

## Syllabus

### SYMBIOSIS INTERNATIONAL (DEEMED UNIVERSITY) PhD ENTRANCE TEST

#### The Syllabus of Research Methodology

1. General
  - Overview of Research: Meaning, purpose, significance of ethical conduct in research, Classification of Research based on its purpose (Basic, Applied, Evaluation and Action Research) • Scientific Thinking: Types of reasoning, Critical Thinking, Importance of existing knowledgebase (research literature) • Elements of Research: Concepts, Constructs, Definitions – Theoretical and Operational, Theory, Literature Review and its importance, Models, research questions and objectives, research design and methodology.
2. Quantitative Research Methods: Variables, Conjecture, Hypothesis, Measurement, Types of data and scales, Sample, Sampling techniques, Probability, Probability Distributions, Hypothesis Testing, Level of Significance and Confidence Interval, t-test, ANOVA, Correlation, Regression Analysis
3. • Qualitative Research Method: Types of approaches – Narrative, phenomenological, grounded theory, ethnographic, case study, Data Sources: Interviews, Focus groups, observations, approaches to analysis of qualitative data –coding, content analysis

## □ I. Foundation of Research (General Concepts)

### 1.1. Introduction to Research

- Meaning and Purpose of Research
- Significance of Research in Society
- **Ethical Conduct in Research** (plagiarism, consent, data fabrication)

### 1.2. Types of Research (Purpose-Based Classification)

- **Basic Research**

- **Applied Research**
- **Evaluation Research**
- **Action Research**

### 1.3. Scientific Thinking

- **Types of Reasoning**
    - Deductive
    - Inductive
    - Abductive
  - **Critical Thinking**
    - Objectivity
    - Skepticism
    - Logical reasoning
  - Importance of **existing knowledgebase**
    - Role of **Research Literature**
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## □ II. Elements of a Research Study

### 2.1. Core Components

- Concepts vs. Constructs
- Definitions: **Theoretical vs. Operational**
- **Theory** and Theoretical Frameworks
- Importance of **Literature Review**

### 2.2. Research Blueprint

- Models of Research
  - Formulating:
    - **Research Questions**
    - **Research Objectives**
  - **Research Design and Methodology**
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## ▣ III. Quantitative Research Methods

### 3.1. Basic Building Blocks

- Variables: Types (Independent, Dependent, Confounding)
- Conjectures and Hypotheses

- **Measurement:** Types and Errors

### 3.2. Data and Scales

- Types of Data: Nominal, Ordinal, Interval, Ratio
- **Levels of Measurement**

### 3.3. Sampling

- Population vs. Sample
- **Sampling Techniques:**
  - Probability: Simple Random, Stratified, Cluster
  - Non-Probability: Convenience, Purposive, Snowball

### 3.4. Probability and Distributions

- Basic Probability Concepts
- **Probability Distributions:** Normal, Binomial, Poisson

### 3.5. Statistical Testing

- Hypothesis Testing
  - **Level of Significance, p-value**
  - **Confidence Interval**
  - **t-test, ANOVA**
  - **Correlation** (Pearson, Spearman)
  - **Regression Analysis** (Simple, Multiple)
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## IV. Qualitative Research Methods

### 4.1. Research Approaches

- **Narrative Research**
- **Phenomenological Research**
- **Grounded Theory**
- **Ethnography**
- **Case Study**

### 4.2. Data Sources

- Interviews (structured, unstructured)
- Focus Groups
- Observations (participant/non-participant)

### **4.3. Data Analysis in Qualitative Research**

- **Coding** (Open, Axial, Selective)
- **Content Analysis**
- Thematic Analysis (Patterns, Themes, Concepts)

## ✓ 1.1 Meaning and Purpose of Research

### 💡 Meaning of Research:

**Research** is a systematic and scientific way of finding answers to questions, solving problems, or discovering new knowledge.

The word “research” comes from “re-” (again) and “search” (to look), meaning “**to search again**” – to investigate thoroughly.

### 🎯 Purpose of Research:

The main goals or **purposes** of research are:

1. **To explore** something unknown (Exploratory)
2. **To describe** characteristics or behaviors (Descriptive)
3. **To explain** causes and effects (Explanatory)
4. **To predict** future trends (Predictive)
5. **To solve** problems or improve practices (Applied)

📖 Example: Research can help a company understand why customers are unhappy OR help scientists develop a new vaccine.

