



Math Virtual Learning

Probability and Statistics

May 7, 2020



Probability and Statistics

Lesson: May 7, 2020

Objective/Learning Target:

Students will be able to identify the types of bias that are present in a study and recommend ways to minimize the level of bias.

Video Tips Recap

Here is a summary of the tips listed in the video. Feel free to reference these when analyzing the survey questions

- Make sure every question is **NECESSARY**
- Keep it **SHORT** and **SIMPLE**
- Ask **DIRECT** questions
- Ask **ONE** question at a time
- Avoid **LEADING** questions
- Use **RELATABLE** language
- Use **RESPONSE SCALES**
- Avoid **TABLE** responses
- Avoid **BINARY** responses
- **TEST DRIVE** your survey

Let's Get Started!

Analyze the way the questions below are written and determine which of the 10 tips were not followed (there may be more than one). Then rewrite the question so that it is a better survey question.

1. In your opinion, how would you rate the speed and accuracy of your work?

Excellent Good Fair Poor

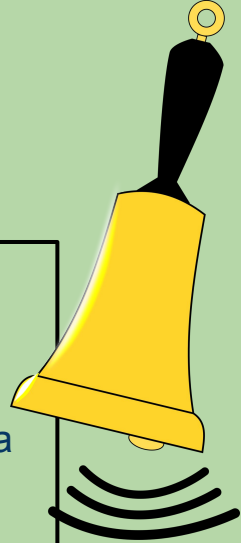
[Click HERE to see the answer](#)

Analyze the way the questions below are written and determine which of the 10 tips were not followed (there may be more than one). Then rewrite the question so that it is a better survey question.

2. Do you always eat breakfast?

Yes or No

[Click HERE to see the answer](#)



Research Bias

Yesterday we learned that scientists do their absolute best to avoid putting bias in their research so that they can gain accurate knowledge about the world around them. No study will be perfect, but we can do everything in our power to minimize the bias that exists.

The bias we looked specifically at yesterday was how to avoid **WORDING BIAS** by writing good survey questions.

Today we are going to look at 3 other types of bias and how to avoid them.

Response/Nonresponse Bias

This bias exists if people volunteer to give their opinion.

If there is a choice, the majority of participants who participate will be passionate about the topic (either positively or negatively) and want to speak up. This means that your results are likely to be polarized...meaning that you will have responses on the two ends of the extreme. There will be very few people in the middle.

This can bias your survey because it gives the false sense that the entire population feels strongly about the topic. When, in fact, many may not have a strong opinion which is why they didn't take the survey.

Sampling Bias

This bias exists if the data in your survey includes too many of one subgroup of the population.

For example, let's say that you were going to gauge the number of students at your high school who enjoy Spanish class. Some examples of a Sampling Bias would include:

- 85% of the people surveyed were male
- 90% of the people surveyed were Sophomores
- 79% of the people surveyed were failing Spanish

All of these subgroups are over-represented in the sample.

Undercoverage Bias

This bias is the exact opposite of Sampling Bias. This bias exists if the data in your survey includes too few of one subgroup of the population.

For example, let's say that you were going to gauge the number of students at your high school who enjoy Spanish class. Some examples of an Undercoverage Bias would include:

- 15% of the people surveyed were female
- 10% of the people surveyed were Juniors
- 21% of the people surveyed were passing Spanish

All of these subgroups are under-represented in the sample.

Let's Practice - Survey Sample Analysis #1

A research study was conducted about the number of students who are happy with the selection of food in the vending machines. One of the English teachers was asked to give the survey to her 6 classes as a sample of the school. When the demographic results came in, the following types of people took the survey.

- 80% Freshmen
- 10% Sophomore
- 7% Junior
- 3% Senior
- 52% Male
- 48% Female

What types of bias exist in the survey?

What steps could have been taken to reduce this bias?

Survey Sample Analysis

A research study was conducted about the number of students who are happy with the selection of food in the vending machines. One of the English teachers was asked to give the survey to her 6 classes as a sample of the school. When the demographic results came in, the following types of people took the survey.

- 80% Freshmen
- 10% Sophomore
- 7% Junior
- 3% Senior
- 52% Male
- 48% Female

What types of bias exist in the survey?

Because this survey was required of all participants, there is NO response/nonresponse bias.

There is a sampling bias of too many Freshmen

There is an undercoverage of too few non-Freshmen - especially Seniors (0%)

What steps could have been taken to reduce this bias?

The survey could have been given to a few different teachers. It seems this teacher was primarily a Freshman English teacher. Giving it to other English teachers could have captured more grade levels

Let's Practice - Survey Sample Analysis #2

A psychology class set up a table outside of Walmart to ask people about their opinions of large chain stores. There was a sign advertising the poll and customers stopped by choice to give their opinions. The demographics of the participants were as follows:

- 35% ages 18-25
- 40% ages 26-40
- 25% ages 41-65
- 42% considered “upper class”
- 48% considered “middle class”
- 10% considered “lower class”
- 12% Male
- 88% Female

What types of bias exist in the survey?

