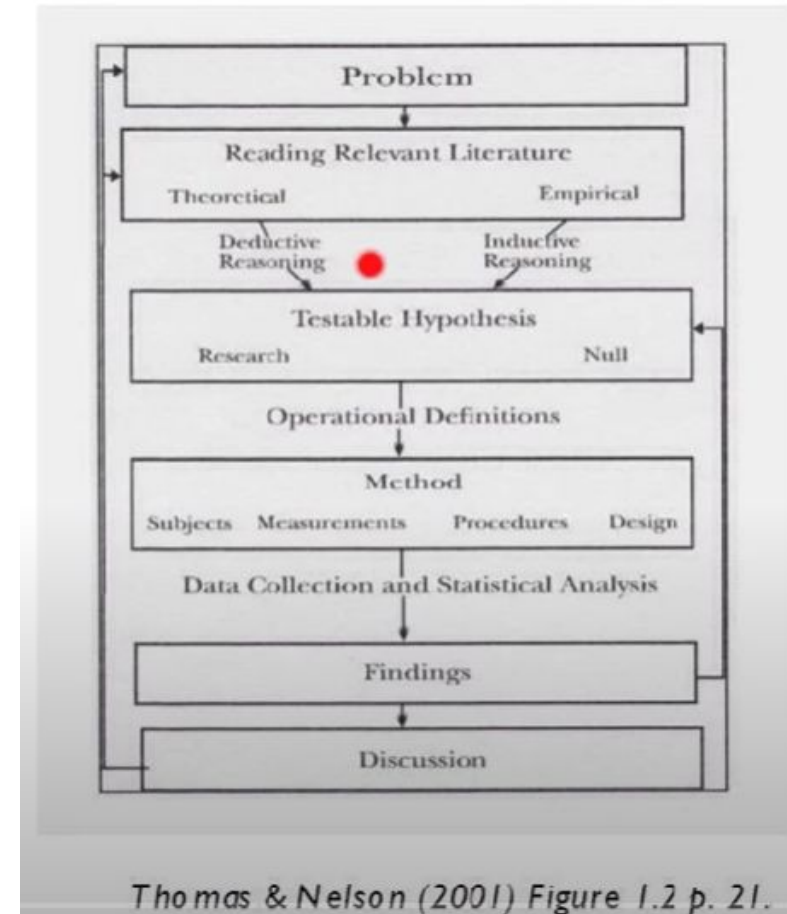
The various steps involved in a research process are not mutually exclusive; nor they are separate and distinct.

They do not necessarily follow each other in any specific order.

However, the following order concerning various steps provides a useful procedural guideline regarding the research process:

1. Formulating the research problem
2. Extensive literature survey
3. Development of working hypotheses
4. Preparing the research design
5. Determining sample design
6. Collecting the data
7. Execution of the project
8. Analysis of data
9. Hypothesis-testing
10. Generalizations and interpretation
11. Preparation of the report or the thesis

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Generation of Research Hypothesis

- Problem Statements become research hypothesis when constructs are operationalized (measurable)
- Initial Idea (vague)
- Search literature
- Identify Research Gap
- Formulate Research Question
- Identify variables
- Develop Theoretical/Conceptual Framework
- Operational definitions
- Research Hypothesis

Hypothesis: Hypo+Thesis

- Hypo meaning tentative OR subject to verification
- Thesis: Statement about solutions to problems
- A hypothesis is a tentative answer to a research problem that can be tested.
- A hypothesis is a tentative statement about the relationship between two or more variables.
- Hypo: composition of two or more variables which are to be verified.
- Thesis means positions of these variables in specific frames of reference
- It is a specific, testable prediction about what you expect to happen in a study.

