Collecting Data

Lesson objectives

- I can collect primary data by designing surveys and experiments
- I can describe the characteristics of an effective survey

1.1 Lesson objectives Teachers' notes Lesson notes

MHR Page 219 #s 1 - 5 & 6abc

Definitions

Treatment Group

- The participants in an experiment who receive the specific treatment being measured

Control Group

- The participants in an experiment who do not receive the specific treatment being measured
- Compared to the treatment group

Bias

- Occurs when there is a prejudice for or against an idea or response
- Biased samples can result from problems with either the sampling technique or the data collection method
- Example: a survey question that asks whether you agree that the government should continue to waste money is biased because it leads people to change their opinion toward government spending

There are two different types of experiments: observational studies and experimental studies.

In observational studies, researchers look at situations that are already occurring and try to make inferences. For example, a researcher might compare two groups of people, one with members who exercise and another with members who do not exercise, to see if one group is healthier than the other.

In experimental studies, researchers control what is going on and make inferences based on those controls. For example, a researcher might randomly choose two similar groups and have members of one group perform rigorous exercise once a day for 30 days while members of the other group continue with their normal lifestyle. The researchers would then measure the fitness of both groups at the end of the month.

In this example, the group that exercises is the **treatment group** while the one that does not exercise is the **control group**. In an experimental study there is a greater chance of determining the cause of a particular behaviour. Three things need to occur to determine the cause:

- Control: as many aspects of the experiment need to be controlled as possible so that if there is an effect, the researchers know what caused it.
- Randomization: when groups are chosen, subjects need to be randomized so that no biases occur in any of the groups.
- Replication: even though the groups are random, when researchers repeat an experiment they should be similar in make-up so that changes from one group to another are easier to detect.

Example 1

What Type of Study?

For each case, answer the following questions:

a) Is it an experimental study or an observational study? Give reasons why.

b) If it is an experimental study, what is the control group and the treatment group? What effect is being studied? If it is an observational study, what are some things that could cause the effect to happen?

Case 1: People with headaches are randomly divided into two groups. One group gets pain medication, and the other does not. One hour later, the participants are asked about their pain.

Case 2: You go to all of the houses in your neighbourhood and ask whether they use fertilizer on their lawns. You then check if their grass is green.

Case 1

a) This is an experimental study. The groups are randomly selected. One group gets medication and the other does not.

b) The control group does not receive medication where as the treatment group does. The effect of pain medication on headaches is being tested.

Case 2

a) This is an observational study. The subjects are not randomized and we do not know who has used fertilizer.

b) Another factor that could make lawns greener could be the amount of watering. Without having a control group it is difficult to say the effect of fertilizer on lawn colour.

Your Turn

1. A researcher interviews people as they leave the gym and finds that they get fewer colds compared to people who do not go to the gym.
   a) Why is this an observational study?
   b) What could be done to turn this into an experimental study?

2. A botanist is studying the effects of acidity on rate of growth. She grows one group of plants using water with neutral pH. She grows each other group using water with increasingly acidic pH levels.
   a) Which are the control and which are the experimental groups?
   b) Why do you think groups of plants were used rather than one single plant for each pH level?

1. Observational because there is no randomization of the subjects and there is no control group. To make it experimental you would need a control group that does not go to the gym. Then you can compare the two groups to see if going to the gym reduces the number of people with colds.

2. Control group has water with neutral pH. Experimental groups have water with different acidity levels. Groups of plants were used to eliminate any plants that may have been diseased when the trials started.

Example 2

Survey Questions

Conducting surveys is another way to collect primary data. Surveys are less controlled than experiments, but a well-written survey can provide useful information. The following survey is being distributed to 100 students:

School Feelings Survey

Name: _____ Age: ☐10–12 ☐12–16 ☐16–17 ☐Over 18

Gender: ☐ Male ☐ Female

1. Would you like to have the freedom to use your cell phone in class or would you rather be alone with no communication? ☐ Cell phones ☐ No cell phones
2. Which of the following is your favourite subject? ☐ Math ☐ English ☐ Drama
3. Do you think it's important for students to attend church? ☐ Yes ☐ No
4. How do you like the new cafeteria menu?
   ☐ Pretty good ☐ Good ☐ Great ☐ Fantastic ☐ Awesome
5. How do you like the new school logo and mascot at the school?
   ☐ Like them ☐ Do not like them

Check to make sure the survey asks appropriate questions.

a) Is the survey anonymous? Why might anonymity be important?
b) Are the choices for ages appropriate and clear? If not, how can you fix this section? Why is this important information to collect?
c) Is #1 a leading question? If so, explain why this is a problem and rewrite the question.
d) Do any questions provide a limited number of options? If so, rewrite the question.
e) Does the survey ask any personal questions that people might prefer not to answer?
f) Is the rating scale in #4 a well-written scale? If not, rewrite it.
g) Question #5 asks for an opinion about two things in one question. Explain why this is a problem and rewrite the question.

e) #3 is unethical as there are other places of worship that could be attended apart from a church. It also has nothing to do with the survey on school feelings.

a) As the survey asks for a name, it is NOT anonymous.

b) Not clear. If a child is 12 or 16 they have two choices where they could put a check mark. No box for an 18 year old either. To fix this, have boxes that do not overlap.

c) Leading question. It is suggesting that if you couldn't use your cell phone in class then you are alone. It is better to have a cell phone than not.

d) #2 has only 3 options. Make it an open question: What is your favourite subject?

f) There is no negative option(s) for #4.

g) Asking you to like or dislike two things. No option for liking one of them.

