SeaGlide_TEAM	Using & Misusing Statistics	Lesson # 8 (60 minutes)

Description:

You are working for Facebook and are in training to be put on the team that helps identify and remove fake news as well as bad or faulty statistics. The goal is to better the public's newsfeed so that they are not being fed misinformation. First you need to identify important skills that should be used in determining good data. Then, your supervisor wants you to practice spotting fake news. Fake news is news that is misleading and not based on fact. Fake news has the intention of disseminating false information, not for comedy, but for consumption.

Students will be able to:

- Apply what they have learned about data and statistics so far to identify misleading statistics
- Identify how statistics can be misused
- Define and spot fake news

Students will understand:

Student will understand why statistics are important and how they can be used to prevent misrepresentation and fake news. Students learn how to recognize fake news and why it is important to be able to do so, as well as how to critically analysis data and studies to determine their validity.

Key Definitions & Concepts [1]:

- **Fake News:** the intention of disseminating false information, not for comedy, but for consumption
- **Data Misrepresentation:** manipulating data in such away that it misleads the consumer/reader

Standards [Copied from: 2]:

CC.2.4.HS.B.5 Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.

CC.2.4.HS.B.2 Summarize, represent, and interpret data on two categorical and quantitative variables.

	Background Information	

Prior Knowledge:

- All previous lessons from *Measurements on Data Analysis*
- 8th/9th grade reading level

Math Practices [Copied from: 3]:	**Core Ideas [Copied from: 4]:**	**Cross Cutting Concepts[Copied from: 5]:**
• Reason abstractly and quantitatively. • Use appropriate tools strategically.	• Optimizing the Design Solution • Developing Possible Solutions	• Patterns • Systems and System Models

Possible Preconceptions/Misconceptions:
Students may not realize that a lot of things they see on the internet may be misleading or fake news. They may not realize how much misinformation is out there and how it affects people and the population as a whole. Even studies that look reliable such as nutrition studies may not be.

	Lesson Plan - 5E(+) Model	

Engage [6]:
Students will watch the video How statistics can be misleading? This video challenges students' preconceptions about what they may assume about statistics and how numbers may or may not have a statistical significance. Students will fill out the half sheet *How statistics can be misleading?* while watching the video. The teacher should briefly review the answers with the class after the video concludes. This engagement should take 5 minutes to complete.

Explore [1], [7], [8]:
Part I: Introduction
Students can work in small groups of 2 or 3 to complete the *Our Tool Box* worksheet. The instructor should give the students 7 minutes to work on completing the worksheet in their small groups. This worksheet prompts students to recall important information from previous lessons and to make connections between these concepts based on their usefulness in determining whether or not data is being used and represented properly. Students are also asked to draw connections on how the tools that they learned can be useful in detecting misleading statistics and improper analysis. These tools are not only helpful for completing the rest of this lesson, but also in life as they grow and begin reading into politics, medicine, etc. The teacher should review students' answers by facilitating an open class discussion before moving forward. This ensures that the students have a proper basic understanding before delving deeper into this lesson's learning goals. The worksheet and class discussion should take 10 minutes to complete.

Part II: *Benchmark Lesson*: Fake News is Bad News
The worksheet *Fake News is Bad News* walks students through how fake news is categorized and identified. There are a few discussion questions to get students thinking about what fake news is and where they may have seen it. Students will then play the game Factitious to practice spotting fake news using both their new and previous knowledge. Each student will need access to the internet for this game. Hence, the instructor must ensure that the students have a computer or tablet. If unavailable, the weblink is mobile friendly, and the students can complete the game by using their phones. The Factitious game will present a news article to the user, and he/she needs to identify whether it is real or fake. The site also scores the user and provides the original article's source. This

activity allows for students to actively learn about detecting fake news articles based on the publisher, the content, etc. There is a question for students to answer on the worksheet after they play the game to ensure that they are playing the game properly and to think about how they decided whether or not the articles were real or fake. Students should play the game and complete the worksheet individually. During this activity, the teacher should be circulating around the room to observe students' interactions with the Factitious game, so he/she can address any misunderstandings or misconceptions as necessary. It is recommended to give the students 15 minutes to interact with the Factitious game then conduct a whole class discussion to review students' responses and experiences. This should take 20 minutes to complete.

Part III: *Investigation Lesson*: You Can't Trust Everything You Read
Students will read the article You Can't Trust What You Read About Nutrition and fill out the worksheet *You Can't Trust Everything You Read*. It is recommended to provide students with a copy of the article instead of needing internet access. It is also recommended to have the students read the article aloud, paragraph by paragraph, to ensure that each student is focused on the article's content. After reading the article students should answer the questions on the worksheet individually. This article addresses issues within studies by explaining what is wrong in the studies and why and by providing examples. This activity allows for students to see and learn about another type of misuse of data and statistics. During this activity, the teacher should be circulating the room to observe students while they are answering the questions on the worksheet, so they can address any misunderstandings or misconceptions as necessary. The instructor should facilitate an open class discussion to review students' responses. This activity should take 25 minutes to complete.

