

VU LEARNING HUB

vulearninghub.xyz

HANDOUT

CS719

Research Methodologies

CS719 by VU Learning HUB

Prepared for VU students • Free study resources

<https://vulearninghub.xyz>

VU STUDY HANDOUT

CS719

Research Methodologies

This handout builds end-to-end research competence for computing and social-science researchers: formulating problems, reviewing literature, choosing designs, sampling, collecting and analyzing data, and writing publishable papers ethically.

15 lecture-wise topics | key terms | exam pointers

Table of Contents

UNIT 1: FOUNDATIONS OF RESEARCH

Lecture 1: What is Research?

Lecture 2: Formulating the Research Problem

Lecture 3: Literature Review

UNIT 2: RESEARCH DESIGNS

Lecture 4: Quantitative Research Designs

Lecture 5: Qualitative Research Designs

Lecture 6: Mixed Methods and Survey Research

UNIT 3: SAMPLING AND DATA COLLECTION

Lecture 7: Sampling Techniques

Lecture 8: Measurement: Validity and Reliability

Lecture 9: Data Collection Methods

UNIT 4: DATA ANALYSIS

Lecture 10: Quantitative Data Analysis

Lecture 11: Qualitative Data Analysis

UNIT 5: REPORTING AND ETHICS

Lecture 12: Writing the Research Report/Thesis

Lecture 13: Referencing and Avoiding Plagiarism

Lecture 14: Research Ethics

Lecture 15: Publishing and Research Impact

UNIT 1: FOUNDATIONS OF RESEARCH

Lecture 1: What is Research?

Learning Objectives

- Define research and its characteristics
- Distinguish research types
- Explain the research process

Key Terms & Definitions

Research

Systematic, controlled, empirical and critical investigation of a problem to discover new knowledge.

Basic vs Applied research

Knowledge for its own sake vs knowledge solving a practical problem.

Hypothesis

A testable tentative proposition about relationships between variables.

Research is **systematic inquiry**: it follows an explicit method, controls bias, grounds claims in **evidence**, and opens itself to **scrutiny**. Its hallmarks: purposiveness, rigor, testability, replicability, precision, objectivity, and parsimony. Casual Googling is not research; a documented, reproducible investigation is.

Types: basic/pure (extends theory), applied (solves real problems), **action research** (practitioner improves own practice iteratively), evaluation research, and **R&D**. In computing, applied/experimental research dominates: build a system, measure it against baselines. **Quantitative** research counts and models; **qualitative** explores meanings; **mixed methods** triangulate.

The **research process**: identify problem -> literature review -> formulate objectives/hypotheses -> design -> collect data -> analyze -> interpret -> report. It is **iterative**: findings send you back to refine questions. Every choice must be **justified** in the thesis - "why this method" matters as much as results.

- **Research gap**: the unanswered question your study fills - the heart of any proposal.
- **Variables**: independent (manipulated), dependent (measured), control/extraneous.
- **Deductive** (theory -> test) vs **inductive** (observations -> theory).
- **Paradigms**: positivism (objective measurement), interpretivism (meaning), pragmatism (what works).

VERY IMPORTANT — Exam Pointer

Very important: define research with its characteristics, and distinguish basic vs applied with computing examples.

Section Summary

Research is disciplined, evidence-based inquiry aimed at a clearly identified gap.

Lecture 2: Formulating the Research Problem

Learning Objectives

- Identify sources of research problems
- Write good research questions
- Evaluate problem statements

Key Terms & Definitions

Problem statement

Clear articulation of the gap, its significance, and the study's intent.

Research questions

Specific interrogatives the study will answer.

Delimitations

Boundaries the researcher deliberately sets (scope).

Problems come from **literature gaps** (contradictions, untested contexts), **practice** (industry pain points), **theory** (unverified predictions), and **prior findings** (a paper's "future work"). In CS: "existing load balancers ignore energy cost in edge data centers" is a problem; "I want to study networks" is not.