What steps could have been taken to reduce this bias?

Survey Sample Analysis

A psychology class set up a table outside of Walmart to ask people about their opinions of large chain stores. There was a sign advertising the poll and customers stopped by to give their opinions by choice. The demographics of the participants were as follows:

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- 42% considered “upper class”
- 48% considered “middle class”
- 10% considered “lower class”
- 12% Male
- 88% Female

What types of bias exist in the survey?

Because participants chose to come take the poll, there is a response/nonresponse bias. The majority of the participants will be those who have a strong opinion about the large chain stores.

There is a sampling bias of too many Females. There is not one percentage of ages or wealth that is higher than all the rest so Females is the only sampling bias.

There is an undercoverage of too few Males and “Lower Class” participants

What steps could have been taken to reduce this bias?

The researchers could have set up a booth outside of a non-large chain store. They could have also actively tried to get men to participate in the study by inviting them personally and not just relying on the sign.

Let's Practice - Survey Sample Analysis #3

A current political campaign office called voters to see which candidate they were supporting in the next city election. The demographics of those willing to take the survey were as follows:

- 5% ages 18-40
- 20% ages 41-64
- 75% ages 65+
- 83% Democrat
- 15% Republican
- 2% Independent

What types of bias exist in the survey?

What steps could have been taken to reduce this bias?

Survey Sample Analysis

A current political campaign office called voters to see which candidate they were supporting in the next city election. The demographics of those willing to take the survey were as follows:

- 5% ages 18-40
- 20% ages 41-64
- 75% ages 65+
- 83% Democrat
- 15% Republican
- 2% Independent

What types of bias exist in the survey?

There is a response/nonresponse bias because people can choose to participate in the call or hang up.

There is a sampling bias of too many people aged 65+ and Democratic voters..

There is an undercoverage bias of too few people aged 18-64 and non-Democratic voters

What steps could have been taken to reduce this bias?

Get a list of people who have registered Democratic, Republican and Independent and make sure that an equal number of participants came from that group. It is difficult to reduce these biases because people have the option to take or not take the survey.

Let's Practice - Survey Sample Analysis #4

A cable company sent an employee around a neighborhood to see if the residents would be willing to change to a new cable service provider. The employee would knock on doors and ask the residents if they were interested in taking the survey. The demographics of those who were willing are as follows:

- 51% Male
- 49% Female
- 55% currently have cable
- 45% do not currently have cable
- 34% ages 20-40
- 30% ages 40-60
- 36% ages 60+

What types of bias exist in the survey?

What steps could have been taken to reduce this bias?

Survey Sample Analysis

A cable company sent an employee around a neighborhood to see if the residents would be willing to change to a new cable service provider. The employee would knock on doors and ask the residents if they were interested in taking the survey. The demographics of those who were willing are as follows:

- 51% Male
- 49% Female
- 55% currently have cable
- 45% do not currently have cable
- 34% ages 20-40
- 30% ages 40-60
- 36% ages 60+

What types of bias exist in the survey?

There is a response/nonresponse bias in this survey because they participants have a choice to answer their door and take the survey or not.

There is no other type of bias because all of the demographics are fairly well distributed.

What steps could have been taken to reduce this bias?

There is not a good way to reduce this bias because, realistically, you can't harass people and force them to take the survey.

Bell Ringer Survey Question Analysis

In your opinion, how would you rate the speed and accuracy of your work?

What tips were not followed?

TIP 4: This is asking two different questions in one. A person may not believe that their speed AND accuracy at work are of the same quality or rating. They may be either fast OR accurate but not both.

TIP 3: “work” is not very descriptive. Are you referring to when they are typing, filing, transferring phone calls, taking orders, giving change, folding clothes???

SAMPLE Improved Question (yours may vary slightly)

Split into two questions and clarify the word work.

How would you rate your speed when taking orders in the drive thru?

How would you rate your accuracy when giving change to the customer in the drive thru?

Bell Ringer Survey Question Analysis

Do you always eat breakfast?

What tips were not followed?

TIP 8: This is a binary response...only two answer options. This would be difficult for a person to respond to if they eat breakfast sometimes, but not all the time.

TIP 3: This is not a direct question. Does eating breakfast sometimes affect what you are researching? By using the word “always” you are limiting their answer.

SAMPLE Improved Question (yours may vary slightly)

How often do you eat breakfast?

- Every day per week
- 5-6 days per week
- 3-4 days per week
- 1-2 days per week
- I usually don't eat breakfast