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Research Work - Analysis Dissertation and Reproducibility

Practical 2 - Supervised research activity guide

Aim

To execute, analyse and document an approved research study reproducibly.

Principle

Reliable research links each result to a defined material or participant, authorised method, original observation and reproducible analysis. Planning, pilot work and final analysis have different deliverables.

Materials and Requirements

- Approved research topic or open-access paper and study records
- Supervisor guidance, institutional ethics/safety requirements and assessment rubric
- Research notebook, analysis plan and presentation tools
- Approved method or teaching-data pack and a dated record sheet

Procedure

1. Define the preparation or dataset, study question and method version. Record identities, units and the criteria to be used before examining the outcome.
2. Define the research question, activity stage, evidence sources and deliverable with the supervisor. Keep supplied originals and a dated record of decisions.
3. Confirm approvals, material identity, method qualification, responsibilities and a version-controlled protocol before collecting study data.
4. Maintain a dated notebook with batch/subject identifiers, actual conditions, controls, deviations and independent replicate structure.
5. Review pilot or main-study data against prespecified quality rules; preserve exclusions, failures and any protocol amendments.
6. Analyse according to the justified plan, inspect assumptions and uncertainty and connect tables/figures to raw data and documented processing.
7. Prepare a balanced report with methods, results, discussion, limitations and an auditable data-to-conclusion trail.
8. Check scientific accuracy, traceability, authorship and confidentiality. Record limitations and obtain the appropriate academic review before dissemination.
9. Retain the original observations and calculations. State deviations, missing information and the limits of the conclusion; do not replace measured values with expected results.

Observations and Record

Enter actual measurements or the supplied teaching data. Record the method, material identity, conditions and units.

Task / evidence	Planned method / criterion	Completed record	Review / next action
Scientific question	Define	Record	Assess
Methods / evidence	Justify	Record	Assess

Task / evidence	Planned method / criterion	Completed record	Review / next action
Analysis / communication	Predefine	Record	Assess

Calculations

• Sample SD = sqrt[sum(x - mean)^2/(n - 1)]

• RSD (%) = sample SD/mean x 100, when meaningful for the measurement scale

Worked Example

Illustrative three independent batches give 98, 100 and 102 units: mean 100, sample SD 2 and RSD 2.0%. Three readings of one batch are technical replication and cannot be presented as three independent batches.

Stage-specific deliverable

• Semester 4: complete the approved study, resolve data queries, perform final analysis, archive reproducible records and finish the dissertation and presentation.

Result and Interpretation

• Deliver a complete notebook/data dictionary, justified analysis, traceable figures and a dissertation-ready account with limitations.

Precautions

• Do not fabricate observations, approvals, participant records or citations.

• Use the appropriate permissions for human, animal, biological or confidential work.

• Distinguish exploratory analysis from prespecified confirmatory analysis.

Viva Questions and Answers

Why record failed experiments?

They are part of the evidence and can reveal method or process limitations.

What is pseudoreplication?

Treating dependent measurements as independent experimental units.

Why retain the analysis version?

It allows another researcher to reproduce the reported results.

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