The _____ of a study is the group the collected data is intended to describe.

Sometimes the intended population is called the target population, since in badly designed studies, the collected data may not be

_____

EXAMPLE
A university sends out a survey to all students in the cafeteria asking about their satisfaction with campus facilities.

What is the population?

_____

EXAMPLE
A local fitness center posts a survey on their website asking visitors how often they exercise each week.

What is the population?

_____

A _____ is a value (average, percentage, etc.) calculated using all the data from a population.

EXAMPLES

If you calculate the average income of every person in a city, that average is a [ ] .

If you determine the [ ] that percentage is a parameter.

[ ] is called a census.

EXAMPLE

[ ]

Every ten years, the United States conducts a national census, where the government attempts to count every person living in the country. The data collected includes information such as age, gender, race, household size, and housing conditions. This information is used for things like determining the number of seats each state has in the U.S. House of Representatives.

EXAMPLE

School Enrollment Census

A school district may conduct a census at the beginning of each academic year to account for every student enrolled in its schools. The census gathers data on student demographics, such as grade level, age, and special education needs, to help allocate resources and plan educational programs.

Since surveying an entire population is often impractical, we usually select a sample to study.

SAMPLE

A sample is a

EXAMPLE

If you're interested in the average height of adults in a city, you might measure the height of 1,000 adults randomly selected from the city's population. This group of 1,000 people is your sample, and the average height calculated from this group is meant to represent the average height of all adults in the city.

EXAMPLE

In a political poll, a sample of voters (say, 1,500 people) is surveyed to estimate how the entire population of voters will vote in an upcoming election.

A **statistic** is

EXAMPLE

If you conduct a survey with 500 people in a city and determine that 60% of them prefer a certain brand of coffee, that 60% is a _____.

EXAMPLE

Medical Study

Researchers conduct a study with a sample of 500 patients to determine the average reduction in blood pressure after taking a new medication. They find that the average reduction in blood pressure among the sample is 10 mmHg. This 10 mmHg is a statistic because

EXAMPLE

Public Health Survey

A health department surveys 800 residents to estimate the prevalence of smoking in a community. They find that 10% of the respondents smoke regularly. This 10% smoking rate is a _____ because it is based on the data from the sample of residents.

QUESTION

A public health researcher wants to assess how residents of New Jersey feel about a new community initiative. To collect opinions, she goes to the New Jersey Farmers Market and randomly surveys 300 visitors. She finds that 70% of those surveyed support the initiative.

What is the sample and population?

Is the 70% value a parameter or a statistic?

QUESTION

An economist wants to find out how employees in San Francisco feel about a proposed change in city minimum wage laws. She visits the San Francisco Ferry Building and randomly interviews 350 workers there. The results show that 55% of those interviewed support the wage increase.

What is the sample and population?

Is the 55% value a parameter or a statistic?

QUESTION

To estimate the average weight of apples in an orchard, a researcher picks 50 apples from different trees throughout the orchard and weighs them.

What is the sample and population in this study?

QUESTION

A hotel manager wants to estimate the average length of stay for guests at the hotel. She reviews the records of 500 randomly selected guests from the past month and calculates their average length of stay.

What is the sample and population in this study?

QUESTION

A company announces that the average annual salary of all its employees is $65,000.

Is this a statistic or a parameter?

QUESTION

A survey conducted by a market research firm interviews 200 randomly selected employees from various companies in a city. The survey finds that the average commute time for these employees is 30 minutes.

Is this a statistic or a parameter?

CENSUS

Parameter

SAMPLE

Statistic

Categorical (qualitative) data are pieces of information that allow us to classify the objects under investigation into

Quantitative data are

EXAMPLE

A researcher is conducting a study on the favorite colors of people in a community. She collects responses from 100 people, and the colors reported are red, blue, green, and yellow.

The data is qualitative because

EXAMPLE

An online bookstore tracks the number of books sold each month. In January, they sold 150 books, in February 200 books, and in March 175 books.

The data is because it consists of numerical values representing the number of books sold.

EXAMPLE

A company surveys its employees about their job satisfaction. The responses include categories such as "Very Satisfied," "Satisfied," "Neutral," "Dissatisfied," and "Very Dissatisfied."

The data is

EXAMPLE

A hospital records the number of patients admitted each day. On Monday, there were 30 patients, on Tuesday, 45 patients, and on Wednesday, 40 patients.

The data is quantitative because

QUESTION

A tourist attraction logs the different countries from which visitors come, such as France, Japan, Brazil, and Canada.

Is the data qualitative or quantitative?

QUESTION

A company records the number of new hires each month. The counts for the past three months are 8, 12, and 10 new hires.

Is the data qualitative or quantitative?

QUESTION

A research study measures the daily water intake of participants in liters. The recorded intakes are 1.5 liters, 2.0 liters, and 2.5 liters.

Is the data qualitative or quantitative?

QUESTION

A librarian categorizes books in the library by genre, such as fiction, non-fiction, mystery, and science fiction.

Is the data qualitative or quantitative?

QUESTION

A company assigns employee ID numbers to its staff for identification purposes. One employee has the ID number 12345.

Is the data qualitative or quantitative?