Nature of Hypothesis

- Conceptual Statement : based on conceptual framework
- Verbal statement in declarative form
- Represents tentative relationship between two or more variables” independent and dependant variables
- Future Oriented: related to future verifications
- All research are designed for verification of Hypothesis
- Helps focus research by developing clear and specific goals
- Derived from research problem, literature review and conceptual framework

Hypothesis Formation

- **Steps for Hypothesis Formation**

- Collection of as many observations about a topic or problem as you can- literature survey/ empirical observations/ prior research
- Evaluation of observations and look for possible causes of the problem.
- Create a list of possible explanations that you might want to explore.
- After you have developed some possible hypotheses, think of ways that you could confirm or disprove each hypothesis through experimentation. This is known as **falsifiability**.
- Falsifiability means is that *if* something was false, then it is possible to *demonstrate* that it is false

Examples of Hypotheses

- A hypothesis often follows a basic format of "If {this happens} then {this will happen}."
- One way to structure your hypothesis is to describe what will happen to the dependent variable if you change the independent variable

Types

- **Directional Hypothesis:** predicts the direction of relationship between the independent and dependent variable
- High Vitamin D content food will lead to increased bone density
- **Non Directional Hypothesis:** predicts the relationship between the independent and dependent variable but not the direction
- Teacher student relationship affects student learning

Causal Hypothesis

- Predicts the cause and effect relationship or interactions between independent variable and dependent variable
- Effect of independent variable (treatment) on dependent variable

Associative Hypothesis

- Predicts an associative relationship between the independent variable and dependent variable. Change in any one variable will cause change in the other
- Positive Association
- Negative Association

Types of Hypothesis

- **Null hypothesis/ Statistical Hypothesis:** This hypothesis suggests no relationship exists between two or more variables. Used in Statistical testing and interpretation
- "There will be no difference in scores on a memory recall task between children and adults."
- **Alternative hypothesis:** This hypothesis states the opposite of the null hypothesis.
- "Adults will perform better on a memory task than children."
- **Statistical hypothesis:** This hypothesis uses statistical analysis to evaluate a representative sample of the population and then generalizes the findings to the larger group.
- **Logical hypothesis:** This hypothesis assumes a relationship between variables without collecting data or evidence.
- **Testable Hypothesis**

Types of Null Hypothesis

- **Simple hypothesis:** This type of hypothesis suggests that there is no relationship between one independent variable and one dependent variable.
 - “Sugar consumption has no effect on memory”
- **Complex hypothesis:** This type of hypothesis suggests there is no relationship between three or more variables, such as two independent variables and a dependent variable.
 - “Smoking, alcoholism and drug abuse have no effect on occurrence of malaria.”

Causal Null Hypothesis

- Predicts there is no cause and effect relationship or interactions between independent variable and dependent variable
- “High fluid intake has no effect on tissue edema”

Associative Hypothesis

- Predicts there is no associative relationship between the independent variable and dependent variable. Change in any one variable will not cause change in the other
- Positive Association: Antibiotic intake will not cause increase in body temperature
- Negative Association

Hypothesis: evaluation criteria

- There are four evaluation criteria that a hypothesis must meet.
- First, it must state an expected relationship between variables.
- Second, it must be testable and falsifiable; researchers must be able to test whether a hypothesis is truth or false.
- Third, it should be consistent with the existing body of knowledge.
- Finally, it should be stated as simply and concisely as possible.

Collecting Data on Your Hypothesis/ Measurements

- Once a researcher has formed a testable hypothesis, the next step is to select a research design, develop research method and evaluate research methodology
- The research method depends largely on exactly what they are studying.

Difference between Research method, methodology and Design

- *Research Design*: Based on research Question-represent overall structure of research
 - What types of methods are more suitable to collect data and analyse to obtain evidence
- *Research Method*: tools and techniques used for research. Broadly 2 types Qualitative and Quantitative- methods based on research design
- *Research Methodology*: explains why certain tools and techniques are being used: determine accuracy of outcome of adopted research methods by a systematic strategy for achieving objective
- De Vaus, D. A. 2001. Research design in social research. London: SAGE.