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## ✓ 1.2 Significance of Research in Society

Research plays a crucial role in making progress in every field:

Field	Role of Research
<b>Medicine</b>	Discovering new treatments or drugs
<b>Technology</b>	Developing better tools (e.g., AI, electric cars)
<b>Education</b>	Improving teaching and learning methods
<b>Business</b>	Understanding markets, trends, and customer behavior
<b>Social Science</b>	Studying behavior, inequality, culture
<b>Policy Making</b>	Making evidence-based laws and regulations

🌟 **Key Point:** Research helps **develop new knowledge, verify existing facts, and make informed decisions.**

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## ✓ 1.3 Ethical Conduct in Research

Ethics in research means following **moral rules** and **honest practices** during all stages of research: planning, data collection, analysis, reporting, and publishing.

### 🔍 Key Ethical Issues:

#### 1. Plagiarism

Using someone else's work (text, ideas, results) **without giving credit**.

🌀 *It is cheating and violates academic integrity.*

#### 2. Informed Consent

If you are studying people, they must:

- Know what the study is about,
- Voluntarily agree to take part,
- Understand risks (if any).

#### 3. Data Fabrication and Falsification

- **Fabrication** = *Making up data or results.*
- **Falsification** = *Changing data or results to fit the expected outcome.*

🌀 *Both are serious misconduct.*

#### 4. Confidentiality

Keeping participants' information private and secure.

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## □ Summary (in simple words):

- Research helps find truths, solve problems, and make progress.
- It's important for fields like science, business, and society.
- Ethical research means being honest, transparent, and respectful to people and data.

## ✓ 1.2 Types of Research (Purpose-Based Classification)

There are **4 main types** in this category:

**Basic, Applied, Evaluation, and Action** Research.

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### 1 Basic Research (also called *Pure or Fundamental* Research)

#### 📖 What it is:

Research done to **gain new knowledge or understanding**, without aiming to solve an immediate problem.

- It is **theoretical**.
- It focuses on **why** things happen.
- The goal is to **build knowledge** or **create theories**.

#### 📦 Example:

- Studying how memory works in the brain.
- Understanding how gravity works at the atomic level.

📌 Even if there's no direct use now, it builds the **foundation for future technologies** and discoveries.

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### 2 Applied Research

#### 📖 What it is:

Research done to **solve real-world problems** using the knowledge from basic research.

- It is **practical**.
- It focuses on **how** to use knowledge.
- It results in **solutions, tools, or strategies**.

#### 🔧 Example:

- Creating a new medicine to treat depression.
- Designing a more energy-efficient engine for cars.

📌 It **applies theory to practice**—it's where knowledge meets reality.

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### 3 Evaluation Research

#### What it is:

Research that **assesses the value, effectiveness, or impact** of a program, product, policy, or process.

- It answers: **Is it working? How well? What can be improved?**
- Often used in education, health, government, and business sectors.

#### Example:

- Evaluating a government scheme like the mid-day meal program.
- Checking if an online training course improved employee skills.

 **Judgment + Measurement** = Evaluation Research

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### 4 Action Research

#### What it is:

Research **conducted by people in their own setting** (e.g., teachers, managers) to **solve immediate problems** and **improve practice**.

- It's **participatory** (researcher = doer).
- Focus is on **improvement through action**.
- It's **cyclical**: Plan → Act → Observe → Reflect → (Repeat)

#### Example:

- A teacher tries new teaching methods, collects feedback, and modifies them.
- A manager tests a new scheduling strategy to improve productivity.

 Action research is **hands-on, local, and improvement-focused**.

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### □ Summary Table:



<b>Type of Research</b>	<b>Purpose</b>	<b>Nature</b>	<b>Example</b>
<b>Basic</b>	Build knowledge or theory	Theoretical	Studying brain function in learning
<b>Applied</b>	Solve practical problems	Practical	Making an app to help dyslexic students
<b>Evaluation</b>	Assess effectiveness or value	Analytical	Checking if a scheme improved literacy
<b>Action</b>	Improve one's own practice	Participatory	Teacher experimenting with methods

## ✓ 1.3 Scientific Thinking

Scientific thinking is the **way scientists approach problems**—using logic, evidence, and fairness to understand reality.

It includes **reasoning, critical thinking**, and **using previous research**.

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### 🔄 A. Types of Reasoning

Reasoning is how we **connect ideas** and **draw conclusions**.

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#### 1 Deductive Reasoning

Starts from a **general rule or theory** and applies it to a **specific case**.

**Think: General → Specific**

◆ If the general rule is true, the conclusion must be true.

#### □ Example:

- All birds have feathers.
- A parrot is a bird.
- ✓ So, a parrot has feathers.

