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CC ALGEBRA 2

Date: 5/18/18
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LESSON #6: TYPES OF STATISTICAL STUDIES

Do Now: The results for a survey of 120 students who were selected randomly are listed below:

- 60 students have a cell phone with company X
- 36 students have a cell phone plan with company Y
- 24 students do not have a cell phone

$\frac{36}{120} = \frac{x}{380}$

$\frac{120x}{120} = \frac{13680}{120}$

$x = 114$

The total population of students was 380. Based on the data, what is the best approximation for the total number of students who have a cell phone plan with company Y?

A) 114 B) 127 C) 143 D) 163

DATA OF STATISTICAL STUDIES:

- In the branch of mathematics known as statistics, you work with data.
- Data can be quantitative such as heights and salaries, or qualitative such as eye color or political affiliation.
- You collect data about a population by surveying or studying some or all of the individuals in the population.
- When *all* the individuals in a population are surveyed and studied, the data-gathering technique is called a census.
- When only some of the individuals in a population are surveyed or studied, the data-gathering technique is called a sample survey.
- Samples that result in accurate estimates are said to be **representative** of the population.

3 TYPES OF STATISTICAL STUDIES:

1. An observational **study** records the values of variables for members of a sample. There are several types and are designed to observe subjects as they are, without any manipulation by the researcher.
2. A survey is a type of observational study that gathers data by asking people a number of questions.
3. An Experiment imposes treatments to see the effect of the treatments on some response.

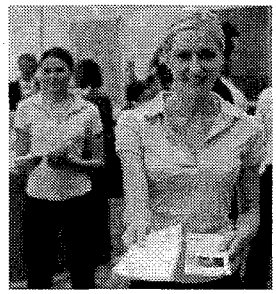
1. OBSERVATIONAL STUDY:

Ex: Stand at the entrance to school and count the proportion of kids who are on their phone while they walk into school.

In an observational study, you do not do anything to influence a response. The event would have happened whether you were there or not.

2. SURVEY:

Ex: I hand out a questionnaire to the class asking if you use snapchat, Instagram, or Facebook the most.



Dangers of Surveys:

a) Wording can be confusing or biased.

b) Participants might not represent everyone's opinion.

c) How survey participants are chosen; If the purpose of the survey is to learn about some population, ideally participants would be randomly selected from the population of interest. If people are not randomly selected, misleading conclusions from the survey data may be drawn.

3. EXPERIMENT:

Ex: I get two flower pots. I plant a seed in one and put it by the window. I plant a seed in the other and put it in the corner of the room. After a month, I see which one grew the most.

To make a cause-and-effect conclusion requires an experiment to be done.
Cause-and-effect cannot be concluded from an observational study or survey.

What should you look for when evaluating an experiment?

4. Were the subjects randomly assigned to treatment groups?
5. Was there a control group or a comparison group?
6. Were the sample sizes reasonably large?
7. Do the results show a cause-and-effect relationship?

THE IMPORTANCE OF RANDOM SAMPLING TO AVOID BIAS!

- In surveys and other observational studies, randomization helps to minimize the effects of Bias, which happens when the group (sample) collected does not accurately reflect the overall population.

- Random sampling of subjects is important in observational studies and surveys in order to eliminate bias so that sample results may be generalized to the population from which the sample was taken.

Example: You want to know the ***average height*** of a high school student. It will be hard to find every person's height so we take a sample and infer from that sample what the actual population height (height of all high school students) would be.

Determine if the following are good or bad samples to find the average height of a student. If the sample is bad, explain why.

1. Sample the boys' varsity basketball team.
   BAD - above average heights

2. Sample our class.
   GOOD - Random but all students are the same age & it's a small sample.

3. Sample every 10th student that walks into school in the morning.
   GOOD - Random, large

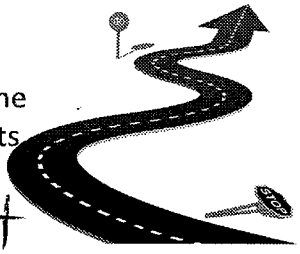
4. Ask people to volunteer to tell you their average height.
   BAD - People can lie or not want to provide their height.