Good **research questions** are focused, researchable, and significant: "How does algorithm X affect latency under bursty IoT traffic compared to Y?" Criteria: **FINER** (Feasible, Interesting, Novel, Ethical, Relevant). Each question maps to objectives and later to findings - maintain this **golden thread**.

The **problem statement** has three moves: the **context** (what is known), the **gap** (what is missing/wrong), the **significance** (why filling it matters, for whom). State **objectives** (SMART), **scope/delimitations**, and operational **definitions** of key terms.

- **FINER criteria** for evaluating a research question.
- **Golden thread**: questions -> objectives -> method -> findings -> conclusions must align.
- **Scope**: say what the study will NOT cover - examiners probe this.
- **Avoid**: questions answerable by yes/no, or by a quick search.

Example

Weak: "Study of e-learning." Strong: "To what extent does adaptive quiz sequencing improve retention among VU distance learners compared to fixed sequencing?"

VERY IMPORTANT — Exam Pointer

Exam pointer: convert a vague topic into a FINER research question with objectives.

Section Summary

A sharp problem statement and FINER questions are the foundation everything else stands on.

Lecture 3: Literature Review

Learning Objectives

- Explain the purposes of literature review
- Search and organize literature
- Write a critical synthesis

Key Terms & Definitions

Literature review

Critical synthesis of existing knowledge identifying gaps and positioning the study.

Systematic review

Protocol-driven, reproducible review (e.g. PRISMA) minimizing selection bias.

Citation databases

IEEE Xplore, ACM DL, Scopus, Web of Science, Google Scholar.

The review **justifies** the study: it maps what is known, exposes the **gap**, positions your contribution, and informs method choices. A good review is **critical and synthetic** - organized by themes/approaches, comparing and evaluating - not an annotated bibliography summarizing papers one by one.

Searching: start with seed papers, then **forward/backward snowballing** (citations), database queries with Boolean operators, and alerts. Track with a reference manager (**Zotero/Mendeley**). Assess quality: venue reputation, citations, method rigor. For a thesis, a **systematic** protocol (inclusion/exclusion criteria, PRISMA flow) adds credibility.

Writing: thematic structure (chronological only when the evolution matters), **synthesis matrices** (papers x themes), critical voice ("However, these studies assume...; none addresses..."), ending by **stating the gap** your study fills. Every claim cited; every citation earned.

- **Synthesize, don't list:** group by theme, compare findings, note contradictions.
- **Snowballing** from 2-3 seed papers beats keyword searching alone.
- **PRISMA:** identification -> screening -> eligibility -> included.
- **Theoretical framework:** the lens (e.g. TAM) guiding your study, derived from the review.

VERY IMPORTANT — Exam Pointer

Very important: distinguish a critical synthesis from an annotated bibliography.

Section Summary

The literature review earns your study's right to exist by critically mapping the gap.

UNIT 2: RESEARCH DESIGNS

Lecture 4: Quantitative Research Designs

Learning Objectives

- Classify quantitative designs
- Explain experimental design
- Discuss validity threats

Key Terms & Definitions

Experimental design

Manipulates an independent variable with random assignment and control.

Quasi-experimental

Lacks random assignment; uses intact groups.

Internal validity

Confidence that the treatment caused the observed effect.

Experimental (true experiment): random assignment + control group + manipulation - the gold standard for **causality**. **Quasi-experimental**: no random assignment (e.g. two existing classes) - weaker causal claims. **Non-experimental**: descriptive surveys, correlational studies, ex post facto - no manipulation.

In computing, experiments are **benchmark studies**: algorithm variants (treatments) on datasets (subjects), measuring latency/accuracy with **repeated runs**, controlling hardware/caching confounds, using **statistical tests** (t-test, ANOVA) rather than eyeballing means. **Ablation studies** isolate each component's contribution.