Your Turn

In each case, identify the problem with the question and rewrite it so that it is more appropriate.

a) What is your favourite game system?
■ Xbox ■ PlayStation® ■ Wii™

b) Running a business is hard. Leadership training will help your business run smoother.
■ Agree fully ■ Somewhat agree ■ Agree a little

c) How important do you think speed and quality of service are?
■ Very important ■ Important ■ Modestly important
■ Of little importance ■ Unimportant

a) There are only three options available. Make it a fill in the blank open question: What is your favourite game system? _____

b) No negative options available, but more importantly, this is a leading question. Rephrase it so that it is neutral: Do you think that leadership training can help a business run more smoothly? Yes, No, No Opinion.

c) This is asking two things in one question. Separate it into two questions with check box answers: How important do you think speed is? How important do you think quality of service is?

Example 3

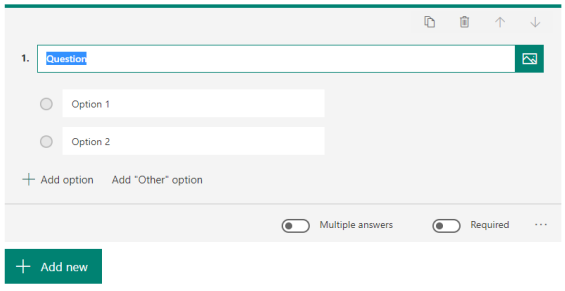
Create a Survey Using Technology

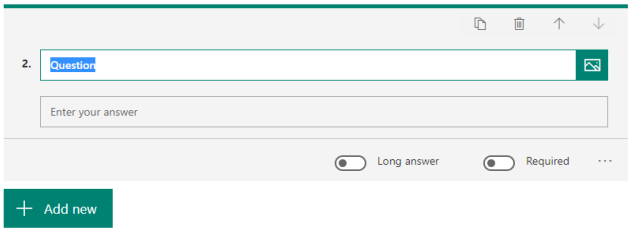
Create a survey to compare how much males and females like baseball.

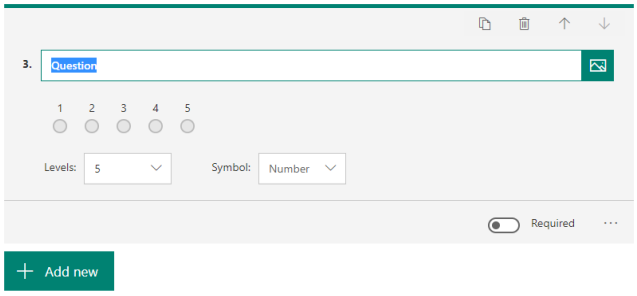
If you go to mycdsbeo.com, login and click on:

This "app" allows you to create a survey.

Types of questions: multiple choice, fill in the blank, ratings etc.







Your Turn

Use a technology of your choice to create a survey with two questions. Share your survey with your classmates.

Key Concepts

- In an observational study, the researcher records behaviour and tries to draw conclusions based on the observations.
- Experimental studies try to determine the cause and effect relationship between two variables by controlling for one variable to see what effect it has on the other variable.
- Effective experiments have good control, randomize the members of the treatment and control groups, and try to have a similar demographic make-up in each group.
- Surveys are a powerful way to gain information about a group of people.
- Surveys should be anonymous but can ask for precise demographic information.
- Items on surveys should be clear, concise, and ask only one question that is free of bias.
- Rating scales on a survey should be evenly distributed between good and bad outcomes.
- Data from surveys can be efficiently collected using technology.

R1. Why do you think asking clear and concise survey questions is important for gaining information about people?

You need to get accurate and unbiased information. To do this you need to ask clear and concise survey questions.

R2. Clinical tests of medication use a third experimental group called the placebo group. This group takes a medication that has no active ingredient. Members of the placebo group do not know that they are not getting the real medication. Why do you think this group is also studied?

This group is studied to see if there are any psychological effects from thinking that they are getting treatment, even though they aren't.

R3. Researchers want to determine whether smoking causes decreased lung capacity. They gather two randomly chosen groups of 100 people. One group smokes one pack of cigarettes a day while the other group does not smoke at all. After two years, the researchers assess the lung capacity in both groups. This is called a longitudinal study. Discuss any possible ethical issues with this study.

Informed consent: must be acquired from each participant and they should have the option to opt out during the study.

Voluntary participation: must have their well-being at the forefront of decision making.

Avoidance of harm: can lead participants to change their behaviour due to feedback.

Confidentiality and data protection: is paramount as information could be used to identify a participant.