Research Design

- Framework of research methods and techniques chosen by a researcher.
- Systematic plan
- Describes types of research method to be used=
Qualitative or Quantitative
- 3 main components of Research Design
 - Data Collection
 - Measurement
 - Data Analysis

Exploratory Versus Confirmatory Research Design

Exploratory research refers to the investigation of a research problem that is not clearly defined or understood

Tests ideas

Generally produces Qualitative data. Where the sample of the study is large and data is collected through surveys and experimentation, explorative research can be quantitative

Primary exploratory research: directly from source

Secondary exploratory research: indirect sources

Generally followed by conclusive research

Conclusive research, as the name suggests, is a type of research that is used to yield information that helps reach conclusions or make decisions

Tests Hypothesis

Usually Quantitative research

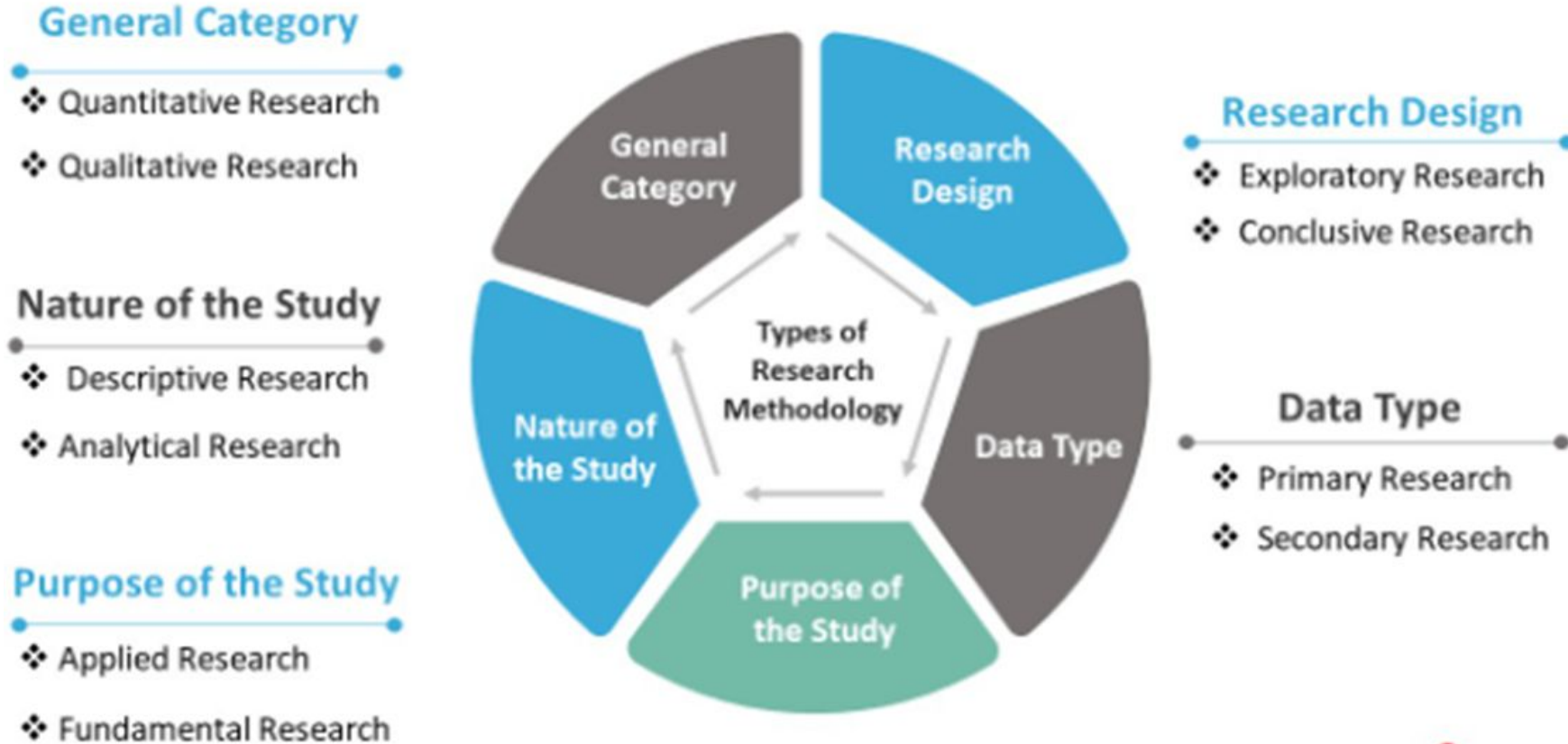
Leads to conclusions/ decision making based on research findings