QUESTION

A city uses zip codes to organize mail delivery. The zip code 30301 is assigned to a particular neighborhood.

Is the data qualitative or quantitative?

SAMPLING BIAS

A sampling method is _____ if every member of the population doesn't have equal likelihood of being in the sample.

There are many ways to sample a population, but there is one goal we need to keep in mind: we would like the sample to be

_____

One way to ensure that the sample has a reasonable chance of mirroring the population is to employ

_____

The most basic random method is simple

_____

A _____ is one in which each member of the population has an equal probability of being chosen.

A **simple random sample** is one in which every member of the population and _____ has an _____ of being chosen.

EXAMPLES OF RANDOM SAMPLING

We could write peoples' names on separate slips of paper. All slips are placed in a box and names are drawn from the box.

We can use assign a number to each person and use a random number generator to select people.

Even a random sample might end up not being totally representative of the population.

If we repeatedly take samples of 1000 people from a population, some of these samples might tend to have a slightly higher percentage of older people and some samples might include more younger people; some samples may have a larger percentage of women than the general population. In most cases, this _____ is not significant.

SAMPLING VARIABILITY

_____

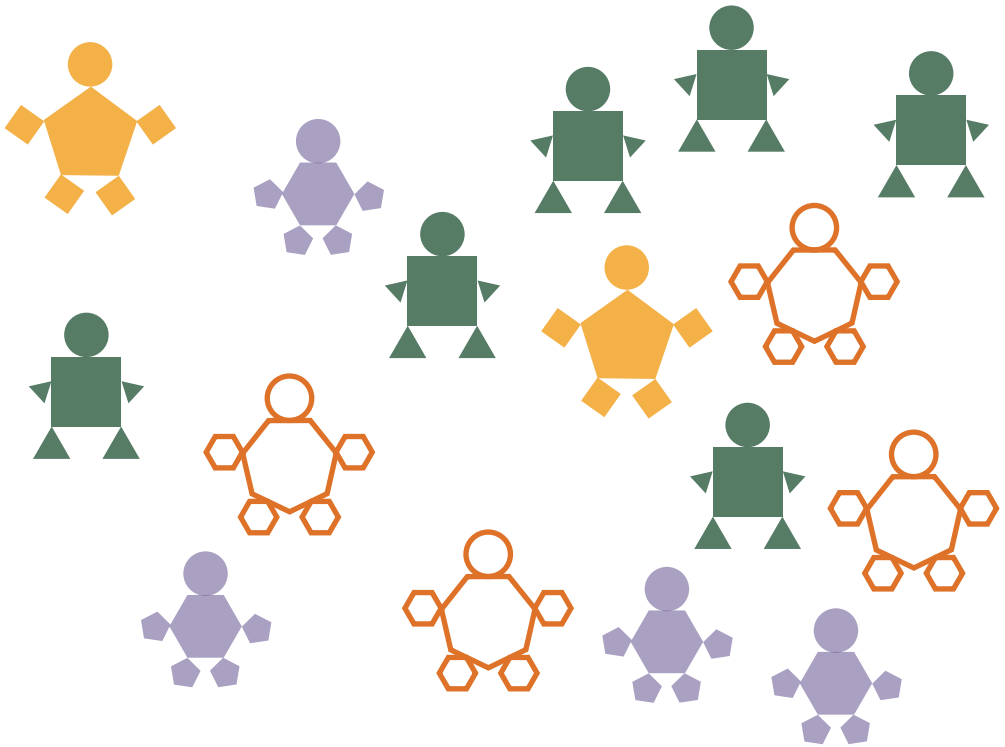
is called **sampling variability**.

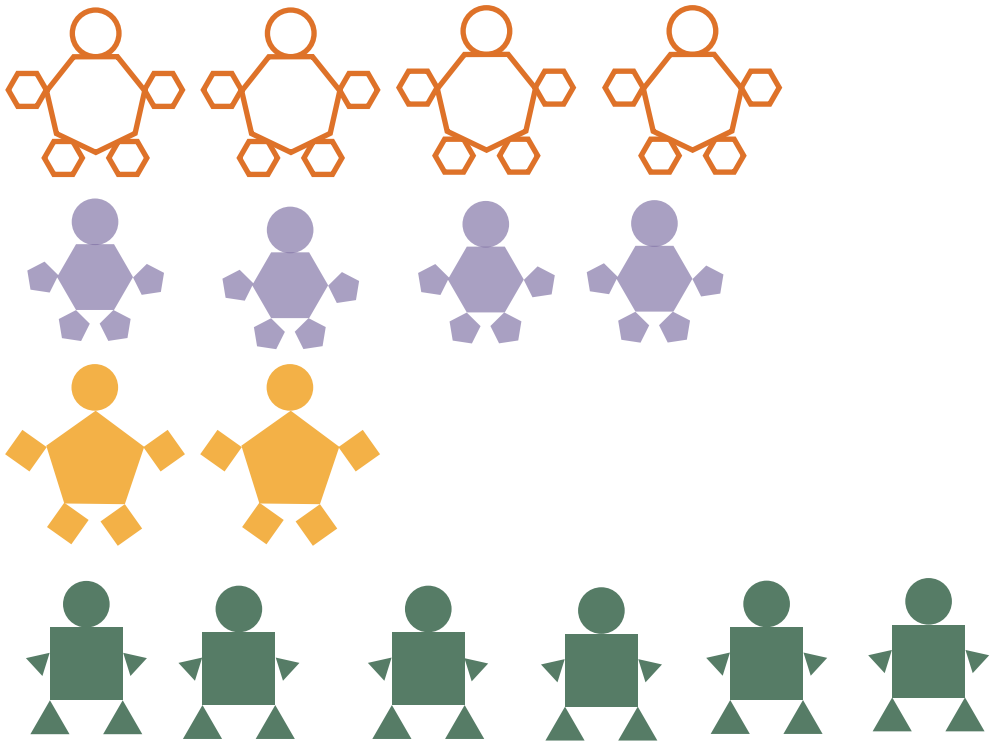
This is unavoidable and expected in random sampling, and in most cases is not an issue.

