

Methods in psychology

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1. Scientific method, variables, hypotheses and sampling
2. Observation, survey, case study, experiment and qualitative methods

1 Scientific method, variables, hypotheses and sampling

Psychological research follows the scientific method: pose a problem, state a hypothesis about how an independent variable affects a dependent variable, control extraneous variables, collect data from a sample that represents the population, and draw conclusions others can repeat.

Core facts

- **Scientific study** = the **systematic** study of facts by a **reliable and correct method**; its marks are being **empirical, objective, systematic, replicable and self-correcting**.
- **Four goals of science (NCERT): description, prediction, explanation, control** (changing behaviour, e.g. through therapy or training).
- **Steps (NCERT):** (1) **conceptualising** a problem, (2) **collecting data**, (3) **drawing conclusions**, (4) **revising** conclusions. Textbook long form: observe → state the problem → hypothesis → test / collect data → analyse → conclude → report and replicate.
- **Four types of psychological data (NCERT): demographic** (name, age, sex, education, occupation, caste, religion), **physical** (rural or urban, house size, room, climate), **physiological** (heart rate, blood pressure, reaction time, EEG, fatigue), **psychological** (intelligence, personality, emotions, attitudes, values).
- **Quantitative** data = numbers (scores, counts); **qualitative** data = **non-numerical** (words, narratives, observations). The main difference between the two methods is the **type of data they collect**.
- **Variable:** any event, characteristic or behaviour that **varies** (takes more than one value), e.g. age, noise, anxiety.
- **Independent variable (IV):** the one the researcher **manipulates** (the cause). **Dependent variable (DV):** the one **measured** (the effect). These are the **two main types**.
- **Extraneous variable:** any other factor that can affect the DV; if it changes along with the IV it becomes a **confounding** variable.
- **Operational definition:** defining a variable by the **procedure used to measure or produce it** (anxiety = score on an anxiety scale).
- **Hypothesis:** a **tentative, testable statement about the relationship between two or more variables**.
- **Null hypothesis (H_0):** no difference or relationship. **Alternative / research hypothesis (H_1):** there **is** one.
- **Population (universe):** all the members of a defined group. **Sample:** a **subset** chosen to represent it.
- **Probability (random) sampling:** simple random, systematic, stratified, cluster, multistage. **Non-probability:** convenience (accidental), purposive (judgement), quota, snowball. Mechanics and sampling errors: see STA-DS-02.

Explained

1. Characteristics of psychological studies (the syllabus wording).

- **Empirical:** based on observation and measurement, not opinion.
- **Objective:** two researchers looking at the same behaviour should record it the same way.
- **Systematic:** follows planned steps.
- **Replicable:** another researcher using the same procedure should get similar results.
- **Self-correcting:** wrong conclusions are revised when new data come.

Psychological data are, however, **relative and context-bound**: behaviour depends on the person, the time and the setting, and the data are often about **subjective experience** reported by the person. So findings are statements of probability, not exact laws. Methods that study it: observation, experiment, correlational research, survey, case study, psychological tests (see EDU-PS-02 for each method).

2. The goals in a probation setting.

Goal	Question	Example
Description	What happens?	How many juveniles in a home reoffend
Prediction	When will it happen?	Peer delinquency predicts reoffending
Explanation	Why does it happen?	Weak family supervision leads to delinquent peers
Control	How can it be changed?	Family counselling reduces reoffending

3. Variables: kinds and examples. Experiment: "Does noise affect memory?"

- **IV:** noise (present / absent), set by the researcher.
- **DV:** number of words recalled, measured.
- **Extraneous:** time of day, practice, the subjects' intelligence and fatigue.
- **Levels:** the values the IV takes (e.g. 0, 60 and 90 decibels: three levels).

Other names you will see:

- **Organismic (subject) variables:** age, sex, intelligence, personality: traits of the participant, which cannot be manipulated, only selected.
- **Situational variables:** light, temperature, noise, instructions.
- **Sequence variables:** practice and fatigue when the same person does several tasks (controlled by **counterbalancing**).
- **Intervening (mediating) variable:** an inner process between IV and DV that cannot be seen (hunger, motivation, learning); term from Tolman.
- **Moderator variable:** changes the strength of the IV–DV link (stress harms performance more in anxious people).
- **Continuous** (height, reaction time) vs **discrete / categorical** (sex, religion, number of children).