📌 Used in **hypothesis testing**.

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#### 2 Inductive Reasoning

Starts with **specific observations** and moves toward a **general conclusion** or pattern.

**Think: Specific → General**

◆ The conclusion is **likely**, but not guaranteed.

#### □ Example:

- Swan 1 is white. Swan 2 is white. Swan 3 is white.
- ✓ All swans might be white.

✦ Used in **theory building** and qualitative research.

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### B Abductive Reasoning

Starts with **incomplete observations** and tries to find the **best possible explanation**.

**Think: Guessing the cause of an effect**

◆ The conclusion is the **most likely**, but not certain.

#### □ Example:

- The grass is wet in the morning.  
    ✓ Most likely, it rained last night (or maybe it was dew).

✦ Used in **diagnosis**, **case studies**, and **detective-like reasoning**.

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#### □ Summary of Reasoning Types:

Reasoning Type	Direction	Use	Certainty
Deductive	General → Specific	Test theories	High
Inductive	Specific → General	Build theories	Medium
Abductive	Clues → Best Guess	Explain causes (like Sherlock)	Low

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#### □ B. Critical Thinking

Critical thinking is **thinking clearly, rationally, and independently**.  
It helps you **analyze information**, **question assumptions**, and **avoid being fooled**.

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### 1 Objectivity

Looking at facts without **personal bias or emotions**.

✦ In research, this means using **data** to decide—not opinions.

## Example:

You may like a teaching method, but if the test scores don't improve, the method may not be effective.

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### *Skepticism*

Not accepting information blindly—asking:  
**Is this really true? Where's the evidence?**

✧ It does **not** mean rejecting everything—it means asking good questions.

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### *Logical Reasoning*

Making decisions step by step, based on **evidence and logic**.

✧ Helps avoid **faulty conclusions** (like confusing correlation with causation).

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## □ C. Importance of Existing Knowledgebase

Before doing new research, you must **study past research**.  
This is called using the **existing knowledgebase**.

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### *Role of Research Literature*

- **Literature** = past studies, books, papers, reports.
- Reading this helps:
  - Understand what is already known.
  - Avoid repeating old research.
  - Find gaps (what's missing).
  - Support your own study with theories and data.

✧ This is why we do a **literature review** before starting new research.

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## □ Recap in Simple Terms:

Concept	Meaning
Deductive Reasoning	Apply a known rule to a case
Inductive Reasoning	Find patterns from examples
Abductive Reasoning	Make a smart guess from clues
Objectivity	Be neutral, not biased
Skepticism	Don't believe everything without proof
Logical Reasoning	Follow facts and logic step by step
Role of Literature	Build on what others have studied; avoid reinventing the wheel

## □ II. Elements of a Research Study – 2.1 Core Components


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### 1 Concepts vs. Constructs

#### What is a Concept?

A **concept** is a basic idea or mental image that helps us understand something.

- It is **general and abstract**.
- Examples: “Health,” “Education,” “Poverty,” “Leadership”


 Concepts are **not directly measurable**.

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#### What is a Construct?

A **construct** is a **special type of concept** that has been **clearly defined** and can be **measured** in research.

- It often includes **multiple variables**.
- Examples: “Job Satisfaction,” “Self-Esteem,” “Intelligence”

 Constructs are used when we study **psychological or social concepts**.

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#### Example:

Term	Type	Measurable?
Happiness	Concept	No
Life Satisfaction (scale)	Construct	Yes (using questionnaire)

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### 2 Definitions: Theoretical vs. Operational

### Theoretical Definition

Explains **what something means** in theory or conceptually.

- Based on **existing knowledge or literature**.
- Abstract and broad.

□ Example:

"Intelligence is the ability to learn from experience and solve problems."

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### Operational Definition

Explains **how to measure** a concept in your research.

- It's practical and specific.
- Makes it possible to collect data.

□ Example:

"Intelligence will be measured using IQ test scores."

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 Summary:

Type	Purpose	Example
Theoretical	Meaning of the concept	Intelligence = problem-solving ability
Operational	How you measure it	Intelligence = score on a 40-question IQ test

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## Theory and Theoretical Frameworks

### What is a Theory?

A theory is a **set of related ideas** that explains **how and why** something happens.

- It connects **concepts and variables**.
- Used to **predict outcomes**.

□ Example:

In psychology, **Maslow's Theory** explains human motivation based on needs.