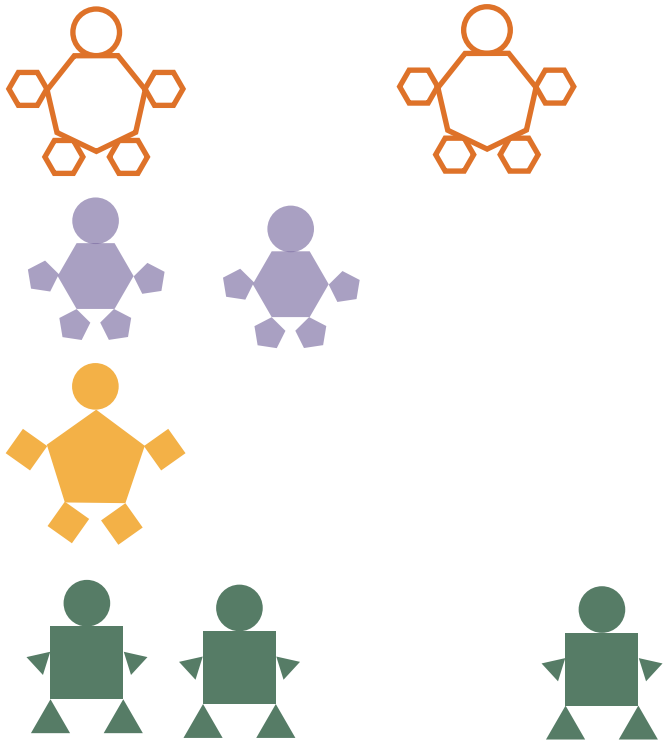
To help account for variability, pollsters might instead use a _____ .

STRATIFIED SAMPLING

In stratified sampling, a population is _____ (or strata). Random samples are then taken from each subgroup with sample sizes proportional to the size of the subgroup in the population.







EXAMPLES OF STRATIFIED SAMPLING

A company has 500 employees. The company has three departments:

40% of the employees work in the **Sales**
35% work in **engineering**
25% work in **marketing**.

The company wants to conduct a survey by sampling **200 employees**. To ensure that the survey accurately reflects the composition of the company, they could use stratified sampling.

From the Sales department **40% of 200=80 employees** should be selected.

From the Engineering department **35% of 200=70 employees** should be selected.

From the Marketing department (**25% of 200**), **50 employees** should be selected.

So, out of the 200 people sampled:

80 employees will come from Sales
70 from Engineering
50 from Marketing

is a variation on stratified sampling, wherein samples are collected in each subgroup until the desired quota is met.

Example
A university wants to conduct a survey on campus facilities satisfaction among its students. They decide to use quota sampling to ensure that their sample includes students from different academic years. They set quotas to include 100 students from each of the following categories:
Freshmen (1st year)
Sophomores (2nd year)
Juniors (3rd year)
Seniors (4th year)

Once they have filled the quota for a particular year (e.g., 100 Freshmen), they no longer include students from that year in the sample. They continue to gather responses from students in the remaining years until all quotas are met.

CLUSTER SAMPLING

In cluster sampling, the population is divided into subgroups (clusters), and a

Example

A city wants to survey public library usage. They randomly select 5 out of 20 library branches. They then survey all patrons who visit those 5 branches during a specific week.

Example

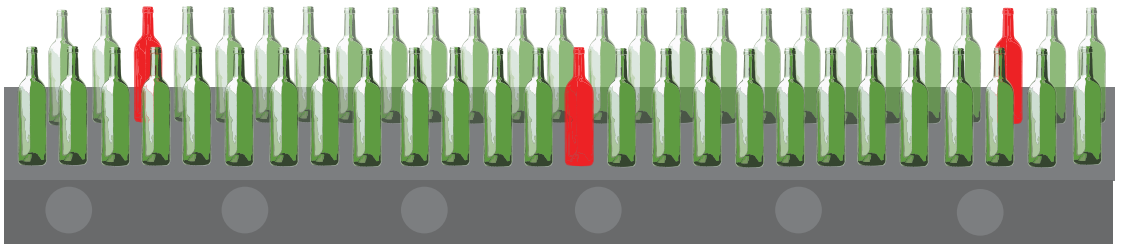
A national park wants to assess visitor experiences. They randomly select 5 out of 30 park campgrounds. They then survey all campers staying at those 5 campgrounds during a particular weekend.

