



Math Virtual Learning

Probability and Statistics

May 8, 2020



Probability and Statistics

Lesson: May 8, 2020

Objective/Learning Target:

Students will be able to distinguish between probability and odds, calculate both from a given situation and calculate one given the other.

Let's Get Started!

A drug company released a commercial to educate the public about their new drug to stop the spread of the common cold. In the study, they stated that 80% of the participants reduced their symptoms in one week.

How MIGHT this study be bias?

Why MIGHT the company bias this study?

The AP statistics class ran an observational research study where they surveyed students about their opinions of the new bell schedule. The surveyed was administered during the lunch period. Students were asked to stop by a table outside of the lunch room to answer a few questions. When those who participated in the survey had the following demographics:

- 10% freshmen
- 20% Sophomore
- 50% Junior
- 20 % Senior
- 80% Female
- 20% Male

Identify the bias that exists in this study and how it could have been minimized.



Let's Get Started! ANSWERS

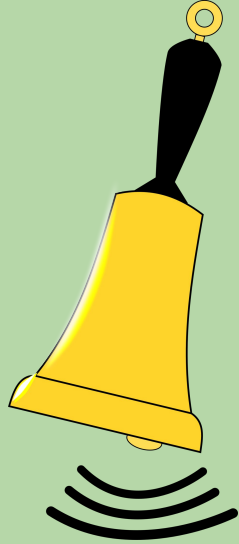
A drug company released a commercial to educate the public about that patients prefer their new drug to stop the symptoms of the common cold. In the study, they stated that 80% of the participants preferred their product to other brands when looking to reduce their symptoms in one week.

How MIGHT this study be bias?

It is very possible that this study was conducted ethically and thoroughly. However, because it is an advertisement, it is important to be critical and evaluate the data carefully. They MIGHT have biased the study by including only healthy patients or used results from primarily those who prefer the brand.

Why MIGHT the company bias this study?

Again, the company may have been ethical and honest. However, it is also possible that the company MIGHT bias the study to gain more profit from their product.



Let's Get Started! ANSWERS

The AP statistics class ran an observational research study where they surveyed students about their opinions of the new bell schedule. The survey was administered during the lunch period. Students were asked to stop by a table outside of the lunch room to answer a few questions. When those who participated in the survey had the following demographics:

- 10% Freshmen
- 20% Sophomore
- 50% Junior
- 20% Senior
- 80% Female
- 20% Male

There is a **RESPONSE/NONRESPONSE** bias because students had the option to stop at the table to take the survey. This means that the students who stop have a greater likelihood to feel strongly about the topic and want their voice heard. It's possible that many students are indifferent and so they didn't take the survey.

There is a **SAMPLING** bias because Juniors and Females are over represented in the sample.

There is an **UNDERCOVERAGE** bias because Freshmen and Males are under represented.



Probability Unit

As we begin our final Unit on Probability, we are going to start by looking at what is Probability and what are Odds and how are they different.

Probability...

- The likelihood of something happening
- A ratio (fraction), decimal, or percent between 0 and 1
- Represents
$$\frac{\textit{what you "want" to happen}}{\textit{what "could" happen}} = \frac{\textit{favorable}}{\textit{total}}$$
- What you expect to get or what “should” happen is called Theoretical Probability. When you first do an experimental trial, the Experimental Probability results won't be exactly the probability that you expect from your Theoretical Probability. But the more times you do a trial, the closer you will get to the Theoretical Probability

Probability...

Let's start by looking at this video

[Probability Explained](#)

Odds...

- Odds are VERY similar to probability! They also express the chances of something happening
- A ratio (fraction), decimal, or percent between 0 and 1
- Represents $\frac{\text{what you "want" to happen}}{\text{what you "don't want" to happen}} = \frac{\text{favorable}}{\text{not favorable}}$
- **Notice that the denominator is different!**
- Can also be written with a colon as **3:7** which means 3 is what you want and 7 is what you don't want
- Odds are either "FOR" or "AGAINST" and you should state which one you are giving.

Odds...

