- A population is the group that is being studied by the research
- A sample is any subset of the population

Example: A principal gives the students in her school a survey to fill out. The entire school is the population. One classroom of students would be a sample.

- A parameter describes a population
- A statistic describes a sample

Example: 47% of students in a school respond they are satisfied with the school lunch options. This is a parameter because it measures the entire population of students. Meanwhile, 36% of the students in Mr. Potter's class responded that they are satisfied with the school lunch options. This is a statistic because it measures a sample on the students.

- Quantitative variables measure an amount of something (can be discrete or continuous)
  - Discrete variables are finite values (counting values)
  - Continuous variables can be any amount (measured amounts)
- Qualitative variables describe a type of something (usually can be thought of as a name or word description)

Example: On a survey given to a patient at a hospital, it asks for height, body weight, regular physician's name, and how many times they have visited their physician in the last year. Determine what type of variables each of those are.

1. Height is a continuous variable
2. Body weight is a continuous variable
3. Physician's name is a qualitative variable
4. Number of times visiting physician is a discrete variable

- The response variable is the variable of interest
- The explanatory variable is the variable that explains or has an effect on the response variable

Example: A researcher wants to determine how the weight of a car affects gas mileage. The variable of interest is the gas mileage, so that is our response variable. The weight of the car explains the gas mileage, so weight is the explanatory variable.

- An observational study occurs when no active participation is required on the part of the researcher. There is no influence involved.
- An experimental study occurs when the explanatory variable is intentionally influenced and changed to see how it affects results.

Example: 10 patients are admitted to a hospital in similar condition. The first researcher monitored these patients to see how long it was before they were discharged. This is an observational study because there was no influence at all on the outcome.

Another 10 patients are admitted to that hospital in similar condition. A second researcher works with a doctor to administer a different dosage of a medication to the patients, and then monitors the patients to see how long it is before they are discharged. This is an experimental study, because the explanatory variable (the dosage of medicine) is being manipulated and influenced in regards to the response variable (how long until discharged).

Types of Sampling

- Stratified: The population is divided into groups, or strata, that are homogenous and non-overlapping. The sampling then chooses some of each strata.
- Systematic: The sampling takes place every kth person, with k being some number
- Cluster: Sampling takes place with everything from a selected subset of the population at random
- Convenience: Sampling relies on a voluntary response
- Simple: Each person or thing in the population has the same chance of being selected

Give an example of each type of sampling:

1. A stratified sampling example would be selecting 5 members of each county in a state to complete a survey. The different counties are the strata.
2. A systematic sampling example would be a department store that surveys every 10th person that comes through the door to ask them about their experience at the store.
3. A cluster sampling example would be selecting 8 classrooms at random in a school and giving all of the students in those classrooms a survey to complete. The classrooms are the clusters, because we are sampling everyone in those rooms.

4. A convenience sampling example would be a football team sends out a survey to its season ticket holders to complete after the season. It is non-random, and completely voluntary, thus it is a convenience sample.
5. A simple random sample would be giving each person in a city a random number, and then randomly selected a subset of them to complete a survey about the city's educational system.

Bias in Sampling and Research

There are three types of bias when it comes to research:

- Sampling bias: This is when the people sampled are not representative of the entire population
- Response bias: Involves misinformation, intentional or unintentional, and leading questions (poorly worded questions)
- Nonresponse bias: Individuals choose not to participate or there are too many non-answers

Give an example of each type of bias:

- A mayor goes to a local high school to survey the students about building a new mall in town. The students do not represent the entire population of the town, so this is an example of sampling bias. A better way to conduct the survey would be to do a stratified or cluster sample of the residents of the town.
- A survey asks "Would you adopt a dog from a homeless shelter?" while also having a picture of dogs at a homeless shelter provided. The picture being included influences the response, and so this is an example of response bias. A better way to conduct the survey would be to do so without the picture included.
- A phone survey of students at a college has a very low response rate. This is an example of nonresponse bias, because with very little returns, there is little information that can be gleaned from it. A better way to conduct the survey would be by going into the classrooms and giving the survey in that manner.