SYSTEMATIC SAMPLING

In systematic sampling, _____ of the population is selected to be in the sample.

Example

A factory wants to inspect the quality of products on the assembly line. They use systematic sampling by checking every 20th item produced during a shift for quality control.



Example

A supermarket wants to assess the freshness of its produce. They use systematic sampling by inspecting every 40th item of fruit delivered each day.

The Worst Way to Sample

Perhaps the worst types of sampling methods are _____ and _____

CONVENIENCE & VOLUNTARY SAMPLING

_____ is the practice of samples chosen by selecting whoever is convenient.

_____ is allowing the sample to volunteer.

Question

A journalist interviews the first 20 people who enter a community center for a public event.

Which sampling method is represented by this scenario?

Question

A company surveys employees who are present at the office during the lunch break.

Which sampling method is represented by this scenario?

Question

A local community center posts a suggestion box for residents to express their opinions on new community programs.

Which sampling method is represented?

Question

What sampling method was used?

Every 6th customer entering a store was selected for a feedback survey.
survey.

Question

What sampling method was used?

A sample was chosen to include 40 teenagers and 60 adults.

Question

What sampling method was used?

Subscribers to a magazine are invited to share their opinions on a new feature through an email survey.

Question

What sampling method was used?

A company uses a random number generator to select 100 employees from their entire staff list for a satisfaction survey.

Question

What sampling method was used?

To study public opinion on a new park, a research firm randomly selects 5 out of 20 neighborhoods and surveys all residents in those neighborhoods.

SOURCES OF BIAS

There are number of ways that a study can be ruined before you even start collecting data.

_____ – when the sample is not representative of the population

Voluntary response bias – the sampling bias that often occurs when _____

_____ – bias that can occur when the researchers have an interest in the outcome

Response bias – when the responder

[ ]

[ ] – when the responder fears giving an honest answer might negatively affect them

Loaded questions – when the question wording

[ ]

[ ] – when people refusing to participate in the study can influence the validity of the outcome

Question
Identify the type of bias.
Consider a recent study that found eating a certain brand of cereal improves athletic performance in high school students. This study was funded by the cereal company itself. Identify the type of sampling bias found in this example.

Question
Identify the type of bias.
A survey asks participants, “How often do you exercise each week?” What type of sampling bias might this lead to?

Question
Identify the type of bias.
An organization conducts a survey asking employees if they feel they receive adequate support for their work. Which sampling bias may occur in this scenario?

Question
Identify the type of bias.
A health survey asks, “How often do you visit your doctor for routine check-ups?” and 35% of people refuse to participate. Which sampling bias is represented?

Question
Identify the type of bias.
A university sends an email survey to alumni asking for feedback on their education experience. What type of sampling method is used, and what bias might occur?

Question
Identify the type of bias.
A political campaign conducts a survey by calling people who have previously donated to their party. What type of sampling bias might this lead to?

Observational studies and experiments

An
is a study based on observations or measurements.

An experiment is a study in which

Examples of experiments:
Agricultural Study: A farmer tests a new type of fertilizer by applying it to half of their crops while using traditional fertilizer on the other half. The new fertilizer is the treatment.

Environmental Science Experiment: A researcher tests the effect of a new water filtration system on river water quality by installing it at one site and comparing it to an unfiltered site. The filtration system is the treatment.

Mental Health Intervention: A therapist tests the effectiveness of a new meditation technique by introducing it to a group of patients and comparing their stress levels to a group that does not use the technique. The meditation technique is the treatment.

Question

Determine whether the following scenario describes an observational study or an experiment:

Blood pressure levels are recorded for 50 people at rest and after walking up a flight of stairs.

Question

Determine whether the following scenario describes an observational study or an experiment:

A researcher records the dietary habits of 100 individuals and tracks their health outcomes over five years.

Question

Determine whether the following scenario describes an observational study or an experiment:

Two groups of athletes are randomly assigned to different training programs, and their performance is measured after six months.

Question

Determine whether the following scenario describes an observational study or an experiment:

Researchers survey 1,000 adults about their sleep habits and analyze the relationship between sleep duration and reported mental health.

A city wants to reduce traffic accidents at a dangerous intersection. To test a new traffic signal system, they install it at the intersection and compare accident rates before and after the change. After six months, the number of accidents decreases significantly.

However, at the same time, the city also began a public safety campaign about driving cautiously, and the signs were changed in the area. It's unclear whether the drop in accidents is due to the new traffic signal, the increased police presence, or the public safety campaign.

This is called _____ – when it is not clear which factor or factors caused the observed effect. Confounding is the downfall of many experiments, though sometimes it is hidden.

Confounding

Confounding occurs when there are two potential variables that

Example

A marine biologist tests a new type of fish food to see if it enhances the growth rate of juvenile fish. They feed one group of fish the new food and another group the standard food. Over a few months, the fish fed the new food show faster growth.

However, during this period, the biologist also installs new water filtration systems and increases the frequency of water changes. It's unclear whether the improved growth is due to the new fish food, the upgraded filtration system, or the more frequent water changes. These additional changes introduce confounding variables, making it difficult to determine the specific cause of the enhanced growth.