Research methodology

- Research methodology is a way to systematically solve the research problem.
- Includes the research methods and the logic behind the methods used
- Has to be decided in the context of our research study and explain why we are using a particular method or technique and why we are not using others so that research results are capable of being evaluated either by the researcher himself or by others

List of Types of Research Methodology

Types of Research Methodology



Types of Research Design

	Type of Research					
	Nonexperimental				Experimental	
	Descriptive	Historical	Correlational	Qualitative	True Experimental	Quasi-experimental
Purpose	Describe the characteristics of an existing phenomenon	Relate events that have occurred in the past to current events	Examine the relationships between variables	To examine human behavior and the social, cultural, and political contexts within which it occurs	To test for true cause-and-effect relationships	To test for causal relationships without having full control
Time frame	Current	Past	Current or past (correlation) Future (prediction)	Current or past	Current	Current or past
Degree of control over factors or precision	None or low	None or low	Low to medium	Moderate to high	High	Moderate to high
Code words to look for in research articles	Describe Interview Review literature	Past Describe	Relationship Related to Associated with Predicts	Case study Evaluation Ethnography Historical Research Survey	Function of Cause of Comparison Between Effects of	Function of Cause of Comparison between Effects of
Example	A survey of dating practices of adolescent girls	An analysis of Freud's use of hypnosis as it relates to current psychotherapy practices	An investigation that focuses on the relationship between the number of hours of television watching and grade-point average	A case study analysis of the effectiveness of policies for educating all children	The effect of a preschool language program on the language skills of inner-city children	Gender differences in spatial and verbal abilities

Table 1.1 Summary of research methods covered in exploring research

Figure 1: Types of Research Design

<https://newsmoor.com/research-design-types-of-research-different-types-of-research-design/>

