**Lesson 11 - Bias in Data**

***Grade 8 Data Management Lesson***

**Learning Goal**

Students will be able to apply strategies to interpret and analyze graphs in order to detect bias and make convincing arguments.

**Success Criteria**

* When I look at data, I can analyze it critically to identify bias
  + I think about who wasn’t included
  + I think about how the data was collected
  + I think about how the data is displayed
* I can design an unbiased survey and use it to collect primary data
  + I can explain my choice of sample vs. census
  + I can explain why my sample is representative
* I can use math vocabulary to explain my thinking to the group

**Key Vocabulary**

Sample, census, population, representative population, bias, survey question

**Materials Needed**

Small prizes, PowerPoint, Always/Sometimes/Never practice work, Character Cards, Sample Graphs (same as on PowerPoint)

**Lesson Outline 1**

**Minds On (5-7 mins)**

1. Give each pair a “Character Card”. This is who they are, and what they want to convince their group of.
2. GRAPHS AND DATA CAN BE USED TO PERSUADE! Give each pair time to circulate around the room/review the graph package to choose the graph they will use in their presentation to be the most persuasive.

**Action** (7-10 minutes)

1. Ask students to get into “set” groups (i.e., the BP Oil execs with the environmentalists, the PDSB admin with the students, etc.). Give them three questions to answer as a group.
   1. Which graph better represents the data?
   2. Is one graph ***biased*** (it leads people to think or feel a specific way that doesn’t necessarily represent the truth)?
   3. What are the specific characteristics of a graph that might make it biased?

**Consolidation** (30-35 minutes)

1. Walk through graphing examples with students, asking each group to explain what made their information biased as it appears on the PowerPoint.
   1. Point out bias can occur **before (**when developing survey question**), during (**when collecting information**), or after(**when presenting information**)**.
2. Make sure each partner-grouping has a device.
3. Play a Kahoot in which students have to define bias, and identify the bias in each of the examples (<https://play.kahoot.it/#/k/30c04e06-5b30-49ba-8c99-2288804d50e9>)
4. Partners now have 4 minutes to make a list of all the ways that a survey or a graph can be biased! Have prizes for those who listed more than 6 ways.
5. Parallel Task: with your partner, choose one of these options to complete
   1. Explain ***why*** this is biased, and then turn it into an unbiased survey question!
   2. Consol.: What was biased about your survey? In each of the survey questions, what type of pop. would you have to question?

**Practice**(10 minutes)

1. Always-Sometimes-Never individual work

**Ways Data Collection/Presentation can be Biased**

* 1. Survey
     1. Inappropriate sample (Should middle school students be taught more comprehensive health/sexual education? Yes, No, Not Sure. Survey given to only teachers in the PDSB)
     2. Question does not include all possible options/other (What is your cultural background? Chinese, Russian, Jamaican, Japanese. Survey given to all students at TRMS.)
     3. Question asks more than one thing (In the past year have you tried out to do well on a test by studying before the test or going in for extra help? Yes No Prefer not to answer)
     4. Question difficult to understand (What is your GAN in MST? Problem Solving, Communication, Reasoning, Other. Survey given to all students in Ms. Teschow’s class)
     5. Answers are not mutually exclusive (can choose more than one answer to the question) (How old the first born child in your household? 0-5, 5-10, 10-15, 15-20, Prefer not to answer. Survey given to all students at TRMS.)
     6. Use unbalanced scales (How do you feel about the food served at McDonalds? It is…Excellent, Great, Good, Horrible, No Opinion/Not Applicable. Survey given to 200 random people walking through Square One)
  2. Graph
     1. No x or y axis label
     2. Scale doesn’t start at 0
     3. Scale doesn’t increase in equal increments
     4. Information purposely left out
     5. Choosing to use an ineffective graph

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| --- | --- |
| **Ways a survey can be biased** | **Ways a graph can be biased** |
| * Inappropriate sample * Question does not include all possible options/other * Question asks more than one thing * Question difficult to understand * Answers are not mutually exclusive (can choose more than one answer to the question) * Use unbalanced scales | * No x or y axis label * Scale doesn’t start at 0 * Scale doesn’t increase in equal increments * Information purposely left out * Choosing to use an ineffective graph |

**Lesson 11 - Character Cards**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **You are the Vice President of BP (a VERY large and successful oil company).**  There was an oil spill in the Gulf of Mexico because one of your under-ocean pipes burst. This resulted in millions of tonnes of oil being pumped into the water.  *Which graph will you use to show the public that you’re doing a GREAT job cleaning up the oil?* |  | | **You are the Vice President of Greenpeace  (a VERY large and successful environmental protection agency).**  There was an oil spill in the Gulf of Mexico because one of BP’s under-ocean gas pipes burst. This resulted in millions of tonnes of oil being pumped into the water.  *Which graph will you use to show the public that BP is NOT doing a great job cleaning up the oil?* | |
| **You are the editor of a newspaper called “The Times”.**  You want to convince all of the owners of the paper that The Times is doing well, selling a lot of papers, and therefore you should get to keep you job.  *Which graph will you use to show the owners that you’re doing a GREAT job as the editor?* |  | **You are the editor of a newspaper called “Daily Telegraph”.**  The owners have called you in to fire you today, because they believe that the competition (“The Times”) is selling many more copies.  *Which graph will you use to show that the Daily Telegraph is actually selling an amount of newspapers similar to The Times?* | |
| **The government of Ontario** is trying to convince businesses and families to use less electricity in an effort to reduce global warming. In order to do this, they would like to show Ontario a graph that clearly shows that our environment is warming up.  *Which graph will the government use to show people how warm Ontario is getting?* |  | **The businesses in Ontario** do not want to have to reduce their electricity use to help “stop global warming”, as their government is encouraging them to do. They want to show the government that temperature is NOT being affected by Global Warming.  *Which graph will they use to prove their point?* | |
| **You are a grade 8 student who REALLY wants a pair of “Beats by Dre” headphones.**  Unfortunately, you don’t have enough money to buy them yourself, so you need to convince your parents to buy them for you.  *Which graph will you use to show your parents just how great these headphones are?* |  | **You are the parent of a grade 8 student who REALLY wants a pair of “Beats by Dre” headphones.**  Unfortunately, your child doesn’t have enough money to buy them for themselves, and they’ve been bugging your for months to buy them a pair.  *Which graph will you use to show your child just how NOT great these headphones are?* | |