📌 A good theory:

- Explains facts clearly
  - Can be tested
  - Helps build new knowledge
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📖 *What is a Theoretical Framework?*

The **theoretical framework** is the part of your research where you **explain which theory or model** you are using to guide your study.

- It shows the **background ideas** behind your research.
- It connects your **research problem** with existing theories.

□ Example:

If you are studying student motivation, you may use **Self-Determination Theory** as your framework.

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## 4 Importance of Literature Review

📖 *What is a Literature Review?*

A **literature review** is a detailed study of existing **books, journal articles, reports, and previous research** related to your topic.

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💡 **Why is it Important?**

- Shows what is **already known**
- Finds **gaps** in knowledge
- Helps in **formulating your research question**
- Avoids **duplicate work**
- Helps design your **research method**
- Gives support to your **arguments**

📌 It's like doing your **homework before starting your experiment**.

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## □ Summary Table:

Component	Simple Meaning	Example
<b>Concept</b>	Abstract idea	Education, Health
<b>Construct</b>	Measurable concept	Motivation, Anxiety
<b>Theoretical Definition</b>	Meaning in theory	Intelligence = mental ability
<b>Operational Definition</b>	How it's measured	Intelligence = IQ score
<b>Theory</b>	Set of ideas explaining something	Maslow's Theory
<b>Theoretical Framework</b>	Theory used in your study	Using Maslow's theory to study stress
<b>Literature Review</b>	Study of past research	Reviewing 20 journal papers on topic

## □ 2.2. Research Blueprint

Think of this section as the **foundation** of your study.

Just like you wouldn't build a house without a blueprint, you shouldn't do research without a **clear plan**.

### 1 Models of Research

 *What is a Model of Research?*

A **research model** is a **structured approach** or **framework** that shows how different elements of a study are connected—like the flow of thinking in your research.

These models help you:

- Decide what to study
- Identify variables
- Link theory to practice
- Choose your method

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 *Common Models:*

Model Type	Focus	Example
Linear Model	Step-by-step sequence	Problem → Hypothesis → Data
Cyclical Model	Repeating improvement cycles	Plan → Act → Observe → Reflect (used in Action Research)
Conceptual Model	Visual diagram of relationships	Flowchart connecting variables
Theoretical Model	Based on existing theory	Maslow's model for motivation

 Models **clarify relationships** and **guide data collection and analysis**.

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## 2 Formulating Research Questions and Objectives

### A. Research Questions

A **research question** is the **main question** your study aims to answer.

It must be:

- **Clear** and focused
- **Researchable** (using data)
- **Relevant** to your field

□ Example:

“What factors influence college students’ use of mental health services?”

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### B. Research Objectives

These are **specific goals** you want to achieve during your research.

They usually start with verbs like:

- To find out...
- To examine...
- To measure...
- To analyze...

□ Example (from above question):

- To identify reasons students avoid mental health services
- To measure the impact of awareness campaigns

### Tips:

- Good questions → guide your objectives
  - Good objectives → guide your method
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## 3 Research Design and Methodology

Let's break this down.

### A. Research Design

The **overall strategy** or **plan** you use to collect and analyze data.

It answers:

**How will you conduct your study?**

#### Types of Research Design:

Type	Purpose	Example
<b>Descriptive</b>	Describe characteristics	Survey on mobile usage habits
<b>Exploratory</b>	Explore unknown areas	Interviews with first-time voters
<b>Explanatory</b>	Explain cause-and-effect	Study on how stress affects grades
<b>Experimental</b>	Test a treatment or condition	A/B testing in software design


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### B. Research Methodology

The **detailed procedures** used for data collection, analysis, and interpretation.

It includes:

- Type of data: **Quantitative** or **Qualitative**
- Tools: Surveys, interviews, experiments
- Techniques: Sampling, coding, statistical analysis

 While **research design** is *what* and *why*, **methodology** is *how* exactly you'll do it.

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### □ Summary Table:

Element	Meaning	Example
<b>Research Model</b>	Flow or structure of research	Conceptual model connecting variables
<b>Research Question</b>	What your study aims to answer	What motivates online learning?
<b>Research Objective</b>	Specific goals of your study	To identify factors affecting motivation

Element	Meaning	Example
Research Design	Overall plan for the study	Descriptive or Experimental design
Methodology	Actual methods used to collect/analyze	Surveys, sampling, regression analysis

## III. Quantitative Research Methods – 3.1 Basic Building Blocks

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### 1 Variables: The Key Ingredients of Research

 *What is a Variable?*

A **variable** is anything that can **change or vary** in your study.

