**Activity 7.2.1 – Types of Statistical Studies**

There are three main types of statistical studies: sample surveys, observational studies, and experiments. Each type of study seeks to answer a *statistical question* – a question that can only be answered through the collection of data, which involves uncertainty.

**Sample Surveys**

Sample surveys contain a variety of questions on a particular topic and are typically given to large random samples of people. They often ask respondents to provide their demographic information (e.g. age, gender, ethnicity) so researchers can analyze relationships between survey variables and demographic variables. When a sample is randomly selected from the population, the sample results can be used to draw conclusions about the entire population. This process is known as *generalizing from sample to population*.

Read the brief description and results of the sample survey and answer the questions below.

In June 2015 the Gallup organization randomly surveyed 1,527 US adults via phone interviews. The survey asked respondents to rate the quality of education at four-year colleges and universities, community colleges, and Internet-based college programs. Respondents had to choose between the options: generally excellent, good, only fair, or poor. Gallup reported that, of all respondents, 70% rate the quality of education at 4-year colleges and universities as “excellent” or “good”, 66% rate the quality of education at community colleges as “excellent” or “good”, and 36% rate the quality of education at Internet-based programs as “excellent” or “good”.

1. What is the population of interest in this survey?
2. What variables did this survey measure?
3. What conclusions can we draw from this survey?

Read the brief description and results of the sample survey and answer the following questions.

In June 2015 Gallup conducted a poll on a random sample of 1527 adults in the US. The survey reported that, among Republicans, 77% favor the death penalty, and 32% feel that blacks are more likely to receive the death penalty than whites when convicted of similar crimes. The survey reported that, among Democrats, 52% favor the death penalty, and 52% feel that blacks are more likely to receive the death penalty than whites when convicted of similar crimes.

1. What is the population of interest in this survey?
2. What variables did this survey measure?
3. What reasonable conclusions can we draw from this survey?

**Observational Study**

An observational study is used to collect data on individuals from a population in a manner that does not interfere or influence the behavior of individuals in the population. These studies can be done using historical data or by collecting data over a period of time. Observational studies allow researchers to examine associations (relationships) between variables. If an observational study is conducted on a random sample from a population, the results of the study are generalizable to the entire population. If the observational study is not conducted on a random sample, the results are not generalizable to the entire population.

Read the description of the observational study and answer the questions below.

A large study of parents and children in Norway found that toddlers who regularly slept less than 10 hours per night or woke frequently (three or more times) at night tended to experience more emotional and behavioral problems when they reached age five. The study involved a large random sample of mothers and children and was conducted over several years.

1. What is the population of interest in this survey?
2. What variables were examined in this study?
3. What reasonable conclusions can we draw from this study?

**Experiments**

The purpose of an experiment is to examine how changes in one variable (treatment variable) lead to changes in another variable (response variable). To conduct an experiment, researchers assign subjects (individuals, animals, objects) to multiple treatment groups such that each group receives a different value of the treatment variable, and responses are observed or measured. Experiments often involve a control group – a treatment group in which subjects receive no treatment. The use of multiple treatment groups enables a comparison of results. By comparing the results of multiple treatments, researchers can assess whether changes in a *treatment variable* lead to changes in a *response variable*.

Researchers conduct experiments to establish *cause-and-effect* conclusions. Cause-and-effect conclusions are only generated from *randomized experiments* – experiments in which subjects are randomly assigned to different treatment groups. Experiments must be carefully planned and replicated to ensure that they correctly determine whether a treatment causes a certain response. Three key characteristics of well-designed experiments are control, randomization, and replication.

Read the description of the experiment and answer the questions below.

A study examined the impact of taking aspirin on blood pressure levels for individuals diagnosed with pre-hypertension – slightly higher than normal blood pressure. 244 adults with pre-hypertension participated in the study. Participants were randomly assigned to three groups: (1) a group instructed to only continue their diet and hygiene regiments, (2) a group instructed to continue their diet and hygiene regiments and take a 100 mg aspirin tablet daily before bedtime, and (3) a group instructed to continue their diet and hygiene regiments and take a 100 mg aspirin tablet daily in the morning. The study was conducted over a three-month period. It found that the daily use of aspirin before bedtime lead to a reduction in blood pressure, whereas the other two treatments lead to no change in blood pressure levels.

1. What is the population of interest in this experiment?
2. Identify the treatment variable. What values are assigned to the treatment variable?
3. Identify the response variable?
4. Identify the control group in this experiment.
5. Is a cause-and-effect conclusion appropriate for this study? Explain.
6. For each research question below:

* Decide what method data collection is most appropriate,
* Determine what variables should be studied,
* Identify whether the variables are categorical or quantitative, and
* Describe how the variables can be examined to address the research question.

1. You want to investigate whether participation in after-school sports programs has a positive effect on student achievement among elementary school students.
2. You are interested in learning about high school students’ view on the presidential candidacy of Donald Trump and whether high school students’ views on Donald Trump’s candidacy are dependent on students’ ethnicity.
3. You are interested in determining whether professional athletes from southern states in the United States earn more money than professional athletes from northern states in the United States.