Name: _____ Date: _____

Two study methods

A college wants to compare two study methods for all 480 students in its introductory statistics course. It randomly selects 60 of these students, then randomly assigns 30 to video practice and 30 to workbook practice. After two weeks, every selected student takes the same 100 point quiz. The response is the quiz score.

(a) Is this an experiment or an observational study? Explain.

Set it up: An experiment assigns a treatment. An observational study records a condition without assigning it.

Work: The researchers randomly assigned video or workbook practice.

Answer: It is a randomized experiment. Study method is the assigned treatment.

(b) Identify the population, sample, explanatory variable and response variable.

Set it up: Population = target group. Sample = observed group. Explanatory variable = study method. Response = quiz score.

Work: Population: 480 course students. Sample: 60 selected students. Explanatory variable has two categories: video and workbook. Response is the score on the same quiz.

Answer: Population 480; sample 60; explanatory variable study method; response quiz score out of 100.

(c) Explain what random selection and random assignment each help justify. Do they guarantee a better score?

Set it up: Random selection supports representing the target population. Random assignment helps balance other influences, called confounding variables, between the groups.

Work: The sample was randomly selected from the 480 students, and the 60 were randomly assigned to methods.

Answer: The design supports generalization to these course students and a causal treatment comparison under proper implementation. Neither random step guarantees a particular score or removes all error.

Across class sections

A college has 900 introductory statistics students in 30 class sections of 30 students each. Researchers randomly select 3 students from EVERY section and record each selected student's usual study method and next quiz score. Researchers do not assign study methods. Some invited students do not respond.

(a) Classify the study and identify the population, intended sample size, explanatory variable and response.

Set it up: Observational studies record existing conditions. Count selected students across all sections.

Work: Population = 900. Intended sample = 30 x 3 = 90 students. Explanatory variable = usual study method; response = next quiz score.

Answer: Observational study. Population: 900 students. Intended sample: 90 students. Explanatory variable: usual study method. Response: next quiz score. Actual respondent count is not given.

(b) Is the sampling method stratified, cluster, or a simple random sample of all students? Explain.

Set it up: Stratified sampling selects within every stratum. Cluster sampling selects whole groups.

Work: Each class section is a stratum, and 3 students are randomly selected within each one.

Answer: Stratified sampling by class section. It is not cluster sampling.

(c) What bias could nonresponse create? Can the results prove that a method caused higher scores?

Set it up: Nonresponse bias can arise if response is related to relevant traits. Causal inference needs an appropriate assignment design.

Work: Students who answer may differ in study habits or scores from those who do not. No study method was assigned.

Answer: Nonresponse could distort the sample; its direction is unknown. This observational design cannot by itself establish a causal effect.

Missing details

A note says: “54 students, 27 using Method A and 27 using Method B. Compare averages at the end.” The note does not say how students entered the groups, what larger population is targeted, or which outcome is averaged.

(a) Can you classify this as an experiment or observational study? State the exact missing fact.

Set it up: An experiment assigns the method; an observational study records an existing choice.

Work: The note gives group counts but no assignment procedure.

Answer: Cannot tell. We need to know whether researchers assigned methods or students already chose them.

(b) What can you identify about the sample, population, explanatory variable and response?

Set it up: Sample = studied participants. Population = target group. Explanatory variable distinguishes the groups. Response is the measured outcome.

Work: Studied group: 54 students. Explanatory variable: method A or B. Target population and measured outcome are not stated.

Answer: The sample contains 54 students; the population and precise response cannot be identified from the note.

(c) Describe how to select a systematic sample of 54 from a roster of 540 students. Give a valid example.

Set it up: To select 54 of 540 students, the interval is 540/54 = 10. Choose the start randomly from 1 through 10.

Work: If the random start is 6, select positions 6, 16, 26, and so on through 536. This gives 54 students.

Answer: Use every tenth roster entry after a random start. Check that roster ordering has no repeating pattern tied to the outcome.