**Lesson 11 homework**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ class: 810

**Always-Sometimes-Never about Bias**

Carefully read the following statements about graphs. In the box next to each statement, write an A if the statement is always true, an S if it is sometimes true, and N if it is never true. Make sure you explain your reasoning for each statement.

1) If the x-axis isn’t labeled, the graph is biased.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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2) To avoid bias, there must always be the option of “other” on a survey.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3) If the vertical scale is large, the graph is biased.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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4) If some of the data gathered isn’t important, it is not biased to leave it off the graph.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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5) To avoid bias when conducting a survey, survey the entire population.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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6) If the vertical axis starts at zero, the graph is not biased.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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7) To avoid bias, the y axis on every graph should start at zero and increase in

equal increments.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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8) If I know what I want to prove BEFORE conducting my survey, my data   
 will be biased.

*Reason:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**DEFINE BIAS**

**Lesson 11 homework solutions**

**ANSWERS**

**Always-Sometimes-Never about Bias**

Carefully read the following statements about graphs. In the box next to each statement, write an A if the statement is always true, an S if it is sometimes true, and N if it is never true. Make sure you explain your reasoning for each statement.

**1) If the x-axis isn’t labelled, the graph is biased.**

**always**

*Reason:* Assuming there IS an x-axis, it must be labelled so the reader understands the graph.

**2) To avoid bias, there must always be the option of “other” on a survey.**

**sometimes**

*Reason:*  There are times when “other” doesn’t make sense. For example: What is your favourite math strand? Number Sense, Geometry, Algebra, Probabiliyt/Data, or Meausrement. But if there are more options than are listed, “other” should always be included to avoid bias.

**3) If the vertical scale is large, the graph is biased.**

**sometimes**

*Reason:* Sometimes a really large scale makes bars look small, which can be a tool used to make data look small and insignificant. Other times, the scale is large because it’s the best way to display the data. Always LOOK at the y-scale intervals and THINK about why that interval has been chosen.

VS.

**4) If some of the data gathered isn’t important, it is not biased to leave it off the graph.**

**never**

*Reason: The wording of this question is tricky. It is biased to leave information off the graph. If it has been gathered, it should be represented in the graph. For example, if you ask people their favourite sport, and NO ONE says they like soccer, it’s important to share information instead of leaving it off the final graph.*

**5) To avoid bias when conducting a survey, survey the entire population.**

**sometimes**

*Reason:* When you survey the entire population (all those the survey concerns) it is called a census. This is a good way to avoid bias. But it is sometimes not possible/reasonable to survey everyone. In those situations, it is mathematically reasonable to survey approximately 10% of the population. It should be REPRESENTATIVE – males AND females, all ages, diverse, etc.

**6) If the vertical axis starts at zero, the graph is not biased.**

**sometimes**

*Reason:* The vertical axis should always start at zero to avoid bias. Remember, though, that there are OTHER ways the graph could *still* be biased (y-axis could increase at unequal increments, the title could be misleading, etc.)

**7) To avoid bias, the y axis on every graph should start at zero and increase in**

**equal increments.**

**always**

*Reason: Assuming that there IS a y-axis, it should start at zero and increase by the same amount each time.*

**8) If I know what I want to prove BEFORE conducting my survey, my data   
 will be biased.**

**sometimes**

*Reason:* The point of conducting a survey is to collect information. You can then use the information; to prove a point, to make a decision, etc. It is ***possible***  that knowing what you **want** to prove could end up affecting your survey sample or survey question, but by carefully constructing an unbiased question and surveying a representative sample, bias can hopefully be avoided/minimized.

**DEFINE BIAS**

* “prejudice in favour of (or against) one thing, person, or group compared with another, usually in a way considered to be unfair”
* “a preconceived opinion about something or someone. A bias may be favorable or unfavorable”
* “the [action](http://dictionary.cambridge.org/dictionary/british/action) of [supporting](http://dictionary.cambridge.org/dictionary/british/supporting) or [opposing](http://dictionary.cambridge.org/dictionary/british/opposing) a [particular](http://dictionary.cambridge.org/dictionary/british/particular) [person](http://dictionary.cambridge.org/dictionary/british/person_1) or thing in an [unfair](http://dictionary.cambridge.org/dictionary/british/unfair) way, because of [allowing](http://dictionary.cambridge.org/dictionary/british/allow) [personal](http://dictionary.cambridge.org/dictionary/british/personal) [opinions](http://dictionary.cambridge.org/dictionary/british/opinion) to [influence](http://dictionary.cambridge.org/dictionary/british/influence) [your](http://dictionary.cambridge.org/dictionary/british/your) [judgment](http://dictionary.cambridge.org/dictionary/british/judgment)”