Validity: internal (confounds, history, maturation, testing effects), external (generalizability - ecological validity of lab benchmarks), construct (does the metric measure the concept?), conclusion (statistical power). **Reliability** (consistency) is necessary but not sufficient for validity.

- **Randomization** is what separates true experiments from quasi.
- **Control confounds**: same hardware, warm-up runs, fixed seeds.
- **Replication** (multiple runs) quantifies variance - report std dev / confidence intervals.
- **Threats checklist** belongs in every thesis methodology.

Example

Comparing two schedulers: same workload traces, 30 runs each, random order, t-test on mean job completion time - a true experimental design in systems research.

VERY IMPORTANT — Exam Pointer

Exam pointer: name four threats to internal validity and one control for each.

Section Summary

Quantitative designs trade off control against realism; validity analysis shows you understand the trade.

Lecture 5: Qualitative Research Designs

Learning Objectives

- Describe major qualitative traditions
- Explain purposive sampling
- Discuss trustworthiness

Key Terms & Definitions

Case study

In-depth investigation of a bounded system (a team, a project, an organization).

Grounded theory

Builds theory inductively from data via coding.

Thematic analysis

Identifies patterns of meaning across qualitative data (Braun & Clarke).

Traditions: case study (the "how/why" of a real context - common in software engineering research), **ethnography** (immersion in a culture, e.g. open-source communities), **phenomenology** (lived experience), **grounded theory** (theory emerging from data), **action research** (intervene + study). Choose by question: "how" questions suit cases; "what is the experience" suits phenomenology.

Data: semi-structured **interviews** (flexible protocol), focus groups, observation, documents/artifacts. **Purposive sampling:** select information-rich cases (maximum variation, snowball) - not random. **Saturation** (no new themes emerging) decides sample size, often 12-30 interviews.

Analysis: transcribe -> **open coding** (label meaning units) -> axial/selective coding -> themes (thematic analysis) or a theory (grounded theory). **Trustworthiness:** credibility (member checking, triangulation), transferability (thick description), dependability (audit trail), confirmability (reflexivity). Software: NVivo, ATLAS.ti.

- **"How/why" questions -> qualitative;** "how much/how many" -> quantitative.
- **Saturation,** not a formula, justifies qualitative sample size.
- **Triangulation:** interviews + documents + observation converging.
- **Reflexivity:** document your own influence on the data.

VERY IMPORTANT — Exam Pointer

Very important: explain credibility, transferability, dependability, confirmability in one line each.

Section Summary

Qualitative designs explore meaning in context; rigor comes from transparency and triangulation.

Lecture 6: Mixed Methods and Survey Research

Learning Objectives

- Explain mixed-method designs
- Design valid questionnaires
- Avoid survey pitfalls

Key Terms & Definitions

Triangulation design

Quantitative + qualitative concurrently to corroborate findings.

Explanatory sequential

Quantitative first, then qualitative to explain results.

Likert scale

Ordered agreement scale (typically 5- or 7-point) for attitude measurement.

Mixed methods: triangulation (concurrent, corroborate), **explanatory sequential** (survey then interviews explaining surprises), **exploratory sequential** (interviews then survey to generalize). Pragmatist paradigm: use what answers the question. Integration must happen - in analysis or interpretation - not two separate studies stapled together.

Questionnaire design: one concept per item, simple unambiguous wording, no double-barreled or leading questions, balanced scales, pilot test (n=10-20) with cognitive debriefing. **Likert** items need labeled points; validate constructs with **factor analysis** and report **Cronbach's alpha** (≥ 0.7) for reliability.

Survey errors: coverage (bad frame), sampling, nonresponse (follow-ups, incentives), measurement (poor items). Online surveys risk self-selection; report response rates honestly. In CS: developer surveys (Stack Overflow style) follow identical principles.

- **Pilot everything:** a 15-minute pilot saves a 300-response disaster.
- **Cronbach's alpha ≥ 0.7** for scale reliability.
- **Avoid:** double-barreled ("fast and reliable?"), leading, and absolute ("always") items.
- **Mixed methods need integration** - a joint display or merged interpretation.