Let's look at this video to see the difference in action

[Odds Explained](#)

Probability vs Odds

RECAP

- Both Probability and Odds will be a fraction, decimal, or percentage between 0 and 1
- Probability is what you want to happen over total
- Odds are what you want to happen over what you don't want to happen
- Odds are for or against something
- Odds are sometimes written with a colon (3:7) but the same thing as a fraction.
- Most companies use odds instead of probability because it looks more favorable for selling their products because they don't expect the average person to know the difference. In fact, they are really the same chances just written as a different fraction.

Probability and Odds Practice

A raffle is being held at a local Senior Citizens home as a fundraiser. Players can purchase a ticket with a color on it. If a marble is drawn that matches the color of the ticket they bought, they will win the prize. There are 18 marbles in the jar. 5 of them are blue, 1 is red, 8 are black and 4 are green.

What is the probability that someone with a black ticket will win?

What is the probability that someone with a green or red ticket will win?

What are the odds that the person with a blue ticket will win?

What are the odds that any one except the person with the red ticket will win?

Probability and Odds Practice **ANSWER**

A raffle is being held at a local Senior Citizens home as a fundraiser. Players can purchase a ticket with a color on it. If a marble is drawn that matches the color of the ticket they bought, they will win the prize. There are 18 marbles in the jar. 5 of them are blue, 1 is red, 8 are black and 4 are green.

What is the probability that someone with a black ticket will win? $8/18 = 4/9$ (44%)

What is the probability that someone with a green or red ticket will win? $5/18$ (28%)

What are the odds that the person with a blue ticket will win? **5:13**

What are the odds that any one except the person with the red ticket will win? **17:1**

Probability and Odds Practice

A radio station published the odds of their listeners winning the different prizes they plan to offer that month.

If the odds of winning a gift card to local restaurant is 3:7, what is the probability?

- A. 30%
- B. 43%
- C. 57%
- D. 70%

Probability and Odds Practice ANSWER

A radio station published the odds of their listeners winning the different prizes they plan to offer that month.

If the odds of winning a gift card to local restaurant are 3:7, what is the probability?

A. 30%

Odds of 3:7 mean that there are 3 chances of winning and 7 chances of losing. This is 10 total ways this drawing could fall out.
 $P(\text{Winning}) = 3/10 = 30\%$

B. 43%

C. 57%

D. 70%

Probability and Odds Practice

It has been said that the probability of it raining today is 0.25. What are the odds of it **NOT** raining. Write your answer as a ratio.

Probability and Odds Practice ANSWER

It has been said that the probability of it raining today is 0.25. What are the odds of it NOT raining. Write your answer as a ratio.

$0.25 = \frac{1}{4}$ This means that there is 1 chance out of 4 total that it will rain.

Therefore there are 3 chances that it will not.

The odds for NOT raining are 3:1 or 3/1

Probability and Odds Practice

The student population of a high school is shown in the table below.

Blue Dolphin High School		
Grade	Male	Female
9	120	150
10	100	100
11	130	110
12	150	175

1. What is the probability of a randomly selected student is a Senior?
2. What are the odds that a randomly selected student is a Male Freshman?
3. What are the odds that a randomly selected student is a Female Junior?
4. What is the probability that a randomly selected student is NOT a Freshman?

Probability and Odds Practice ANSWER

Blue Dolphin High School		
Grade	Male	Female
9	120	150
10	100	100
11	130	110
12	150	175

There are 1035 total students

1. What is the probability of a randomly selected student is a Senior?
There are 325 Seniors (150+175). $P(\text{Senior}) = 325/1035 = 0.31$ or 31%
2. What are the odds that a randomly selected student is a Male Freshman?
There are 120 students who are Male Freshmen so there are 915 (1035-120) who are not.
Odds = 120:915 = 8:61
3. What are the odds that a randomly selected student is a Female Junior?
There are 110 Juniors that are Female Juniors so there are 925 (1035 - 110) who are not.
Odds = 110:925 = 22:185
4. What is the probability that a randomly selected student is NOT a Freshman?
There are 270 Freshmen. So there are 795 students who are NOT a Freshman.
 $P(\text{Not Freshman}) = 795/1035 = 0.77$ or 77%