4. Operational definitions. "Aggression" is vague; "number of times a child hits the Bobo doll in 10 minutes" is operational. Operational definitions make studies **measurable and repeatable**. The idea comes from physicist P.W. Bridgman (operationism, 1927).

5. Hypotheses.

Type	Says	Example
Null (H_0)	No effect or no relationship	Noise has no effect on recall
Alternative / research (H_1)	There is an effect	Noise affects recall
Directional (one-tailed)	States the direction	Noise reduces recall
Non-directional (two-tailed)	Effect, direction not stated	Noise changes recall

A good hypothesis is **testable**, **falsifiable** (could be shown wrong), **specific** (names the variables), **simple** and grounded in earlier theory or observation. Statistics test the **null** hypothesis: we **reject** H_0 or **fail to reject** it; we never "prove" H_1 .

6. Population and sample. A **parameter** describes the population (population mean μ); a **statistic** describes the sample (sample mean). The **sampling frame** is the list from which the sample is drawn. A sample is useful only if it is **representative**: large enough and chosen without bias. Sampling follows the **scientific approach**: results from a well-drawn set of units are generalised to the whole population (APPSC 2023).

7. Sampling methods in psychological research.

Method	How	Psychology example
Simple random	Every member has an equal chance (lottery, random numbers)	100 names drawn from a list of all inmates
Systematic	Every k-th name after a random start	Every 10th case file
Stratified	Divide into strata, sample from each	Boys and girls in proportion to their numbers
Cluster	Pick whole groups at random	Choose 5 observation homes, test every child
Convenience	Whoever is easily available	Students in one's own college
Purposive	Researcher picks typical or expert cases	Only probation officers with 10+ years' service
Quota	Fill set numbers per category, non-randomly	50 men and 50 women, whoever comes first
Snowball	Each participant refers others	Drug users, sex workers: hard-to-reach groups

Random **sampling** (who is chosen for the study) is not the same as random **assignment** (who goes to the experimental or control group). Sampling protects **generalisation**; assignment protects **cause-and-effect** conclusions.

Common traps

✗ "The dependent variable is the one the researcher changes." ✓ The researcher changes the **independent** variable; the **dependent** variable is measured.

✗ "The two main types of variables are field and case variables." ✓ **Independent and dependent** variables.

✗ "A hypothesis is a proven fact." ✓ A **tentative, testable** statement about the relationship between variables.

✗ "The null hypothesis states the expected difference." ✓ It states **no** difference; the alternative states the difference.

✗ "Quantitative and qualitative research differ in the type of hypotheses." ✓ They differ in the **type of data** they collect (numbers vs words).

✗ "Making a stereotype or a table is a step of the scientific method." ✓ The steps begin with **making an observation** / conceptualising a problem (APPSC 2023 keyed "make an observation"; drawing a conclusion is also a step, so read such options carefully).

✗ "Quota sampling is a random method." ✓ Quota, convenience, purposive and snowball are **non-probability** methods; stratified is the random one that uses categories.

✗ "Random sampling and random assignment are the same." ✓ Sampling picks **who is studied**; assignment decides **which group** each joins.

✗ "Type I error = accepting a false null." ✓ Type I = **rejecting a true** null; Type II = **accepting a false** null.

Quick revision

- Goals: describe, predict, explain, control.
- Steps (NCERT): conceptualise → collect data → conclude → revise.
- Data types: demographic, physical, physiological, psychological.
- Quantitative = numbers; qualitative = non-numerical.
- IV manipulated (cause); DV measured (effect); extraneous → confound.
- Operational definition = defined by how it is measured.
- Hypothesis = testable statement relating two or more variables.
- H_0 = no effect; H_1 = effect; directional = one-tailed.
- Population = all; sample = representative subset.
- Random: simple, systematic, stratified, cluster; non-random: convenience, purposive, quota, snowball.