Examples:

- Age, income, exam scores, motivation level, hours of study
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### Types of Variables

 *A. Independent Variable (IV)*

The variable **you change or control** to see its effect.

☐ Example: Number of hours studied

☒ You're choosing this value → it's **independent**

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 *B. Dependent Variable (DV)*

The variable **you measure**—it **depends on** the independent variable.

☐ Example: Exam score

☒ It changes **because of** how many hours were studied.

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 *C. Confounding Variable*

A **hidden factor** that may affect both IV and DV and **confuses the results**.

□ Example: Suppose you're studying if coffee helps study hours (IV) improve memory test scores (DV). But **sleep** could also affect memory.

✓ So **sleep** is a confounding variable.

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Variable Type	Meaning	Example
Independent (IV)	What you change	Hours of study
Dependent (DV)	What you measure	Test scores
Confounding Variable	A hidden influence	Sleep quality

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## ◆ 2 Conjectures and Hypotheses

### Conjecture

A **general idea or guess** you believe might be true, **without proof yet**.

- It's like a **hunch or early thought**.
- May come from **experience or observation**.

□ Example: Students who sleep more may score better.

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### Hypothesis

A **clear, testable statement** predicting the relationship between variables.

✂ It's a **scientific guess** you can check with data.

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## ✳ Types of Hypotheses:

Type	Description	Example
Null Hypothesis ( $H_0$ )	Says <b>no effect</b> or <b>no relationship</b>	"Coffee has no effect on alertness"
Alternative Hypothesis ( $H_1$ )	Says <b>there is an effect or relationship</b>	"Coffee increases alertness"

📌 In testing, you **try to reject the null** hypothesis using statistics.

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### 📌 3 Measurement: Types and Errors

📖 *What is Measurement?*

The **process of assigning numbers or labels** to things, so we can **compare** them.

□ Example: Measuring “motivation” using a 1–10 scale.

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### ✳️ Types of Measurement Scales:

Scale Type	What it Measures	Example
<b>Nominal</b>	Categories (no order)	Gender (Male/Female)
<b>Ordinal</b>	Order, but no fixed distance	Rank 1st, 2nd, 3rd
<b>Interval</b>	Order + equal gaps, <b>no true zero</b>	Temperature in °C
<b>Ratio</b>	Order + equal gaps + <b>true zero</b>	Age, Height, Weight

📌 Most **statistical analysis** works best with interval and ratio data.

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📖 *Measurement Errors*

Mistakes or inaccuracies in the way we **collect or record** data.

🔍 Types of Errors:

Error Type	Meaning	Example
<b>Systematic Error</b>	Error that repeats in same direction	Faulty thermometer always shows +2°C
<b>Random Error</b>	Unpredictable, due to chance	Respondent guessed an answer

📌 We try to **reduce errors** with good tools and proper research design.



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## ✓ Summary Chart

Concept	Simple Meaning
Variable	Anything that can change (age, score, time)
Independent Variable	You control or manipulate
Dependent Variable	You observe/measured output
Confounding Variable	Unseen factor messing up results
Conjecture	Early idea or guess without full proof
Hypothesis	Clear statement predicting relationships
Null Hypothesis	Says there is <b>no effect</b>
Measurement Scale	How we assign numbers to data (nominal to ratio)
Measurement Error	Mistake in recording values

## 3.2 Data and Scales

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### ◆ Types of Data (Levels of Measurement)

In research, we **measure variables**, but different variables are measured differently. These measurements are categorized into **four levels**—from **simplest** to **most detailed**.

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#### 1 Nominal Data (Labels / Categories)

Data is just **names or categories**, with **no order** and **no number value**.

- You **cannot rank** or do arithmetic.
- Just **classify**.

□ Examples:

- Gender: Male, Female, Other
  - Blood group: A, B, AB, O
  - Religion: Hindu, Muslim, Christian
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#### 2 Ordinal Data (Order matters)

Data has **a clear order**, but the **differences between values are unknown**.

- You can **rank**, but **can't measure exact gap**.

□ Examples:

- Class position: 1st, 2nd, 3rd
  - Likert scale: Strongly Agree → Strongly Disagree
  - Socioeconomic class: Low, Middle, High
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#### 3 Interval Data (Equal gaps, no true zero)

Data has **equal intervals** between values but **zero doesn't mean “nothing”**.

- Arithmetic possible (add/subtract), but **ratios don't make sense**.

□ Examples:

- Temperature in °C or °F
- Calendar years (1990, 2000)
- IQ scores

#### 4 Ratio Data (Equal gaps, true zero)

Has all properties: **order, equal intervals, and a true zero** (zero means nothing).