Example

Explanatory sequential: survey finds 68% of developers distrust AI code review; follow-up interviews reveal the distrust centers on security-blind approvals - the qualitative explains the quantitative.

VERY IMPORTANT — Exam Pointer

Exam pointer: name the three mixed-method designs and when each fits.

Section Summary

Surveys quantify attitudes at scale; mixed methods combine numbers with the reasons behind them.

UNIT 3: SAMPLING AND DATA COLLECTION

Lecture 7: Sampling Techniques

Learning Objectives

- Distinguish probability and non-probability sampling

- Compute sample size logic
- Avoid sampling bias

Key Terms & Definitions

Probability sampling

Every element has a known, non-zero chance of selection.

Stratified sampling

Population divided into strata; random sample within each.

Sampling frame

The list from which the sample is drawn.

Probability: simple random, **stratified** (by department/year - guarantees representation), **cluster** (sample whole groups, e.g. classes - cheap for dispersed populations), systematic (every kth). Only probability samples support **statistical generalization** with measurable sampling error.

Non-probability: convenience, purposive, snowball, quota. Legitimate for qualitative/exploratory work and when no frame exists - but findings **do not generalize** statistically; say so explicitly. Most student surveys are convenience samples: acknowledge the limitation.

Sample size: for estimation, n depends on desired margin of error, confidence level, and population variance (Cochran's formula); for experiments, **power analysis** (G*Power: effect size, alpha 0.05, power 0.80). Rules of thumb (n=30, 10% of population) are weak - justify with power or saturation.

- **Stratified > simple random** when subgroups must be represented.
- **Power analysis** justifies experimental sample sizes.
- **Sampling frame quality** bounds everything - a bad list means a bad sample.
- **Report:** technique, frame, size justification, response rate.

VERY IMPORTANT — Exam Pointer

Very important: contrast probability vs non-probability sampling and state what each permits you to claim.

Section Summary

Sampling determines what you may generalize; match the technique to the claim.

Lecture 8: Measurement: Validity and Reliability

Learning Objectives

- Explain levels of measurement
- Assess validity types
- Measure reliability

Key Terms & Definitions

Construct validity

The instrument truly measures the intended concept.

Reliability

Consistency of measurement across time/items/raters.

Operationalization

Turning a concept into measurable indicators.

Levels: nominal (categories), ordinal (ranked), interval (equal gaps, no true zero), ratio (true zero). The level dictates permissible statistics (means need interval+; chi-square for nominal). **Operationalization:** "usability" -> task completion time + SUS questionnaire score.

Validity: content (expert coverage), criterion (correlation with a gold standard), **construct** (convergent/discriminant evidence, factor analysis). A speed test that actually measures test-taking skill lacks construct validity.

Reliability: test-retest, **internal consistency** (Cronbach's alpha), inter-rater (**Cohen's kappa**). Unreliable measures attenuate real effects - pilot and refine. **Validity requires reliability**, but reliability alone is not validity.

- **Nominal < ordinal < interval < ratio:** know which statistics each allows.
- **Pilot + alpha + factor analysis:** the instrument validation trio.
- **Kappa** for agreement between human coders/raters.
- **Report psychometrics** for every adopted or adapted scale.

Example

Adopting the System Usability Scale (SUS): 10 items, 5-point Likert, score 0-100; prior studies report alpha > 0.90 - cite this as reliability evidence.

VERY IMPORTANT — Exam Pointer

Exam pointer: explain why reliability is necessary but not sufficient for validity.

Section Summary

Measure the right thing (validity) consistently (reliability), and prove both.

Lecture 9: Data Collection Methods

Learning Objectives

- Select appropriate data collection methods
- Conduct effective interviews
- Use observation systematically

Key Terms & Definitions

Semi-structured interview

Guided by a protocol but flexible to follow up.

Structured observation

Predefined coding scheme for recording behavior.