Example

A chemist tests a new method for purifying water by using a novel filtration material. They apply the method to one batch of contaminated water and compare its purity to another batch treated with the traditional filtration method.

At the same time, the chemist also changes the flow rate of the water through the filter and adjusts the temperature of the water. It's unclear whether the improvement in water purity is due to the new filtration material, the altered flow rate, or the temperature adjustments. These additional changes introduce confounding variables, making it difficult to determine which factor most significantly affected the water purity.

Question

To evaluate the effectiveness of a new sleep aid on improving sleep quality, a researcher conducts the following experiment: 80 participants (50 men and 30 women) who report having trouble sleeping are recruited. Their sleep quality is measured using a sleep diary and wearable devices. The researcher gives the men a new sleep aid pill and the women a placebo pill, but only the researcher is aware of this distinction.

The results of the experiment are likely to be invalid mostly because:

A: The subjects did not know if they were receiving the real treatment.
B: The treatment group and control group were not the same size.
C: The subjects were volunteers.
D: The gender of the participant is a confounding variable in this experiment.

There are a number of measures that can be introduced to help reduce the likelihood of confounding. The primary measure is to use a

Control Group

When using a control group, the participants are divided into two or more groups, typically a

The treatment group receives the ; the control group does not

Example

A pharmaceutical company tests a new drug by administering it to one group of patients while another group receives the standard treatment. Both groups are monitored in the same clinic with similar conditions and protocols. The health outcomes are compared to control for differences in clinical environment and care.

Example

An environmental scientist tests a new method of cleaning oil spills by applying it to one section of a contaminated beach and using a standard method on another section.

Both sections are exposed to similar environmental conditions. The effectiveness of the new cleaning method is compared to assess its impact on oil removal and beach recovery.

Sometimes not giving the control group anything does not completely control for confounding variables. For example, suppose a medicine study is testing a new headache pill by giving the treatment group the pill and the control group nothing. If the treatment group showed improvement, we would not know whether it was due to the medicine in the pill, or a response to have taken any pill. This is called a

Placebo effect

The placebo effect is when the

so a result might be seen even if the treatment is ineffectual.

A 2013 study from the U.K. found that 97% of physicians acknowledged in a survey having used some form of placebo during their career. This might be as simple as expressing a strong belief in the likelihood that a patient will feel better from whatever treatment the doctor prescribes, even if the treatment itself is not chemically powerful.

Howick, Jeremy, Felicity L. Bishop, Carl J. Heneghan, Jane L Wolstenholme, Sarah L Stevens, FD Richard Hobbs and George Lewith. "Placebo Use in the United Kingdom: Results from a National Survey of Primary Care Practitioners." PLoS ONE 8 (2013): n. pag.

To control for the , a placebo, or dummy treatment, is often given to the control group. This way, both groups are truly identical except for the specific treatment given.

Placebo & Placebo controlled experiments

A placebo is a

An experiment that gives the control group a placebo is called a

Example

In a clinical trial testing a new anti-nausea medication, participants in the control group receive a pill that looks identical to the medication but contains only a harmless substance. This allows researchers to determine whether the new medication is more effective than the placebo at reducing nausea.

Example

In a trial for a new antihistamine, one group of participants receives the actual drug while another group gets a placebo tablet made of an inert substance. Both groups are asked to track their allergy symptoms, allowing researchers to see if the new antihistamine provides better relief compared to the placebo.

When using a placebo, it would defeat the purpose if the participant

Blind studies

A _____ is one in which the participant does not know whether or not they are receiving the treatment or a placebo.

A double-blind study is one in which those interacting with the participants don't know

Example

In a study about anti-depression medicine, you would not want the psychological evaluator to know whether the patient is in the treatment or control group either, as it might influence their evaluation, so the experiment should be conducted as a double-blind study.

It should be noted that not every experiment needs a control group.

An example of an experiment without a control group is if a researcher is interested in the effect of a new medication on blood pressure, they could measure blood pressure in the same group of participants both before and after taking the medication.

Question

To evaluate a new dietary supplement, researchers divide participants into two groups: one group receives the supplement, and the other group receives a placebo that looks identical to the supplement. The researchers administering the supplement do not know which participants are receiving the real supplement and which are receiving the placebo.

Does this experiment have a control group?

Is it blind, double-blind, or neither?

Question

A study is conducted to evaluate the effectiveness of a new cognitive training program designed to improve memory. Participants are randomly assigned to either the new training program or a traditional training program. The evaluators who assess the participants' memory improvement do not know which program each participant underwent.

Does this experiment have a control group?

Is it blind, double-blind, or neither?

Question

A research team wants to assess the impact of a new classroom teaching method on students' math test scores. They conduct a study with 500 students from several schools. The students are randomly assigned to one of two groups. The first group of 250 students is taught using the new teaching method, while the second group of 250 students is taught using the standard teaching method. The students' math test scores are compared at the end of the school year. All students know which teaching method they are receiving.

In this study, which is the control group?

A: The group of 250 students using the new teaching method
B: The 500 students in total
C: The group of 250 students using the standard teaching method
D: There is no control group.