- You can do all math, including ratios.

□ Examples:

- Age, Weight, Height
- Salary
- Distance traveled

#### □ Summary Table:

Level	Ordered?	Equal Gaps?	True Zero?	Examples
Nominal	✗	✗	✗	Gender, Blood Type
Ordinal	✓	✗	✗	Rank, Satisfaction Level
Interval	✓	✓	✗	Temperature, IQ Score
Ratio	✓	✓	✓	Age, Weight, Salary

### □ 3.3 Sampling

#### ◆ Population vs. Sample

### Population:

The **entire group** you want to study.

□ Example: All PhD students in India.

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### Sample:

A **smaller part** of the population you actually study.

□ Example: 200 PhD students selected from 10 universities.

📌 A **good sample** should represent the population well.

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## ◆ Sampling Techniques

Sampling techniques are divided into **two categories**:

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### 1 Probability Sampling (Everyone has a chance)

Every member of the population has a **known, non-zero chance** of being selected. This is **more scientific** and allows generalization.

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#### A. Simple Random Sampling

- Every individual has an **equal chance**.
- Often done using **random numbers**.

□ Example: Pick 100 names from a list of 1000 students randomly.

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#### B. Stratified Sampling

- Divide population into **subgroups (strata)** and pick random samples **from each**.

□ Example: Divide by gender (Male/Female) and select random students from each.

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### C. Cluster Sampling

- Divide population into **clusters (groups)**, then **randomly select whole clusters**.

□ Example: Divide India into states. Randomly pick 5 states and survey all students in them.

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## Non-Probability Sampling (Not random)

Some people have **more chance** of being selected. Faster, easier—but may have **bias**.

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### A. Convenience Sampling

- Choose whoever is **easiest to reach**.

□ Example: Ask students who are in your class right now.

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### B. Purposive Sampling

- Select people based on **purpose or expertise**.

□ Example: Only survey PhD guides for expert opinion.

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### C. Snowball Sampling

- Ask participants to **refer others**, especially in **hard-to-reach groups**.

□ Example: Interviewing drug users or LGBTQ+ youth by referrals.

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## □ Summary Table:

Type	Random?	Use Case	Example
Simple Random		General random selection	Pick 50 students randomly

Type	Random?	Use Case	Example
Stratified	✓	Ensure subgroups are included	Gender-wise split
Cluster	✓	Group-based sampling	Pick a few colleges entirely
Convenience	✗	Easy and quick	Ask nearby people
Purposive	✗	Based on specific criteria	Interview only experts
Snowball	✗	Hidden or sensitive groups	Peer-referred participants

## ✓ 3.5 Statistical Testing

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### ◆ 1 Hypothesis Testing

A hypothesis is a **claim or assumption** you make about a population.

We test this claim using sample data.

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#### Two Types of Hypotheses:

- **Null Hypothesis ( $H_0$ ):** No effect, no difference.

Example: "There is **no difference** in marks between male and female students."

- **Alternative Hypothesis ( $H_1$  or  $H_a$ ):** There **is** an effect or difference.

Example: "There **is a difference** in marks between male and female students."

□ The goal is to **test** if data supports  $H_1$  and **reject**  $H_0$ .

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### ◆ 2 Level of Significance ( $\alpha$ )

It's the **threshold** for deciding whether a result is **statistically significant**.

- Usually:  $\alpha = 0.05$  (5%)
- Means: You allow **5% chance** of being wrong if you reject the null hypothesis.

 If **p-value**  $< \alpha$ , reject  $H_0 \Rightarrow$  result is **significant**

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### ◆ 3 p-value

It tells you the **probability** of getting your result if the **null hypothesis were true**.

- **Low p-value ( $< 0.05$ ):** Strong evidence **against**  $H_0 \Rightarrow$  Reject  $H_0$
- **High p-value ( $> 0.05$ ):** Weak evidence  $\Rightarrow$  **Do not reject**  $H_0$

□ Example:

If  $p = 0.02$ , you have **only 2% chance** that the result is due to random chance.

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## ◆ 4 Confidence Interval (CI)

A range of values that likely contains the **true population parameter** (like mean).

- Commonly used: **95% CI**
- It means: If you repeat the experiment 100 times, **95 times** the CI will contain the true value.

□ Example:

If  $CI = [48, 52]$ , then the population mean is likely between 48 and 52.

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## ◆ 5 t-test

Compares **means** between groups to check for significant difference.