2 Observation, survey, case study, experiment and qualitative methods

Psychologists gather data by watching behaviour (observation), asking people (survey, questionnaire, interview), studying one case in depth (case study), manipulating a cause under control (experiment) or measuring how two things vary together (correlation), using numbers (quantitative) or meanings and words (qualitative), always within ethical rules such as informed consent and confidentiality.

Core facts

- **Naturalistic observation:** behaviour watched **where it normally happens**, without interference.
- **Controlled (laboratory) observation:** behaviour watched in a **controlled and structured** setting chosen by the researcher.
- **Participant** observer joins the group; **non-participant** observer stays outside.
- **Hawthorne effect:** people change their behaviour because they **know they are being studied** (Western Electric Hawthorne Works studies, 1924–1932, interpreted by Elton Mayo and colleagues; the term was coined by H.A. Landsberger in 1958).
- **Survey:** collects **opinions, attitudes, facts** from **many people** through **questionnaires, interviews, telephone** or online forms; good for **how often** something occurs.
- **Interview:** **structured** (fixed questions in fixed order) or **unstructured** (free, flexible).
- **Case study:** an **in-depth study of one person, group or event**, using history, interviews, tests and observation; a **non-experimental** method.
- **Clinical method:** case study aimed at **diagnosis and treatment**; Lightner **Witmer** opened the first psychological clinic, University of Pennsylvania, **1896**.
- **Experimental method:** studies **cause and effect**; the **independent variable (IV)** is changed, the **dependent variable (DV)** is measured.
- **Experimental group** gets the treatment; **control group** does not.
- **Correlational method:** finds whether two variables **vary together**; the coefficient runs from **-1 to +1**; **correlation is not causation**.
- **Cross-sectional** design: **different age groups at one time**; **longitudinal:** **the same people over years**.
- **Quantitative** research collects **numbers**; **qualitative** research collects **non-numerical data** (words, narratives, images). The main difference is the **type of data** collected and analysed.
- **Research ethics:** **voluntary participation, informed consent, debriefing, sharing results, confidentiality** (the NCERT list).

Explained

This note covers the methods as a psychology student meets them. The classroom version (introspection, observation, experiment, case study for teachers) is in **EDU-PS-02**; read that for introspection, the oldest

method. The goals and steps of research, kinds of data, variables, hypotheses and sampling are in **PSY-ME-01**.

1. Observation

- **What it involves:** **selecting** what to watch, **recording** it (notes, checklists, rating scales, video), and **analysing** the record. Good observation is planned, not casual watching.
- **Naturalistic:** children on a playground, shoppers in a market, workers on a shop floor. Behaviour is genuine, but the researcher cannot control what happens or when.
- **Controlled:** the researcher sets up a room (for example a playroom with chosen toys) and watches through a one-way mirror. More precise and repeatable, less natural.
- **Participant:** the researcher becomes a member (lives in a village, joins a gang study). Gains trust and inside view, but may lose objectivity.
- **Non-participant:** watches from outside, without joining.
- **Problems:** **observer bias** (seeing what one expects), **reactivity / Hawthorne effect** (behaviour changes because people know they are watched), slow and costly, and it shows **what** people do, not **why**.

2. Survey method

- **Purpose:** to learn the attitudes, opinions, beliefs or behaviour of a **large population**, usually from a **sample**. Psychologists use questionnaire surveys to find **how common** a problem is and its likely causes (for example stress among students, alcohol use among youth).
- **Forms:** personal interview, **questionnaire** (mailed, handed out or online), **telephone survey**, and **controlled observation** (NCERT's list).
- **Questionnaire:** a written set of questions answered by the respondent. **Closed (fixed-response)** items offer choices (yes / no, multiple choice, rating); **open-ended** items allow free answers. Cheap, reaches many, anonymous; but needs **literate** respondents, return rates can be low, and people may give socially desirable answers.
- **Interview:** a face-to-face (or phone) conversation with a purpose. **Structured (standardised):** same questions, same order, for everyone; easy to compare. **Unstructured (non-standardised):** the interviewer follows the answers; rich but hard to compare. Interviews can be **individual-to-individual**, **individual-to-group**, **group-to-individual** or **group-to-group**. They suit **illiterate** people and children, but cost time and invite **interviewer bias**.
- **Sampling:** a survey is only as good as its sample; a **random, representative** sample lets the results be generalised. Sampling follows the **scientific approach**: results from a particular set of units are extended to the population.

