WPHS Science Research Program

Bias in Research

SWBAT: Review Bias in Research. Work in small groups to identify bias in research examples.

Summary Activity: Re-take the "Bias in Research" 7 question quiz. This one will be graded, and you can only take it once. Due date: Monday 3/1/21 11:59pm

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Assignment #1: Whole Class Activity. Take notes as Mrs. Fleming presents a PowerPoint presentation about Bias in Research
File needed: "Bias in Research Presentation revised".pdf (PowerPoint)

Assignment #2: Small Group Activity. In breakout rooms, read the research scenario you are presented with and discuss the following: 1) Source of the bias(es), 2) Type of bias (sampling or measurement), 3) Affects of bias on results

Presentation Questions/Notes

Fill in the questions based on information in the presentation.

What is good science? (slide 3)

Define "Bias": (slide 4)

What are the two main types of bias? (slide 4)

a)

b)

What is a sample? (slide 5)

When is sampling bias introduced? (slide 5)

What are factors that contribute to sampling bias? (slide 6)

What are some ways to minimize sampling bias? Include definitions. (slide 6)

What are 3 factors that contribute to measurement bias? (slide 7)

What measures does the scientific community take to minimize bias in science? Include definitions for terms used. (slide 9)

What are some clues that scientific information you are reading is biased? Provide examples for each clue type. (slide 11-14)

a)

b)

c)

Closing/Summary Questions

Read each statement and mark whether you think the statement is true (T) or false (F).

1. ___ Science is concerned with understanding how nature and the physical world work.
2. ___ Science can prove anything, solve any problem, or answer any question.
3. ___ Any study done carefully and based on observation is scientific.
4. ___ Science can be done poorly.
5. ___ Anything done scientifically can be relied upon to be accurate and reliable.
6. ___ Different scientists may get different solutions to the same problem.
7. ___ Knowledge of what science is, what it can and cannot do, and how it works, is important for all people.

Smoking Bias Activity (Small Groups)

When you are given scientific information, it is important to be able to evaluate if the information is accurate. You can investigate the accuracy of scientific information by evaluating whether the conclusions presented are justified based on the experimental design used to collect data. In today's activities you will practice identifying sources of bias introduced by different experimental designs. In this activity, you will be presented with six studies, all which make different claims about the rate of teenage smoking. First, carefully read each study and the results from each study. Next, report an aspect of the experimental design that might bias the results. Following this, determine if the bias you have identified is sampling bias (testing unrepresentative sample, not taking a random sample, or taking too small a sample) or measurement error. Finally, write two sentences explaining the possible affects of the bias on the results (e.g. overestimation or underestimation of teenage smoking).

<u>Evaluating different experimental designs</u>

Experiment 1: Dr. Jackson is making observations at Davisville High School to investigate the rate of smoking among American teenagers. Dr. Jackson decides she will observe students having their lunch in the parking lot where smoking is permitted. Dr. Jackson observes 25 out of 30 students smoking in the parking lot. Based on her observations she records that 83.3% of American teenagers smoke.

Source of Bias:

_____

What Type of Bias:

_____

Possible Affects of Sampling Bias on Results:

_____

Experiment 2: Dr. Cloud is conducting interviews of Davisville and Springville High School students to determine the rate of smoking among American teenagers. Dr. Cloud gets a list of all the students from each high school and randomly selects 50 students from each school. An appointment for the interview is scheduled with each student and their parents. Each student is interviewed with their parents in the room. The students are asked questions such as, "Do you smoke regularly?", "Have you ever smoked?", and "What percentage of your friends smoke?" After finishing the interviews Dr. Cloud concludes that only 1% of American teenagers smoke regularly and 18% of teenagers have tried smoking.

Source of Bias:

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What Type of Bias:

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Possible Affects of Sampling Bias on Results:

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Experiment 3: Dr. Garcia is using both observations and interviews to investigate the rate of smoking among American teenagers. She first selected three study sites: one urban, one rural, and one suburban. Dr. Garcia went to two popular teenage hangouts in each study site and made

observations of the teenage students standing around the buildings. She observed a total of 117 students and of those 33 were smoking (28%). Dr. Garcia then went to one high school in each study site and interviewed 25 students from each school. The principal of each school selected the 25 students that would be interviewed for Dr. Garcia's study. Of the 75 total students only 3 said that they smoked regularly (4%). Taking the average percentage from her observations and interviews, Dr. Garcia concluded approximately 16% of American teenagers smoke.

Source of Bias:

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What Type of Bias:

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Possible Affects of Sampling Bias on Results:

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Experiment 4: Dr. Nandi is using confidential interviews to estimate the rate of smoking among American teenagers. She contacted principals at three high schools (rural, urban, and suburban) and asked for entire lists of their student body. After randomly selecting 50 students from each school, she gave permission slips and confidentiality forms to each student so that the students' parents would know that their child was participating in the study and they, as parents, would not have access to the file on their own child. Roughly 35 students from each school returned the permission slips and confidentiality forms. Students were asked fifteen questions about their experiences with smoking. Dr. Nandi found that 53% of the high school students had tried smoking and 25% of high school students smoke a half pack of cigarettes or more a day.

Source of Bias:

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What Type of Bias:

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Possible Affects of Sampling Bias on Results:

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Experiment 5: Dr. Wellstone is using a shadowing method to study rates of smoking among American high school students. First, Dr. Wellstone hired 50 college freshmen and sophomores making certain that the hired students blended in well with the high school students being sampled. He received a list of students attending Davisville and Springville high schools and randomly selected 25 students from each school. Each college student Dr. Wellstone hired shadowed one of the randomly selected high school students from 3 pm to 5 pm and the college students attended Thursday, Friday, and Saturday night parties for two consecutive weeks. The hired college students recorded whether or not their study subject smoked and, if so, how often. Dr. Wellstone concluded that 28% of American teenagers smoke regularly and 44% will smoke at weekend parties only.

Source of Bias:

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What Type of Bias:

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Possible Affects of Sampling Bias on Results:

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Experiment 6: A citizen's group, No Butts, has passed around a petition that will make it illegal to have billboard cigarette advertisements in their city. The group claims that billboard cigarette advertisements are often geared at teenagers and that these billboards cause increased smoking rates among teens. The Dancing Frog Cigarette Company claims that their advertising is not aimed at teenagers and that restricting their advertising will have no effect on the rate of teenage smoking. To demonstrate their point, Dancing Frog Cigarette Company hires Dr. Crabtree to conduct a study comparing the smoking rate at schools in towns with cigarette billboard advertising and schools in towns without cigarette billboard advertising. Dr. Crabtree goes to three freshman classrooms in areas with and without advertising. These areas are approximately 5 miles apart. Dr. Crabtree asks the students to raise their hands if they would answer "yes" to the following questions: Have you ever smoked? Do you smoke everyday? Do you smoke once a month or more? The following data was recorded from Dr. Crabtree's data collection:

	Schools Without Advertising	Schools With Advertising
Have you smoked?	4%	3.5%
Daily Smoker?	1.3%	1.5%
Monthly Smoker?	2.1%	2%

Because there is no significant difference in the results, Dr. Crabtree concludes that the cigarette advertising has no effect on the teenage smoking rate.

Source of Bias:

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What Type of Bias:

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Possible Affects of Sampling Bias on Results:

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