Secondary data

Existing datasets reused for new questions.

Interviews: structured (identical questions, comparable), **semi-structured** (protocol + probes - the qualitative workhorse), unstructured (conversational). Craft open questions, avoid leading, probe ("tell me more about..."), record with consent, transcribe verbatim.

Observation: participant vs non-participant; structured (checklists, e.g. counting help-desk requests) vs unstructured field notes. **Documents/artifacts:** commit logs, tickets, policies - unobtrusive and rich in software research. **Secondary data** (Kaggle, UCI, public APIs) is legitimate when the question fits - cite the source.

Fieldwork discipline: consent forms, anonymization at collection, secure storage, audit trail of decisions. Response quality beats quantity: ten deep interviews beat 200 careless questionnaires.

- **Match method to question:** behaviors -> observation; experiences -> interviews; traces -> artifacts.
- **Informed consent** always: purpose, voluntariness, anonymity, withdrawal right.
- **Triangulate** collection methods to offset each one's weakness.
- **Log everything:** dates, settings, non-responses, deviations.

VERY IMPORTANT — Exam Pointer

Very important: list the ethical requirements of data collection (consent, anonymity, withdrawal).

Section Summary

Collect data the question demands, ethically and traceably.

UNIT 4: DATA ANALYSIS

Lecture 10: Quantitative Data Analysis

Learning Objectives

- Choose appropriate statistical tests
- Interpret p-values and effect sizes
- Present results correctly

Key Terms & Definitions

p-value

Probability of data this extreme if the null hypothesis were true.

Effect size

Magnitude of the difference/relationship (Cohen's d, r, eta-squared).

Type I / Type II error

False positive (alpha) / false negative (beta).

Test selection: compare two means -> t-test (paired if same subjects); 3+ groups -> ANOVA; categorical association -> chi-square; relationship -> correlation/regression; non-normal/small samples -> non-parametric (Mann-Whitney, Wilcoxon). Check **assumptions** (normality: Shapiro-Wilk; equal variance: Levene) before trusting the test.

$p < 0.05$ is not the finding - it only rejects the null. Report **effect sizes** (Cohen's d: 0.2 small, 0.5 medium, 0.8 large) and **confidence intervals**, which convey practical significance. **Multiple comparisons** inflate false positives - correct with Bonferroni/Holm.

Presentation: descriptives first (means, SDs, n), then inferential results in APA style: $t(28) = 2.45, p = .021, d = 0.89$. Tables for precision, figures for patterns. Never "prove" - you "found evidence for".

- **Assumptions first, test second.**
- **Effect size + CI** always alongside p-values.
- **Correct for multiple comparisons.**
- **Practical vs statistical significance:** huge n makes trivia "significant".

Example

New cache policy: mean hit-rate 87.3% vs 82.1%, $t(58)=3.12, p=.003, d=0.81$ (large) - practically meaningful, not just significant.

VERY IMPORTANT — Exam Pointer

Very important: interpret a p-value correctly and explain why effect sizes are required.

Section Summary

Statistics quantify evidence; effect sizes and intervals tell you whether it matters.

Lecture 11: Qualitative Data Analysis

Learning Objectives

- Code qualitative data
- Build themes systematically
- Use CAQDAS tools

Key Terms & Definitions

Open coding

Labeling data segments with conceptual codes.

Axial coding

Relating codes into categories and relationships.

Member checking

Returning interpretations to participants for validation.

Thematic analysis (Braun & Clarke, six phases): familiarize -> generate initial codes -> search themes -> review themes -> define/name -> write up. **Codes** are labels ("frustration with documentation"); **themes** are patterns answering the research question ("documentation as a barrier to onboarding").

Grounded theory goes further: constant comparison builds an explanatory **theory** (e.g. how teams adopt DevOps). Keep **memos** - analytic notes capturing your thinking; they become the theory's scaffolding. **Negative case analysis** strengthens claims.