3. Case study and clinical method

- **Case study:** everything about one case: family and developmental history, school or work record, medical history, interviews with the person and others, tests, observation. It is used for **rare or unusual** cases and to generate hypotheses. Famous examples in textbooks: **Phineas Gage** (personality change after frontal brain injury, 1848), patient **H.M.** (memory loss after brain surgery, 1953), and Freud's clinical cases.
- **Clinical method:** the case study used by counsellors and clinical psychologists to **diagnose and treat** a person's problem, then follow up. Piaget's **clinical interview** with children is a related technique.

- **Merits:** depth; a whole-person picture; useful where experiments are impossible or unethical.
- **Limits:** cannot be **generalised** to others; depends on the honesty and memory of informants; the researcher's interpretation can be subjective; time-consuming.

4. Experimental method

- **Logic:** change one factor (**IV**), keep everything else the same, and see whether another factor (**DV**) changes. If it does, the IV **caused** the change.
- **Example:** does background noise lower memory scores? IV = noise (present / absent); DV = number of words recalled; controlled: the word list, time, room, instructions.
- **Extraneous (confounding) variables:** anything other than the IV that could change the DV (age, fatigue, practice, time of day). Three standard controls (NCERT): **holding conditions constant** (or eliminating them), **counterbalancing** (varying the order of tasks so practice and fatigue balance out) and **random assignment** (every participant has an equal chance of being in either group).
- **Experimental and control groups:** the experimental group gets the IV; the control group is identical but does not; the difference between them is the effect.
- **Placebo:** a dummy treatment (sugar pill) given to the control group so that **expectations** are the same in both groups.
- **Single-blind:** participants do not know their group. **Double-blind:** neither participants nor the experimenter who measures them know. It controls **demand characteristics** (participants guessing what is wanted) and **experimenter bias** (the researcher's expectations shaping results).
- **Laboratory experiment:** maximum control, artificial setting.
- **Field experiment:** the IV is manipulated in a **real setting** (a school, a factory); more natural, less control.
- **Quasi-experiment:** the researcher **cannot randomly assign** people to groups because the groups already exist (for example, children who lived through an earthquake compared with those who did not, or men compared with women). Cause can be suggested but not proved as firmly.

5. Correlational method

- Measures two variables as they occur and calculates a **correlation coefficient (r)**: **positive** (both rise together, e.g. study time and marks), **negative** (one rises as the other falls, e.g. anxiety and test performance), or **zero** (no relation).
- Strength depends on how close r is to ± 1 ; the sign gives only the direction. How to read r and how to compute it are in **PSY-MS-01** and **STA-CR-01**.
- **Correlation does not prove causation:** a third variable may drive both (ice-cream sales and drowning both rise in summer), or the direction may run either way.
- Used when an experiment is impossible or unethical (smoking and illness, poverty and school results), and for prediction.

6. Designs for change with age

Design	Who is studied	Strength	Weakness
Cross-sectional	different age groups, once	quick, cheap	cohort effect: age groups grew up in different times

Design	Who is studied	Strength	Weakness
Longitudinal	the same people, repeatedly over years	shows real individual change	slow, costly, dropouts (attrition) , practice effects
Cross-sequential	several age groups, each followed for a few years	separates age from cohort effects	complex and costly

7. Quantitative and qualitative methods

Point	Quantitative	Qualitative
Data	numbers, scores, counts	words, narratives, observations, images
Aim	test hypotheses, measure, generalise	understand meanings and experience
Tools	experiments, tests, structured surveys	in-depth interviews, focus groups, participant observation
Sample	large, often random	small, chosen on purpose
Analysis	statistics	themes, categories, interpretation

- **Qualitative approaches:** **in-depth interview**; **focus group** (6–10 people discuss a topic led by a moderator); **ethnography** (living in a community and describing its culture); **narrative / life history**; **phenomenology** (how people experience something); **grounded theory** (theory built up from the data, not tested on it; Glaser and Strauss, 1967); **thematic analysis**.
- **Content analysis** turns text, speeches or media into categories; it can be counted (quantitative) or interpreted (qualitative).
- **Mixed methods / triangulation:** using both kinds of data on one question, so that each checks the other.