Explain:
During each activity in the exploration of this lesson, students are expected to explain their reasoning and answers. In the introduction part of the exploration, students must explain how a certain concept in data analysis and statistics can be used to determine the misuse of data. In the benchmark part of the exploration, students must explain why it is important to care about fake news and also explain why they may have gotten an answer wrong while playing the Factitious game. This allows for students to self-evaluate and to reflect on the activity and their responses. In the investigation part of the exploration, students must be able to explain important concepts and ideas from the article after reading it. The teacher should also be asking probing questions during completion of the worksheets that prompt the students to explain what they are doing and why. This allows for students to learn through inquiry and discovery, which ensures that they gain deeper understanding of the learning goals of this lesson.

Elaborate:
Fake news is a real and relevant example for students that affects them directly. Students see fake news in their social media feeds all of the time and may not realize it. Students have also seen the effect of fake news on the american population and how dangerous misinformation can be such as anti-vaccination, political lies, etc. This example will engage students through an active learning process for identifying fake news and becoming an advocate for reading and consuming valid information.

Evaluate:

Students are evaluated both informally and formally throughout the entirety of this lesson. The informal evaluations occur during the open class discussions and reviewing worksheets. When the teacher is circulating the classroom, he/she is able to check for surface level understanding and make sure that the class is all on the same page by observing students' responses. The instructor can gauge student progress through observing whether or not they are struggling to complete the activities. Formal assessment comes from checking the worksheets for correctness but most especially in the investigation part of the exploration. Students must answer questions that check for both reading comprehension and content understanding.

Enrich:

This can be extended into a government and politics class. There is a lot of fake news in politics that affects the American public. A class can analyze fake news articles and their effects on voting and American politics. This lesson easily connects to government and politics because falsified information, misleading headlines, and misinformation has begun to dominate our media especially surrounding politics and elections. This lesson could be implemented after the class has already learned the basic underlyings of politics and elections.

All associated documents are attached below

Reference *Annotated Bibliography* on the very last page of this packet

Name:_____ Date:_____

How Statistics Can be Misleading [6]

What is a lurking variable?

Which hospital is better? Why?

Name:_____ Date:_____

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Which hospital is better? Why?

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Our Tool Box

You are working for Facebook and are in training to be put on the team that helps to identify and to remove fake news and faulty statistics. The goal is to better the public's newsfeed so that they are not being fed misinformation. First, you need to identify important skills that should be used in determining good data. What are four tools we learned to make good statistics, and how can we use them to spot problems within statistics?

1.

2.

3.

4.

What causes bad statistics?

How can we look out for bad statistic or data misrepresentation?

Name:_____ Date:_____

Fake News is Bad News [1], [7]

Your supervisor wants you to practice spotting fake news. Fake news is news that is misleading and not based on facts. Fake news has the intention of disseminating false information, not for comedy, but for consumption.

There are 4 categories that fake news falls in; sometimes, it can fall into more than one category.

1. Websites that disseminate false information to get social media likes, clicks, and engagement.
2. Websites that disseminate misleading or disingenuous information
3. Click bait articles
4. Satire or comedy

What are two examples you know of fake news?

Why should we care about fake news?

Some tricks on how to spot fake news

- Check the source and author, are they credible? Are they real?
- Read beyond the headline some headlines have nothing to do with the article.
- Check the date. Is it recent or an old story being reposted?
- Are their supporting sources and are they real sources? Check those links
- Is it a joke? If it sounds like one os is outlandish it probably is not real

Play the game Factitious to practice spotting fake news.

Where there times you got the answer wrong? What did you miss in spotting the fake news?

Name:_____ Date:_____

You Can't Trust What You Read [8]

Read the article You Can't Trust What You Read About Nutrition on fivethirtyeight, which is a website that uses data and statistics to discus real world problems and events. Answer the following questions about the article:

Do the correlations show causation? Why or why not?

What are three experiments that were conducted in this article?

What is a false positive?

What is one problem current studies suffer from?

Why do we need to be careful when reading information claiming they have done studies?

Name:_____ANSWER KEY_____ Date:_____

How Statistics Can be Misleading [6]

What is a lurking variable?

A hidden additional factor that significantly affects results

Which hospital is better? Why?

Hospital B is better because, when you take multiple factors into account and look deeper into the variables, you can see that there is better chance of surviving at Hospital B.

Name:_____ANSWER KEY_____ Date:_____

Our Tool Box

You are working for Facebook and are in training to be put on the team that helps to identify and to remove fake news and faulty statistics. The goal is to better the public's newsfeed so that they are not being fed misinformation. First, you need to identify important skills that should be used in determining good data. What are four tools we learned to make good statistics, and how can we use them to spot problems with in statistics?

1. Mean, median, mode: This allows us to study the spread of the data and whether or not it is skewed. In a good data set, the three values should be close to each other.

2. Standard deviation and distributions: This allows us to see the data spread via a visual representation with a formal unbiased mathematical approach.

3. Graphing and visual representation: Graphs made properly without manipulation are great tools. If they are manipulated, data can easily be made to look like something it is not. Checking for scales, axis manipulation, and cherry picking are important.