Tools (NVivo, ATLAS.ti, MAXQDA) organize coding, not do thinking. **Inter-coder reliability** (Cohen's kappa on a subset) for team projects. Present themes with **evocative quotes**, counts used sparingly (qualitative != quantitative).

- **Code -> categorize -> theme**: the analytic ladder.
- **Memos** capture insight when it strikes - write them immediately.
- **Quotes evidence themes**; never present a theme without data.
- **Audit trail**: codebook versions, theme decisions, reflexive notes.

VERY IMPORTANT — Exam Pointer

Exam pointer: outline the six phases of thematic analysis.

Section Summary

Qualitative analysis turns transcripts into trustworthy themes through systematic coding.

UNIT 5: REPORTING AND ETHICS

Lecture 12: Writing the Research Report/Thesis

Learning Objectives

- Structure a thesis/paper
- Write each chapter effectively
- Master academic style

Key Terms & Definitions

IMRaD

Introduction, Methods, Results, and Discussion - the standard paper structure.

Abstract

150-250 word standalone summary: problem, method, key results, conclusion.

APA style

American Psychological Association formatting and citation standard.

Thesis structure: preliminary pages -> Chapter 1 Introduction (background, problem, questions, objectives, significance, scope, definitions) -> Chapter 2 Literature Review -> Chapter 3 Methodology (design, population, sampling, instruments, procedure, analysis, ethics) -> Chapter 4 Results -> Chapter 5 Discussion/Conclusion (summary, implications, limitations, future work) -> references -> appendices.

Writing craft: one idea per paragraph with a topic sentence; **hedge** claims appropriately ("suggests" not "proves"); past tense for your procedures/results, present for established knowledge; figures/tables numbered, titled, and **referenced in text**. Write the **abstract last**.

Paper version (IMRaD): conferences/journals want contribution up front - abstract, introduction ending in contributions, related work, method, evaluation, discussion, conclusion. Follow the venue's template exactly; page limits are hard.

- **Golden thread:** every chapter answers the research questions.
- **Methodology must enable replication** - enough detail to redo the study.
- **Discuss limitations honestly** - it strengthens, not weakens, credibility.
- **Abstract last**, and make it self-contained.

VERY IMPORTANT — Exam Pointer

Very important: list thesis chapters and state the purpose of the methodology chapter.

Section Summary

Structure carries the argument: IMRaD for papers, five chapters for theses, precision throughout.

Lecture 13: Referencing and Avoiding Plagiarism

Learning Objectives

- Apply APA citation correctly
- Distinguish plagiarism types
- Use Turnitin responsibly

Key Terms & Definitions

Plagiarism

Presenting others' work/ideas as one's own, with or without intent.

Paraphrasing

Restating ideas in one's own words with citation.

Self-plagiarism

Reusing one's own published work without disclosure.

APA 7th basics: in-text (Author, Year); direct quotes need page numbers; reference list alphabetical with hanging indent: Author, A. (Year). Title. Source. **Cite** every idea, number, and distinctive phrase that is not yours

- including code and figures (adapted/redrawn with credit).

Plagiarism spectrum: copy-paste, mosaic/patchwriting (stitched paraphrases), inadequate paraphrase, missing citations, **self-plagiarism**. **Paraphrase** = fully restate + cite; **quote** = exact words in quotes + cite + page. When in doubt, cite.

Turnitin similarity index is not a plagiarism verdict - properly quoted/cited text matches legitimately; HEC thresholds guide but judgment rules. Keep drafts and notes as **evidence of authorship**.

Fabrication/falsification of data is the cardinal sin - never.

- **Every non-original idea gets a citation** - no exceptions.
- **Paraphrase + cite**; quote sparingly with page numbers.
- **Reference managers** (Zotero) eliminate formatting errors.
- **Keep an authorship trail**: notes, drafts, data files.

Example

Patchwriting: changing every third word of a source paragraph without citation is still plagiarism - restate the idea completely or quote it.