Question

A research team wants to assess the impact of a new classroom teaching method on students' math test scores. They conduct a study with 500 students from several schools. The students are randomly assigned to one of two groups. The first group of 250 students is taught using the new teaching method, while the second group of 250 students is taught using the standard teaching method. The students' math test scores are compared at the end of the school year. All students know which teaching method they are receiving.

This study is:

A: Not an experiment
B: Not blind.
C: Double-blind
D: Blind, but not double-blind
E: None of the above

Question

A researcher tests whether a new type of energy bar improves athletic performance. The study involves 100 participants who are divided into two groups. The first group of 50 participants eats the new energy bar before exercising, while the second group of 50 participants eats a regular energy bar. The participants' exercise performance is measured and compared. All participants know which type of energy bar they are consuming.

In this study, which is the control group?

A The group of 50 participants eating the new energy bar
B The 100 participants in total
C The group of 50 participants eating the regular energy bar
D There is no control group.

Question

A researcher tests whether a new type of energy bar improves athletic performance. The study involves 100 participants who are divided into two groups. The first group of 50 participants eats the new energy bar before exercising, while the second group of 50 participants eats a regular energy bar. The participants' exercise performance is measured and compared. All participants know which type of energy bar they are consuming.

This study is:

A Not an experiment
B Not blind.
C Double-blind
D Blind, but not double-blind
E None of the above

Question

A research study is conducted to test the effectiveness of a new anti-anxiety medication. Participants are randomly assigned to receive either the new medication or a placebo pill that looks identical but contains no active ingredients.

Participants: 100 participants are divided into two groups: one group receives the new medication, while the other group receives the placebo.
Healthcare Providers: The therapists who interact with the participants and assess their anxiety levels do not know which treatment each participant is receiving.

Q:Which is the control group?

Q. What type of study is this?

Question

A research team wants to assess the impact of a new classroom teaching method on students' math test scores. They conduct a study with 500 students from several schools. The students are randomly assigned to one of two groups. The first group of 250 students is taught using the new teaching method, while the second group of 250 students is taught using the standard teaching method. The students' math test scores are compared at the end of the school year. All students know which teaching method they are receiving.

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This study is:

A Not an experiment
B Not blind.
C Double-blind
D Blind, but not double-blind
E None of the above

Math 102 Bank of Questions section 10

1. An analyst interviews 50 out of the 200 city council members in a metropolitan area.
   a. What is the sample size?
   b. What is the population size?
2. A professor surveys 60 of the 150 school board members in various districts across the state.
   a. What is the sample size?
   b. What is the population size?
3. A sociologist gathers data from 80 out of 250 city representatives on urban planning strategies.
   a. What is the size of the sample?
   b. What is the size of the population?
4. A marketing researcher surveys 120 out of 500 employees at a tech company about job satisfaction.
   a. What is the size of the sample?
   b. What is the size of the population?
5. A company has 2,500 employees. A survey of 200 randomly selected employees was conducted to evaluate job satisfaction. 120 said they were satisfied, 60 said they were unsatisfied, and 20 were undecided.

   Describe the population the surveyors are really interested in.

   A. All citizens in the city
   B. All employees of the company
   C. All employees who responded to the survey
   D. The 200 employees surveyed
   E. The 120 employees who were satisfied
   F. None of the above
6. A high school has 1,200 students. A survey of 150 randomly selected students was conducted to understand opinions about the new uniform policy. 90 supported the policy, 40 opposed it, and 20 were undecided.

   Describe the population the surveyors are really interested in.

   A. All parents of the students
   B. All students in the high school
   C. All students with uniforms
   D. The 150 students surveyed
   E. The 90 students who supported the policy
   F. None of the above

7. A hospital has 3,000 patients. A survey of 400 randomly selected patients was conducted to gauge satisfaction with hospital services. 250 said they were satisfied, 100 were unsatisfied, and 50 were neutral.

   Describe the population the surveyors are really interested in.

   A. All citizens in the city
   B. All patients in the hospital
   C. All patients who filled out the survey
   D. The 400 patients surveyed
   E. The 250 patients who were satisfied
   F. None of the above

8. A town has 5,000 registered voters. Two candidates, Wilson and King, are running for mayor. The day before the election, an online poll of 300 randomly selected voters was conducted. 160 said they'd vote for Wilson, 120 for King, and 20 were undecided.

   Describe the population actually represented by this survey.

   A. All citizens of the town
   B. All registered voters in the town
   C. All registered voters with internet access in the town
   D. The 300 voters surveyed
   E. The 160 voters who said they'd vote for Wilson
   F. None of the above

9. A university has 10,000 students. Two candidates, Davis and Lee, are competing for student body president. A survey of 250 students was conducted during lunchtime at the campus cafeteria. 140 said they'd vote for Davis, 80 for Lee, and 30 were undecided.

   Describe the population actually represented by this survey.

   A. All students at the university
   B. All students registered to vote in the election
   C. All students who eat lunch at the campus cafeteria
   D. The 250 students surveyed
   E. The 140 students who said they'd vote for Davis
   F. None of the above

10. A company has 1,200 employees. A survey was conducted by email to gather preferences for a new company benefits plan. 100 employees responded, with 60 preferring Plan A, 30 preferring Plan B, and 10 undecided.