4. Bias: This is when there is an unlying factor affecting data or statistics by swaying results towards a specific interpretation. It is important to look for bias in data and studies because bias can lead the consumer in a specific direction without realizing it.

What causes bad statistics?

Bias, data manipulation, misusing or manipulating graphs, bad research techniques etc.

How can we look out for bad statistic or data misrepresentation?

Being mindful of what to look out for to spot misused statistics and by using our tool box above.

Name:_____ANSWER KEY_____ Date:_____

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1. Websites that disseminate false information to get social media likes, clicks, and engagement.
2. Websites that disseminate misleading or disingenuous information
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4. Satire or comedy

What are two examples you know of fake news?

Students may discuss examples on social media, tabloids, headlines etc. Some examples may include: anti-vax, flat earth, etc.

Why should we care about fake news?

It affects what people think is true or not, how they make informed/misinformed decisions. It also affects our democratic society by creating political conflicts. This results in the public being misinformed and skewed voting.

Some tricks on how to spot fake news

- Check the source and author, are they credible? Are they real?
- Read beyond the headline some headlines have nothing to do with the article.
- Check the date. Is it recent or an old story being reposted?
- Are their supporting sources and are they real sources? Check those links
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Play the game Factitious to practice spotting fake news.

Where there times you got the answer wrong? What did you miss in spotting the fake news?

Dependent on student experience, but expect the students to incorrectly spot valid versus fake news articles. Their reasoning will also be dependent on the studies that they've answered incorrectly.

Name:_____ANSWER KEY_____ Date:_____

You Can't Trust What You Read [8]

Read the article You Can't Trust What You Read About Nutrition on fivethirtyeight, which is a website that uses data and statistics to discus real world problems and events. Answer the following questions about the article:

Do the correlations show causation? Why or why not?

No, the correlations are rather random and are not statistically based. They do not show a reason why a particular trend is present.

What are three experiments that were conducted in this article?

As provided by the article: any of the correlation in the chart such as potato chips leads to higher SAT math scores, energy drinks is linked with smoking, etc. Notice that this does not list three separate experiments. Rather, this discussed random correlations. This is the point behind the article - running an experiment that produces random correlations is not a proper experiments and can easily lead to misinformation and misrepresentation.

What is a false positive?

When the relationship between data variables appears to be positively correlated, but the data does not actually correlate positively. When an experimental test has a positive result, but it should be a false/negative result.

What is one problem current studies suffer from?

As provided from the article: we expect far too much from them, and we want them to answer a myriad of questions

Why do we need to be careful when reading information claiming they have done studies?

Just because there is a study testing for a relationship between data does not imply that the study was conducted properly or that the results were represented/communicated accurately and without misinformation or bias.

Annotated Bibliography

[1] Research Guides @ Fordham: Fake News: Using & Misusing Statistics. (n.d.). Retrieved from https://fordham.libguides.com/FakeNews/Statistics

This website was used for adaptation within the Using and misusing Statistics lesson plan in the in the Measurements and Data Analysis module. This reference aided in the completion of definitions and was also used for research and inspiration in creating the Fake News is Bad News worksheet.

[2] Standards Aligned System. (n.d.). Retrieved from https://www.pdesas.org/

This website was used in each lesson in the Measurements and Data Analysis module to select proper Pennsylvania State standards, which are based in Common Core, that each lesson is centered around.

[3] Standards for Mathematical Practice. (n.d.). Retrieved from http://www.corestandards.org/Math/Practice/

This website used in every lesson in the Measurements and Data Analysis module to find Standards for Mathematical Practices that are applicable in each lesson.

[4] Nsta. (n.d.). Disciplinary Core Ideas. Retrieved from https://ngss.nsta.org/DisciplinaryCoreIdeasTop.aspx

This website was used in each lesson in the Measurements and Data Analysis module to select appropriate disciplinary core ideas set forth by the NSTA that are at the center of each lesson.

[5] Nsta. (n.d.). Crosscutting Concepts. Retrieved from https://ngss.nsta.org/CrosscuttingConceptsFull.aspx

This website was used in each lesson in the Measurements and Data Analysis module to selecting appropriate crosscutting concepts set forth by the NSTA that apply to each mathematics lesson

[6] TED-Ed. (2016, January 14). How statistics can be misleading - Mark Liddell. Retrieved from https://www.youtube.com/watch?v=sxYrzzy3cq8

This video was used as an instructional for students to watch and complete a half-sheet that has questions developed based on the video.

[7] Factitious. (n.d.). Retrieved from http://factitious.augamestudio.com/#/

This is an online tool centered around Fake News and is used as an instructional aid for student exploration in the Using and Misusing Statistics lesson in Measurements and Data Analysis module.

[8] Cragcrest. (2016, January 06). You Can't Trust What You Read About Nutrition. Retrieved from https://fivethirtyeight.com/features/you-cant-trust-what-you-read-about-nutrition/

This article is used as a student reading in the Using and Misusing Statistics lesson in Measurements and Data Analysis module and was also used in the development in reading comprehension questions and answer key in the You Can’t Trust What You Read worksheet