Partner Practice:

For # 1 – 3, state if the following is an observational study, survey, or experiment, and give a reason for your answer.

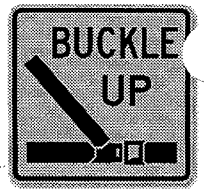
1. People should brush their teeth at least twice a day for at least two to three minutes with each brushing. For a statistics class project, you ask a random number of students at your school questions concerning their tooth-brushing activities.

survey - random sample of students who are being asked questions.



2. The local Department of Transportation is responsible for maintaining lane and edge lines on its paved roads. There are two new paint products on the market. Twenty comparable stretches of road are identified. Paint *A* is randomly assigned to ten of the stretches of road and paint *B* to the other ten. The department finds that paint *B* lasts longer.

observational study - bc you are not doing anything to influence the outcome.



3. The National Highway Traffic Safety Administration conducts annual studies on drivers' seatbelt use at a random selection of roadway sites in each state in the United States. To determine if seatbelt usage has increased, data are analyzed over two successive years.

observational study - bc you are not influencing seatbelt use.

4. A researcher wanted to find out whether higher levels of a certain drug given to experimental rats would decrease the time it took them to complete a given maze to find food. Why would the researcher have to carry out an experiment rather than an observational study?

Bc they are imposing a treatment and examining a cause + effect relationship

5. Describe how a controlled experiment can be created to examine the effect of ingredient X in a toothpaste.

Randomly assign participants to 2 groups. One using toothpaste w/ ingredient X and one without.

PRACTICE PROBLEMS:

1. Which statement(s) about statistical studies is true?

   I. A survey of English classes in a high school would be a good sample to determine the number of hours students throughout the school day spend studying.

   II. A survey of all 9th graders in a high school would be a good sample to determine the number of parking spaces needed at that high school.

   III. A survey of all students in one lunch period in a high school would be a good sample to determine the number of hours adults spend on social media websites.

   IV. A survey of all Calculus students in a high school would be a good sample to determine the number of students throughout the school that don't like math.

   1) I, only 2) I and III 3) II, only 4) III and IV

2. If the heights of 50 randomly selected students from Calhoun are taken to estimate the mean height of all Calhoun students, the 50 students chosen represent a

   (1) Sample
   (2) Population
   (3) Census
   (4) Mean

3. A survey given to 30 random freshmen from the 560 students at a local high school concludes that 65% of the freshmen attend home sporting events. What is the population of this survey?

   (1) All freshmen at the school
   (2) The 30 freshmen surveyed
   (3) People attending sporting events
   (4) All 560 high school students

4. Which group should be surveyed to determine how people commute to work in order to produce a random sample?

   (1) Students in your school
   (2) People passing through a toll booth on a given day
   (3) People in your state whose last name begins with S
   (4) People whose annual income is greater than $1,000,000

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LESSON #6: EXIT TICKET

1. In which of the following cases would an observational study be necessary as compared to an experiment?

   (1) The study of how increased nutrient levels affect plant growth.
   (2) The study of how educational levels affect median household income.
   (3) The study of how a vaccine affects the percent of mice that get a particular disease.
   (4) The study of how noise level affects the sleep patterns of volunteers in a sleep study.

2. I want to find the mean height of all Calhoun HS students. Which sample group of students would get a mean score closest to the actual mean height of all students?

   (1) 50 random students from my Algebra 2/Trig classes
   (2) 50 random boys found in the hallways
   (3) The first 50 students who walk into the school one morning
   (4) Any 50 students I want to choose

3. Which statement about statistical analysis is false?

   (1) Experiments can suggest patterns and relationships in data.
   (2) Experiments can determine cause and effect relationships.
   (3) Observational studies can determine cause and effect relationships.
   (4) Observational studies can suggest patterns and relationships in data.

4. Which of the following research questions would involve collecting data through a survey?

   (1) Watching people exit a grocery store to see the percent of people who use reusable bags.
   (2) Assigning people to two groups to see the effect of a particular amount of sleep.
   (3) Calling people on the telephone to see if they will be voting in the upcoming election.
   (4) Dropping salt cubes into two different liquids to determine which dissolves faster.