    Describe the population actually represented by this survey.

    A. All employees at the company
    B. All employees with email access at the company
    C. All employees who responded to the survey
    D. The 100 employees surveyed
    E. The 60 employees who preferred Plan A
    F. None of the above

11. A town has 8,000 registered voters. Two candidates, Garcia and Patel, are running for mayor. The day before the election, an online poll of 500 randomly selected registered voters was conducted. 300 said they'd vote for Garcia, 180 said they'd vote for Patel, and 20 were undecided. Describe the sample for this survey.

    A. All citizens of the town
    B. All registered voters in the town
    C. All registered voters with internet access in the town
    D. The 500 voters surveyed
    E. The 300 voters who said they'd vote for Garcia
    F. None of the above

12. A company has 3,000 employees. Two candidates, Nassar and Liu, are running for union president. A survey by email was conducted among 250 randomly selected employees. 120 said they'd vote for Nassar, 100 for Liu, and 30 were undecided. Describe the sample for this survey.

    A. All employees at the company
    B. All employees with email access at the company
    C. All employees who received the survey
    D. The 250 employees surveyed
    E. The 120 employees who said they'd vote for Nassar
    F. None of the above

13. The county of Brookfield has 12,500 registered voters. Two candidates, Smith and Jones, are running for county commissioner. The day before the election, a telephone poll of 250 randomly selected registered voters was conducted. 85 said they'd vote for Smith, 150 said they'd vote for Jones, and 15 were undecided.

    a. Give the sample statistic for the proportion of voters surveyed who said they'd vote for Smith.
    b. This sample statistic suggests that we might expect _____ of the 12,500 registered voters to vote for Smith.

14. The town of Lakeside has 6,200 registered voters. Two candidates, Taylor and Morgan, are running for mayor. A door-to-door survey of 150 randomly selected registered voters was conducted. 45 said they'd vote for Taylor, 90 said they'd vote for Morgan, and 15 were undecided.

    a. Give the sample statistic for the percentage of voters surveyed who said they'd vote for Taylor.
    b. This sample statistic suggests that we might expect _____ of the 6,200 registered voters to vote for Taylor.

15. Determine whether the value 25% is a parameter or statistic: 25% of households in a city use renewable energy sources.

    A. Statistic
    B. Parameter

16. Determine whether the value 40% is a parameter or statistic: 40% of all employees in a company received a promotion last year.

    A. Statistic
    B. Parameter

17. In a study, the data you collect is number of hours worked per week. This data is:

    A. Quantitative
    B. Qualitative (Categorical)

18. In a study, the data you collect is age of participants. This data is:

    A. Quantitative
    B. Qualitative (Categorical)

19. In a study, the data you collect is types of pets owned by households (e.g., dog, cat, bird, fish). This data is:

    A. Quantitative
    B. Qualitative (Categorical)

20. In a study, the data you collect is zip codes of customers. This data is:

    A. Quantitative
    B. Qualitative (Categorical)

21. Which source of bias is most relevant to the following situation: A survey asks: "Do you support increased funding for mental health services even if it means higher taxes?"

    A. Self-interest study
    B. Voluntary response bias
    C. Nonresponse bias or missing data
    D. Perceived lack of anonymity
    E. Loaded or leading question

22. Which source of bias is most relevant to the following situation: A survey asks: "How often do you use our product, considering it is the best option available?"

    A. Self-interest study
    B. Voluntary response bias
    C. Nonresponse bias or missing data
    D. Perceived lack of anonymity
    E. Loaded or leading question

23. In a study, the sample is chosen by randomly selecting 30 employees from a company's complete list of employees using a random number generator. What is the sampling method?

    A. Simple Random
    B. Stratified
    C. Convenience
    D. None of these

24. In a study, the sample is chosen by selecting 25 participants who are available at a local community center at the time of the survey. What is the sampling method?

    A. Simple Random
    B. Stratified
    C. Convenience
    D. None of these

25. To determine how people in a city feel about public transportation, a survey was conducted by selecting 100 residents from a neighborhood known for its high use of public transportation. The results of this survey are unreliable primarily because of:

    A. The absence of a control group
    B. Response bias
    C. Sampling bias
    D. Voluntary response bias
    E. None of the above

26. To evaluate employee satisfaction in a large corporation, a survey was conducted by selecting 50 employees from the IT department and 50 from the marketing department. The results of this survey are unreliable primarily because of:

    A. The absence of a control group
    B. Response bias
    C. Sampling bias
    D. Voluntary response bias
    E. None of the above

27. In a study, the data you collect is levels of satisfaction rated as Very Satisfied, Satisfied, Neutral, Dissatisfied, and Very Dissatisfied. This data is:

    A. Quantitative
    B. Qualitative (Categorical)

28. In a study, the data you collect is categories of customer feedback such as Excellent, Good, Fair, Poor, and Very Poor. This data is:

    A. Quantitative
    B. Qualitative (Categorical)

29. Does this describe an observational study or an experiment? A new teaching method is implemented in several classrooms, and student performance is measured over a semester.

    A. Observational Study
    B. Experiment

30. Does this describe an observational study or an experiment? Researchers track the daily exercise habits of people and record their health outcomes over the course of a year.