8. Research ethics

- **Voluntary participation:** people take part only if they choose, and may **withdraw at any time** without penalty.
- **Informed consent:** before taking part they are told what the study involves, its risks and benefits, in words they understand. For children, consent from parents and agreement (assent) from the child.
- **Debriefing:** after the study, participants are told its true purpose and any **deception** is explained; they should leave in the same state as they came.
- **Sharing results** with participants where possible.
- **Confidentiality:** data is kept private and reported without names; anonymity where possible.
- **Protection from harm:** physical or psychological risk must be minimal and justified by the value of the study. Studies are approved by an **ethics committee** (in India, institutional ethics committees following ICMR guidelines; in the USA, Institutional Review Boards).
- **Studies that changed the rules:** Watson and Rayner's "**Little Albert**" fear conditioning (1920), **Milgram's obedience** experiments (early 1960s, deception and distress), **Zimbardo's Stanford prison** study (1971, stopped early).

9. Merits and limits at a glance

Method	Best for	Main merit	Main limit
Naturalistic observation	real-life behaviour, children, animals	genuine behaviour	no control; observer bias
Controlled observation	precise records of behaviour	repeatable	artificial; reactivity
Survey / questionnaire	attitudes of large groups	many people, cheap	shallow; false answers; no cause
Interview	detail, illiterate respondents	flexible, can probe	slow; interviewer bias
Case study	rare or complex single cases	depth	cannot generalise
Experiment	cause and effect	control, replicable	artificial; ethical limits
Correlational	relations, prediction	studies what cannot be manipulated	no cause
Qualitative	meanings, new areas	rich understanding	small samples; subjective

Common traps

✗ "Controlled observation happens in a natural setting." ✓ It happens in a **controlled and structured** setting; **naturalistic** observation uses the natural setting.

✗ "The DV is what the experimenter changes." ✓ The experimenter changes the **IV** and measures the **DV**.

✗ "Random assignment and random sampling are the same." ✓ **Sampling** chooses who takes part (generalisation); **assignment** decides which group each person joins (cause and effect).

✗ "A strong correlation proves cause." ✓ Only an **experiment** can show cause; correlation shows variables **vary together**.

✗ "Case study is an experimental method." ✓ It is **non-experimental**: nothing is manipulated.

✗ "Longitudinal design compares different age groups at one time." ✓ That is **cross-sectional**; longitudinal follows **the same people over time**.

✗ "Qualitative and quantitative research differ only in sample size." ✓ They differ mainly in the **type of data** collected and analysed: words versus numbers.

✗ "Debriefing is done before the study." ✓ **Informed consent** comes before; **debriefing** comes **after**.

✗ "The Hawthorne effect is observer bias." ✓ Hawthorne is a change in the **participants'** behaviour because they are watched; observer bias is in the **researcher**.

Quick revision

- Observation: select, record, analyse; Hawthorne effect = people change when watched.
- Naturalistic = natural setting; controlled = structured setting; participant vs non-participant.
- Survey: many people, questionnaire / interview / phone; how common a problem is.
- Structured interview = fixed questions; unstructured = flexible.
- Case study: one case in depth, non-experimental; clinical method adds treatment (Witmer 1896).
- Experiment: IV changed, DV measured; experimental vs control group; cause and effect.
- Controls: hold constant, counterbalance, random assignment; double-blind stops bias.
- Correlation -1 to +1; never proves cause.
- Cross-sectional = many ages once; longitudinal = same people over years.
- Ethics: voluntary, informed consent, debriefing, sharing results, confidentiality.