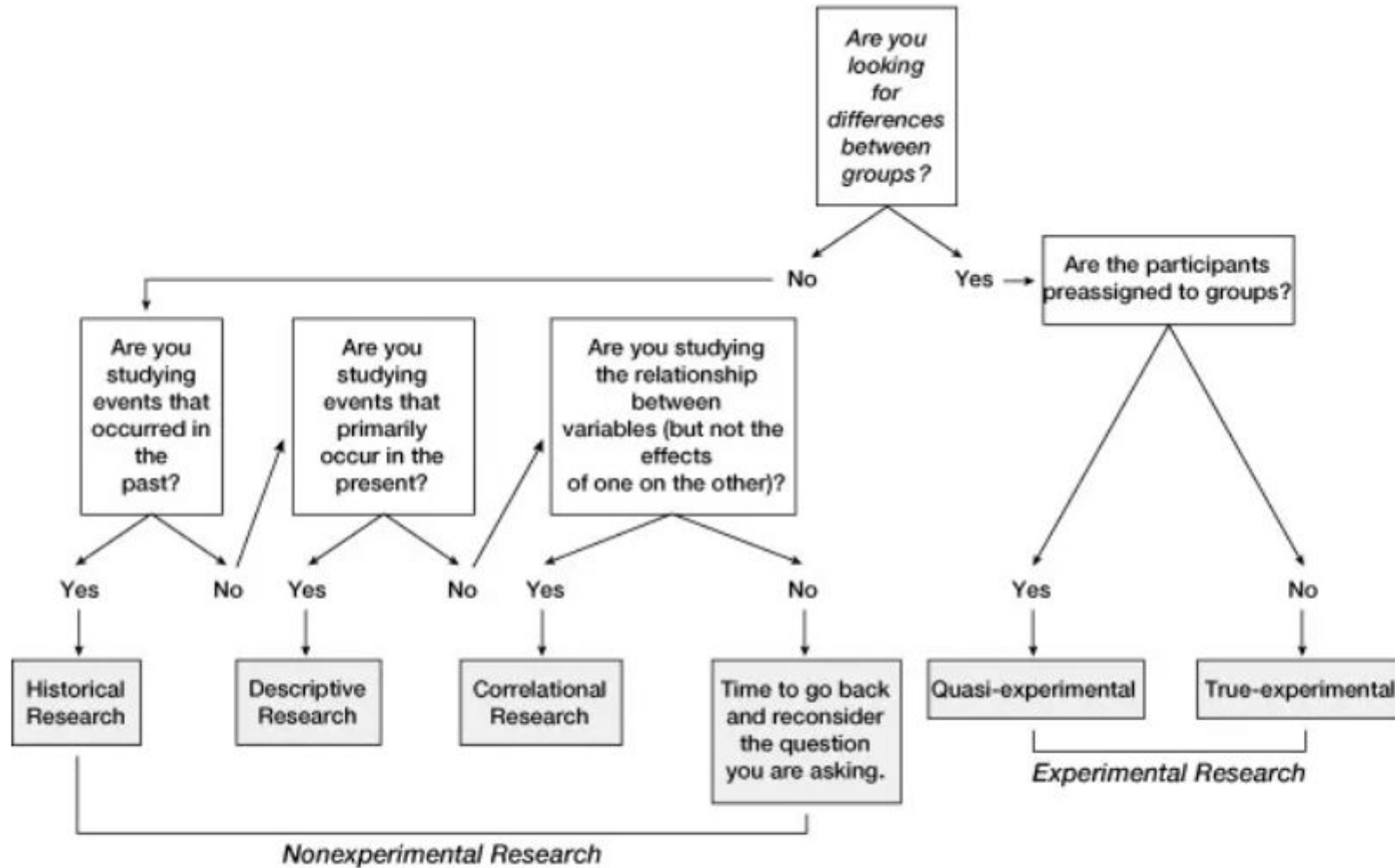


Figure 2: Research Design Cheat Sheet

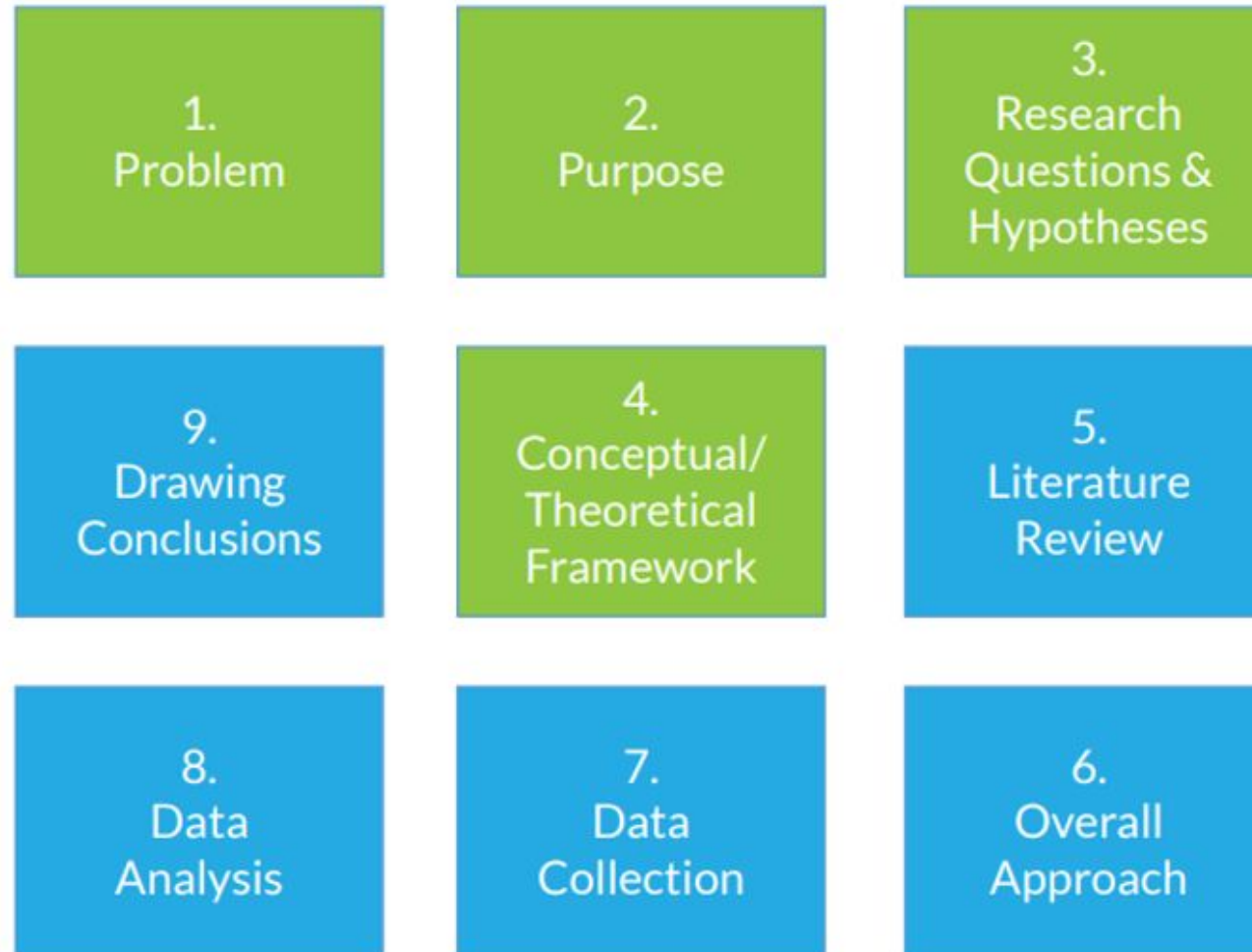
<https://newsmoor.com/research-design-types-of-research-different-types-of-research-design/>