    A. Observational Study
    B. Experiment

31. Does this describe an observational study or an experiment? A group of participants is divided into two groups, one receiving a specific diet plan and the other following their usual diet, and their weight loss is compared after three months.

    A. Observational Study
    B. Experiment

32. A research team is evaluating the impact of a new teaching method on student performance. They randomly assign students into two groups. Group 1 is taught using the new teaching method, while Group 2 continues with the traditional teaching method. Neither the students nor the teachers know which method is being used for each group.

    a. Which is the treatment group?
        A. Group 1
        B. Group 2
        C. Neither group
    b. Which is the control group (if there is one)?
    c. Is this study blind, double blind, or neither?
        A. Blind
        B. Double-blind
        C. Neither
    d. Which best describes this research?
        A. Survey
        B. Controlled Experiment
        C. Experiment
        D. Placebo Controlled Experiment

33. A study is conducted to assess the effectiveness of a new pain relief medication. Participants are randomly assigned to two groups.

    Group 1 receives the new pain relief medication, and Group 2 receives a standard pain relief medication.

    Neither the participants nor the healthcare providers administering the medication are aware of which group is receiving which treatment.

    a. Which is the treatment group?
        A. Group 1
        B. Group 2
        C. Neither group
    b. Which is the control group (if there is one)?
    c. Is this study blind, double blind, or neither?
        A. Blind
        B. Double-blind
        C. Neither
    d. Which best describes this research?
        A. Survey
        B. Controlled Experiment
        C. Experiment
        D. Placebo Controlled Experiment

34. In a science experiment, a biologist has a tank filled with 500 fish, 300 of which are goldfish and 200 are guppies. The biologist tells the students the tank has 500 fish and asks them to estimate how many are guppies without counting them all.

    A student uses a net to catch 50 fish from the tank, finding that 20 are guppies.

    a. The data collection method can best be described as:
        A. Clinical study
        B. Survey
        C. Census
        D. Controlled study

b. The target population consists of:

A. The 500 fish in the tank
B. The 250 goldfish in the tank
C. The 50 fish the student observed
D. The 30 guppies the student observed
E. None of the above

c. The sample consists of:

A. The 250 goldfish in the tank
B. The 30 guppies observed by the student
C. The 50 fish observed by the student
D. The 200 guppies in the tank
E. None of the above

d. Based on the sample, the student would estimate that ___ fish in the tank were guppies.

A. 100
B. 120
C. 150
D. 200
E. None of the above

35. A clinical trial evaluates the effectiveness of a new cholesterol medication. The study involves 400 participants who are randomly assigned to one of two groups. The first group of 200 participants receives the new medication. The second group of 200 receives a placebo. Participants are aware of their treatment assignment, as are the people administering the medication.

a. In this study, which is the control group?

A. The 400 participants
B. The first group of 200 receiving the new medication
C. The second group of 200 receiving the placebo
D. There is no control group.

b. This study is:

A. Blind, but not double-blind
B. Not blind
C. Double-blind
D. Not an experiment
E. None of the above

36. To investigate the impact of a new diet on weight loss, a researcher conducts the following study: 80 participants (50 men and 30 women) are selected. Their weights are measured before starting the diet. The researcher gives all the men a meal plan with the new diet and all the women a meal plan with a standard diet, but only the researcher knows which meal plan is which.

The results of the study are likely to be invalid mostly because:

A. The treatment group and control group were not the same size.
B. The gender of the participants is a confounding variable in this study.
C. The participants were selected from a specific age group.
D. The participants did not know if they were receiving the new or standard diet.
E. None of the above

37. A researcher investigating opinions on public transportation efficiency surveys a randomly selected group of 180 commuters who all use a specific subway line. 80% of those surveyed indicated that they find the subway line to be efficient. The researcher concluded that "a large majority of commuters find public transportation efficient."

    This conclusion might be invalid because:

    A. 80% is not a large majority.
    B. The sample is not representative of all commuters, just those on one subway line.
    C. The sample size is too small.
    D. There was no control group.
    E. None of the above

38. In a study, the sample is chosen by separating all cars by size, and then selecting 10 of each size grouping. What is the sampling method?

    A. Simple Random
    B. Stratified
    C. Convenience
    D. None of these

39. As part of a statistics project, a teacher brings a bag of marbles containing 700 white marbles and 300 red marbles. She tells the students the bag contains 1000 total marbles, and asks her students to determine how many red marbles are in the bag without counting them.

    A student randomly draws 150 marbles from the bag. Of the 150 marbles, 47 are red.

    a. The data collection method can best be described as
        A. Controlled study
        B. Clinical study
        C. Survey
        D. Census

    b. The target population consists of
        A. The 300 red marbles in the bag
        B. The 1000 marbles in the bag
        C. The 47 red marbles drawn by the student
        D. The 150 marbles drawn by the student
        E. None of the above

    c. The sample consists of
        A. The 150 marbles drawn by the student
        B. The 1000 marbles in the bag
        C. The 300 red marbles in the bag
        D. The 47 red marbles drawn by the student
        E. None of the above

    d. Based on the sample, the student would estimate that how many marbles in the bag are red?
        A. 100
        B. 150
        C. 200
        D. 250
        E. None of the above