

Study Guide — BI Problem 8: Independent Project (Pretest / Capstone Preview)

Biomedical Innovations · Problem 8 — Independent Project · Modeled on the PLTW Guided Review format

Vocabulary to know cold

Term	Definition
Independent variable	The single factor the researcher deliberately changes or manipulates.
Dependent variable	The outcome that is measured and that may change in response to the independent variable.
Controlled variable	A condition held constant across all groups so it cannot explain the results.
Control group	The untreated or standard comparison group used as a baseline.
Hypothesis	A testable, falsifiable prediction about the relationship between variables.
Replication	Repeating trials or the whole study to test reliability and reduce random error.
IRB (Institutional Review Board)	A committee that reviews human-subjects research to protect participants.
Informed consent	A participant's voluntary agreement to take part after being told the risks and purpose.
Correlation	A statistical association between two variables that does not by itself prove cause.
Sharps container	A rigid, puncture-resistant, labeled container for needles and blades.
PPE	Personal protective equipment such as gloves, goggles, and a lab coat.
Pre-analytical error	A mistake in collection, labeling, handling, or storage that occurs before testing.

Worked examples (follow the reasoning)

Example 1. A student wants to test whether a new study-music playlist improves quiz scores. Identify the independent variable, dependent variable, one controlled variable, and the control group.

- The factor the student changes is whether the playlist is played, so that is the independent variable.
- The measured outcome is quiz score, so that is the dependent variable.
- Conditions held constant could be the same quiz, same room, and same study time; these are controlled variables.
- The group that studies with NO playlist is the control group, the baseline for comparison.

Answer: IV = playlist (on/off); DV = quiz score; controlled = same quiz/time/room; control group = students with no playlist.

Example 2. A lab receives a blood specimen that arrived unlabeled and was left on the bench for 6 hours at room temperature. List two reasons this specimen should be rejected.

- An unlabeled specimen cannot be reliably matched to a patient, risking a dangerous identity error.
- Whole blood left at room temperature for hours can degrade, causing hemolysis and inaccurate results.
- Both issues are pre-analytical errors that compromise specimen integrity.

Answer: Reject it: (1) no patient identifier (mislabeling/identity risk) and (2) improper storage temperature and time degraded the sample.

Practice questions (with reasoning)

1. Which is the BEST example of a testable hypothesis?

- A. Plants are interesting to study.
- B. If plants get more light, then they will grow taller.
- C. Light is important.
- D. Why do plants grow?

Answer: B. A hypothesis is an if-then prediction relating an independent variable (light) to a dependent variable (height).

2. A researcher tests one person and reports a result. The biggest weakness is the lack of:

- A. a colorful graph
- B. an adequate sample size and replication
- C. a long bibliography
- D. an expensive instrument

Answer: B. A single subject cannot show that results are reliable or generalizable; more subjects and replication are needed.

3. Which action best protects research participants' rights?

- A. Telling them the results only at the end
- B. Obtaining informed consent before the study
- C. Choosing only friends as subjects
- D. Skipping the IRB to save time

Answer: B. Informed consent ensures voluntary, knowledgeable participation and is an ethical requirement.

4. Where should a used scalpel blade be discarded?

- A. Regular trash
- B. Sharps container
- C. Sink drain
- D. Paper recycling

Answer: B. All sharps go in a rigid puncture-resistant sharps container to prevent injury and exposure.