T and U approach to starting Research

1. **Problem**
2. **Purpose**
3. **Research Question/Hypothesis**
4. **Designing Framework:** A **conceptual or theoretical framework** is a diagram that depicts the key constructs or variables (independent, dependent, etc.) along with the relationships between those constructs along with the key contextual factors that influence the constructs and relationships. The development of the conceptual/theoretical framework begins early, and it evolves as the design process unfolds.
5. **Literature survey** Research design begins with theory, and the results of the research contribute back to theory. The amount and specificity of the current empirical knowledge will influence the choice of an appropriate overall research approach
6. **Overall approach** (quantitative, qualitative, mixed) and the specific design (e.g., case study). Ultimately, the approach is determined based on whether it is the best approach to contribute the new knowledge specified in the purpose and problem.
7. **Data Collection** consists of three key components: (a) a sampling plan; (b) a measurement plan and (c) a data collection plan.
8. **Data Analysis:** Plan method used for understanding relationships between variables, constructs
9. **Drawing Conclusions:** Understanding implications and finding answers for research question

Research Canvas

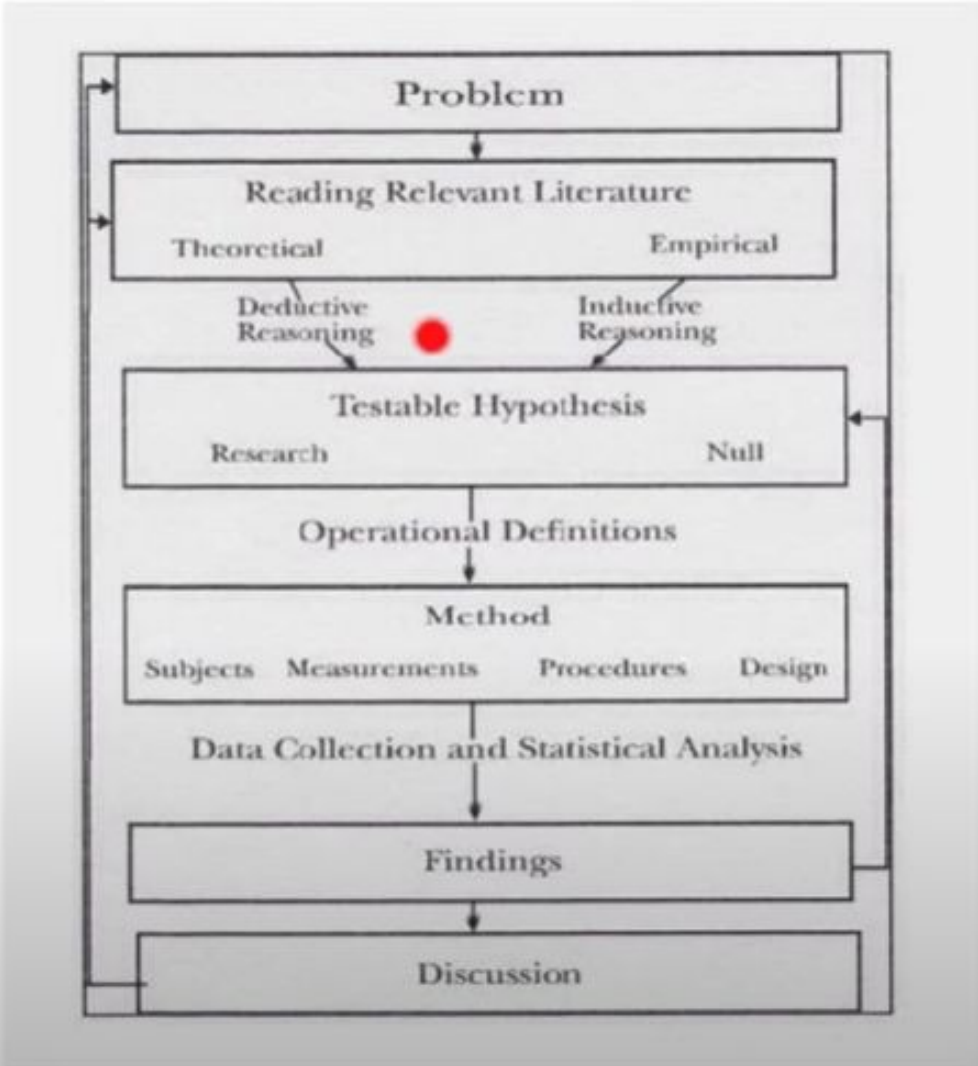
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Research Canvas https://www.drjohnlatham.com/wp-content/uploads/2021/03/The_Research_Canvas_3-1-1.pdf

1. Problem <ol style="list-style-type: none">1. Identify a "real world" problem2. Describe the undesirable symptoms3. Identify the knowledge gap that needs to be filled in order to help solve the problem4. Support your discussion with solid peer-reviewed references	2. Purpose <p>Deliverable - Describe the new knowledge and insights the study will produce that will help fill the knowledge gap identified in the problem statement (not the specific content but the "type" of new knowledge)</p>	3. Research Questions <ol style="list-style-type: none">1. Identify the "type(s)" of questions that need to be answered to fulfill the purpose2. Develop the main research questions and sub-questions3. Develop hypotheses as appropriate
9. Conclusions <ol style="list-style-type: none">1. Identify the larger application(s) and meaning(s) of the findings2. Identify how the applications contribute to the knowledge gap3. Identify the limitations associated with the findings and conclusions	4. Conceptual Framework <ol style="list-style-type: none">1. Identify and diagram the key variables in the research questions2. Identify and diagram the key relationships between the variables3. Identify and diagram the key context factors4. Describe the framework	5. Literature Review <ol style="list-style-type: none">1. Create an outline or "mindmap" of the key theories and concepts2. Dig deep into the "peer-reviewed" literature for each theory and concept and create an annotated bibliography and literature map3. Write the literature review
8. Data Analysis <ol style="list-style-type: none">1. Based on the research questions, the overall approach and the data collected, identify the data analysis methods (be specific)2. Identify the validity and reliability issues and methods to address the issues	7. Data Collection <ol style="list-style-type: none">1. Develop a measurement plan for the variables in the research questions and hypotheses (survey, interview guide, etc.)2. Develop a data collection plan including sampling strategy and data collection process	6. Overall Approach <ol style="list-style-type: none">1. Identify the "level" of empirical knowledge (see literature review)2. Identify the type of knowledge needed (purpose statement)3. Identify the options and select an approach based on the "research arc"4. Describe the approach

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Thomas & Nelson (2001) Figure 1.2 p. 21.