VERY IMPORTANT — Exam Pointer

Very important: distinguish paraphrasing, quoting and patchwriting with the citation each needs.

Section Summary

Credit every idea; paraphrase honestly, quote exactly, and let tools check - not judge.

Lecture 14: Research Ethics

Learning Objectives

- Apply core ethical principles
- Navigate IRB approval
- Handle ethical dilemmas

Key Terms & Definitions

Informed consent

Voluntary agreement based on full disclosure of the study.

Anonymity vs Confidentiality

No identifiers collected vs identifiers protected.

IRB/Ethics committee

Institutional board approving human-subject research.

Principles (Belmont): respect for persons (autonomy, consent), beneficence (maximize benefit, minimize harm), justice (fair selection of subjects). Operationalized: **informed consent**, voluntary participation, right to withdraw, **anonymity/confidentiality**, debriefing, data security.

IRB approval is required before collecting human data in most universities: submit protocol, instruments, consent forms; expedited vs full review by risk level. **Deception** needs strong justification + debriefing. Vulnerable populations (minors) need extra safeguards and guardian consent.

Computing-specific: scraping/API terms of service, user data privacy (PDPA/GDPR), dual-use concerns (security research - **responsible disclosure**), authorship ethics (who qualifies: substantial contribution; gift/ghost authorship is misconduct). **Conflicts of interest** must be declared.

- **Belmont trio:** respect, beneficence, justice.
- **Consent is a process**, not a form - ongoing and revocable.
- **Anonymize early:** separate identifiers from data at collection.
- **Authorship = substantial contribution** (conception, analysis, writing).

VERY IMPORTANT — Exam Pointer

Exam pointer: a researcher wants to scrape student Facebook posts for a study - list the ethical issues.

Section Summary

Ethics protects participants and the researcher's credibility; get approval before data, not after.

Lecture 15: Publishing and Research Impact

Learning Objectives

- Choose publication venues
- Navigate peer review
- Understand impact metrics

Key Terms & Definitions

Peer review

Independent expert evaluation before publication.

Impact factor

Journal-level citation metric (mean citations per article).

h-index

Researcher metric: h papers with at least h citations each.

Venues: in CS, top **conferences** (NeurIPS, ICSE, SIGCOMM) outrank most journals; elsewhere journals dominate. Check **HEC recognized** lists for Pakistan. Avoid **predatory journals** (spam invitations, fake impact factors, no real review - check Beall's criteria/ThinkCheckSubmit).

Peer review: single/double-blind; respond with a **rebuttal** addressing every comment (agree + change, or politely disagree with evidence). Rejection is normal - revise and resubmit elsewhere. **Open access** (gold/green) widens readership; watch APC costs.

Metrics: journal impact factor, **h-index**, i10-index, citations - useful but gameable; DORA warns against metric misuse. Real impact = uptake by researchers/practitioners. Build a profile: Google Scholar, ORCID,

ResearchGate.

- **ThinkCheckSubmit** before submitting anywhere unfamiliar.
- **Rebuttals**: number every reviewer point; show exact changes.
- **Predatory red flags**: guaranteed acceptance, broad scope spam, fake metrics.
- **ORCID + Scholar profile** from day one.

VERY IMPORTANT — Exam Pointer

Very important: list five red flags of predatory journals.

Section Summary

Publish where the community reads, survive review with grace, and measure impact honestly.

Glossary of Key Terms

FINER — Feasible, Interesting, Novel, Ethical, Relevant - criteria for research questions.

Paradigm — Worldview guiding research: positivism, interpretivism, pragmatism.

IMRaD — Introduction, Methods, Results, and Discussion paper structure.

p-value — Probability of extreme data under the null hypothesis.

Saturation — Point where new data yields no new themes (qualitative sample-size rule).

Triangulation — Converging multiple methods/sources on one finding.

Belmont principles — Respect for persons, beneficence, justice.

h-index — h papers cited at least h times each.