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□ Types:

- **One-sample t-test:** Compare sample mean vs. population mean
- **Independent t-test:** Compare means of **two different groups**

Example: Male vs. Female test scores

- **Paired t-test:** Compare **same group** at two different times

Example: Before vs. After treatment

□ Used when sample size is small & population standard deviation is unknown.

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## ◆ 6 ANOVA (Analysis of Variance)

Compares **means of 3 or more groups**.

If ANOVA finds a significant difference, you can explore **which groups differ** using post-hoc tests (like Tukey).



□ Example: Compare marks in 3 departments – Science, Commerce, Arts.

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## ◆ 7 Correlation

Measures how **strongly two variables move together**.

### *Pearson Correlation (r)*

- Measures **linear relationship**
- r ranges from **-1 to +1**
  - +1: perfect positive correlation
  - -1: perfect negative correlation
  - 0: no correlation
- Requires interval or ratio data

### *Spearman Correlation ( $\rho$ or $r_s$ )*

- Measures **rank-based** relationship (not strictly linear)
- Works with **ordinal data** or non-normal data

□ Examples:

- Pearson: Height vs. Weight
  - Spearman: Rank in class vs. Rank in sports
- 

## ◆ 8 Regression Analysis

Predicts one variable based on another.

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### *Simple Linear Regression:*

- One **independent** variable (X) predicts one **dependent** variable (Y)
- Formula:  $Y = a + bX$

□ Example: Predict weight based on height

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### ✓ Multiple Regression:

- Two or more X variables predict Y
- Formula:  $Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$

□ Example: Predict salary based on education, experience, and age

---

### □ Summary Table

Concept	Purpose	Example
Hypothesis Testing	Check if results are significant	Gender & scores
p-value	Probability of observed result by chance	$p < 0.05$ = significant
CI	Range where true value lies	95% CI = [48, 52]
t-test	Compare 2 group means	Male vs Female scores
ANOVA	Compare 3+ group means	Science vs Arts vs Commerce
Correlation	See how two variables move together	Hours studied vs Marks
Regression	Predict one value using others	Predict salary from education & experience

## IV. Qualitative Research Methods

### ◆ 4.1 Research Approaches

Each approach has its own **focus**, **purpose**, and **data collection style**.

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#### 1 Narrative Research

Focus: **Personal stories or life experiences** of individuals

*What it does:*

- Studies a person's **life story** in detail to understand how they **make sense** of their experiences.
- Data is often collected through **interviews**, **diaries**, or **letters**.

*Example:*

Studying the **life journey of a cancer survivor** and how they describe their healing process.

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#### 2 Phenomenological Research

Focus: **Lived experiences** of people regarding a specific phenomenon

*What it does:*

- Aims to understand the **common meaning** of a certain experience shared by several people.
- Seeks the **essence** of an experience—what it **feels like** to go through it.

*Example:*

Understanding the **experience of losing a loved one**—how people emotionally process grief.

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#### 3 Grounded Theory

Focus: **Generating a new theory** based on collected data

▮ *What it does:*

- Collects data from participants and develops a theory that is **grounded in** (emerges from) the data.
- Uses **coding** (labeling pieces of data) and **constant comparison**.

*Example:*

Creating a new theory about **why college students drop out**, based on interviews from 50 students.

---

## 4 Ethnography

Focus: **Cultural patterns** of a group of people

▮ *What it does:*

- The researcher **immerses** themselves in the group's setting (like a village, organization, or community).
- Studies daily life, rituals, language, interactions, etc.
- Often takes **months or years** to observe and record.

*Example:*

A researcher lives with a **tribal community** to study their **belief systems and lifestyle**.

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## 5 Case Study

Focus: **In-depth investigation of a single unit (case)**

▮ *What it does:*

- Studies one **individual, group, organization, event, or situation** in detail.
- Helps understand **complex phenomena** within a real-life context.
- Uses multiple data sources (interviews, documents, observation, etc.)

*Example:*

Studying one **school's unique way of teaching visually impaired students**.

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□ **Summary Table**

Approach	Focus Area	Data Type	Example
Narrative	Life stories of individuals	Interviews, journals	Story of a refugee’s life journey
Phenomenology	Shared lived experiences	Interviews, reflections	How people feel after surviving an earthquake
Grounded Theory	Developing a theory from data	Interviews, focus groups	Theory of job satisfaction in tech companies
Ethnography	Cultural and social patterns of a group	Observation, field notes	Studying rituals in a rural Indian village
Case Study	Deep dive into a single case	All available sources	How one hospital adapted during COVID-19

## 4.2 Data Sources in Qualitative Research

These are the **tools** or **techniques** used to gather information from people or settings, especially about their **thoughts, feelings, behaviors, and experiences**.

