

Secondary Math 3

Statistics #1 - Study Design

1/3/24

What is a sample?

Population: the entire group we are interested in

Sample: the group that is selected to represent the population

Parameter of Interest: the thing we are interested in knowing about the population

Practice: identify the population, sample, and parameter of interest.

BE SPECIFIC

1. A grocery store wants to know the average number of items that shoppers purchase in each visit to the store. They decide to count the items in the cart of every twentieth person through the check stand.

- Population people in the grocery store
- Sample every 20th shopper from check stand
- Parameter of interest average # of items bought

2. A team of biologists wants to know the average weight of fish in a lake. They decide to drop a net and measure all the fish caught in three different locations in the lake.

- Population fish in lake
- Sample fish in net from 3 different locations in lake
- Parameter of interest average weight of fish the lake

Sampling Methods

There are several different ways to choose a sample.

Population: my students

Parameter of interest: did students complete their homework.

Sampling Method	Description	Example
Simply Random	Randomly select individuals from the population	I put everyone's name in a hat and choose 20 names
Cluster	divide the population into subgroups and randomly select entire subgroups	Divide all my students based on the grade they earned last quarter in my class. Ask everyone who got an A, C, or F.
Stratified	divide the population into subgroups and randomly select a few individuals from each group	Divide all my students based on the grade they earned last quarter in my class. Ask 3 people who got an A, 3 people who got a B, 3 people who got a C, etc.
Systematic	choose every 5 th or 7 th or 20 th member of the population	I make a list of all my students and ask the 10 th , 20 th , 30 th , etc. person on the list.
Convenience	choose based on the researcher's convenience	I survey everyone that's in class right now so I can have my answer quickly.

Practice: Identify the following sampling techniques

- You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You decide to put the name of each student in the school into a big bowl. You draw 100 names and ask those students to respond to a survey about the activities they prefer.

simply random

2. You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You assign each student in the school a number. You randomly select a starting number among the first 10 numbers and then select every tenth student in the list from that point forward.

Systematic

3. You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You use the rolls from each first period class. You go through each homeroom class, drawing 2 names from each class. You ask those students to respond to a survey about the activities they prefer.

stratified

4. You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You get the list of all the first period classes and randomly select 5 classes. You go to each of the classes selected and survey all the students in that class.

cluster

5. You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You stand in the cafeteria during your lunch break and ask students in they would be willing to participate in your survey as they walk by.

convenience

6. You are in charge of school activities. You want to know what activities students would prefer to participate in during the school year. You make a lot of copies of the survey about the activities that students prefer and you put them on a table outside the cafeteria. Students can choose to take the survey and drop their responses into a big box on the table.

convenience

Analyzing a Sampling Method

When choosing a sampling technique, you should consider how well it will represent your population.

- *Representative*: a sample is considered representative of the population if it accurately portrays the responses of the population.
- Law of Large Numbers: the more individuals included in the sample, the more representative the sample will be.

Practice: Determine what sampling method was used. Do you consider the sampling method representative?

1. You want to know the average number of hours that high school seniors spend playing video games in your state. You randomly select 20 high schools in the state and then ask all the seniors at each of the 20 high schools about their video game habits.

a. Sampling method: cluster

b. Representative? no, because not all H.S. have same senior population

2. A shopping mall management company would like to know the average amount that shoppers in the mall spend during their visit. They post two survey takers near one of the exits who ask shoppers to tell them what they spent as they leave the mall.

a. Sampling method: convenience

b. Representative? no, not big enough sample, need to do more exits, do a dif exit,

Types of Studies

Once you have chosen a parameter of interest, you need to choose a way to measure your parameter of interest. There are 3 types of studies:

Type of Study	Description
<i>Sample Surveys</i>	When you want to know how people feel, what their preferences are, what they own, how much they make, etc., design a survey.
<i>Observational Studies</i>	In this type of study, researchers observe the behavior of the participants/subjects without trying to influence it in any way so they can learn about the parameter of interest.
<i>Experimental</i>	In an experiment, researchers manipulate the variables to try to determine cause and effect

Example: Identify each type of study from the descriptions below.

Imagine that you want to know whether a new diet plan is effective in helping people lose weight. You might choose any of the three methods to determine this.

- Survey: you could simply ask people that had tried the diet plan if they lost weight.
- experiment: you might randomly assign participants to two groups. One group (the control group) eats as they normally would and the other group (the experimental group) eats according to the diet plan. At the end of two months, the two groups are compared to see the average weight gain or loss in each group.
- observation: you might monitor volunteers that try the diet plan and measure how much weight they lost (or gained).

Practice: Identify which type of study was used.

1. To determine whether drinking orange juice prevents colds, researchers randomly assigned participants to a group that drank no orange juice or a group that drank two glasses of orange juice a day. They measured the number of colds that each group had over the course of the year and compared the results of the two groups.
experimental
2. To determine whether exercise reduces the number of headaches, researchers randomly selected a group of participants and recorded the number of hours each participant exercised and the number of headaches each participant experienced.
observation
3. To determine the effectiveness of a new advertising campaign, a restaurant asked every tenth customer if they had seen the advertisement, and if it had influenced their decision to visit the restaurant.
Survey
4. To determine if a new drug is an effective treatment for the flu, researchers randomly selected two groups of people that had the flu. One group was given a placebo (a sugar pill that has no physical effect) and one group was given the new drug. Researchers measured the number of days that participants experienced flu symptoms and compared the two groups to see if they were different.
experiment
5. To determine if higher speed limits cause more traffic fatalities, researchers compared the number of traffic deaths on randomly selected stretches of highway with 65 mph speed limits to the number of traffic deaths on an equal number of randomly selected stretches of highway with 75 mph speed limits.
observational