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### 1 Interviews

Talking directly to participants to understand their personal views, thoughts, or stories.

 *Types of Interviews:*

Type	Description	Example
Structured	Same set of <b>predefined questions</b> for all participants; formal and consistent	Job interview with a fixed questionnaire
Unstructured	<b>Open conversation</b> , free-flowing; researcher may ask follow-up questions	Talking casually about school experience
Semi-structured	Some fixed questions, but allows flexibility to explore interesting points	Asking about health habits, then diving deeper based on answers

 *Tip:*

- Best for **deep understanding** of personal views
  - Requires **listening carefully** and sometimes recording (with permission)
- 

### 2 Focus Groups

A small group of people (usually 6–10) are interviewed **together** to discuss a topic.

 *Features:*

- Group setting allows for **discussion, debate, and interaction**
- The researcher acts as a **moderator**, guiding the conversation
- Can help uncover **shared beliefs, opinions, and even conflicts**

 *Example:*

Discussing people's views on **online education** in a group of college students.

Pros:

- Saves time (multiple participants at once)
- Stimulates **ideas** and **social responses**

Cons:

- Some people may dominate the conversation
- Not ideal for **sensitive topics**

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## ◆ 3 Observations

Watching people in their **natural setting** to understand how they behave or interact.

📖 Types:

Type	Description	Example
<b>Participant Observation</b>	Researcher becomes <b>part of the group</b> being studied	Living with farmers to observe their daily routines
<b>Non-participant Observation</b>	Researcher stays <b>outside the group</b> , observes quietly	Watching how students interact in a classroom

📌 Uses:

- Helpful when people might **not express** everything in words
- Useful in **ethnographic** and **case study** research

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## ☐ Summary Table

Method	Key Feature	Best Used For
Interviews	One-on-one conversations	Personal experiences, deep emotions
Focus Groups	Small group discussions	Exploring social norms, opinions
Observations	Watching natural behavior	Understanding culture, real-life actions

## 4.3 Data Analysis in Qualitative Research

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### 1 Coding

**Coding** means giving **labels or tags** to chunks of data (sentences, phrases, or paragraphs) that represent certain ideas, actions, or emotions.

 *Example:*

If someone says, “I feel anxious during exams,” you might code that as: **“Exam anxiety”** or **“Stress trigger”**

 *Types of Coding:*

Type	Description	Purpose
<b>Open Coding</b>	Breaking down raw data into <b>initial codes</b> or labels	First step to explore the data
<b>Axial Coding</b>	<b>Linking codes together</b> to form categories (cause-effect, relationships)	Organize data meaningfully
<b>Selective Coding</b>	Picking a <b>core theme or central idea</b> , and linking all other codes to it	Final step in theory-building

 *Process:*

1. Read the text closely
  2. Highlight meaningful parts
  3. Assign labels (codes)
  4. Group similar codes → categories → themes
- 

### 2 Content Analysis

A **systematic method** to identify patterns, frequencies, and meanings in **textual data**.

 *Key Features:*

- Counts how often **certain words, phrases, or themes** appear.
- Useful for **structured analysis** of interviews, social media, newspapers, etc.



- Can be **quantitative** (e.g., “how many times ‘stress’ is mentioned”) or **qualitative** (e.g., “how stress is described”).

▮ *Example:*

Analyzing 100 tweets to find how people talk about "online exams".

### ◆ 3 Thematic Analysis

A method for **finding patterns and themes** across data.

📖 *Steps:*

1. Read all transcripts carefully
2. Do open coding
3. Group codes into **themes** (e.g., "exam fear", "peer pressure")
4. Review and name themes
5. Interpret: What does this tell us?

▮ *Example:*

Interviewing students about online learning, and finding themes like:

- **Distraction at home**
- **Technical issues**
- **Lack of motivation**

✂ Thematic analysis is **flexible** and works across many qualitative approaches.

### □ Summary Table

Method	Focus	Output	Best Used For
Coding	Breaking and labeling data	Codes → Categories → Themes	All types of qualitative research
Content Analysis	Counting + interpreting text	Word frequencies, patterns	Structured documents, media content

Method	Focus	Output	Best Used For
Thematic Analysis	Exploring deeper patterns/themes	Narrative explanation of data	Interviews, open-ended surveys, stories