

## USGS Data Exploration Unit: Presentation 1 (KEY)

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### Opening Questions

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

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

### Presentation Questions

Fill in the questions based on information in the presentation.

Define: objective

*Objective = Not influenced by feelings, interests and prejudices; UNBIASED*

Give two examples of how you use scientific information in your life.

a) *to heal self when sick, take medicine*

b) *decide opinions on environmental issues*

*etc.*

What is good science?

*Objectivity is the key to good science.*

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*To be objective, experiments need to be designed and conducted in a way that does not introduce bias into the study.*

Define bias:

- *A prejudiced presentation of material*
- *A consistent error in estimating a value*

What are the two main types of bias?

a) *Sampling bias*

b) *Measurement bias*

What is a sample?

*Sample = A group of units selected to be “measured” from a larger group (the population).*

When is sampling bias introduced?

*Sampling bias is introduced when the sample used is not representative of the population or inappropriate for the question asked.*

What are factors that contribute to sampling bias?

*SAMPLE SIZE: Is the sample big enough to get a good average value?*

*SELECTION OF SAMPLE: Does the composition of the sample reflect the composition of the population?*

What are some ways to minimize sampling bias? Include definitions.

1. *Use a RANDOM SAMPLE = Every individual has an equal likelihood of being chosen.*
2. *Limiting the question asked to the specific group sampled.*

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What are 3 factors that contribute to measurement bias?

1. *Measurements taken correctly*
2. *No additions to the environment that will influence results*
3. *Experiment designed to separate out the affect of multiple factors*

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

*Experimental results are verified by independent duplication and publication in a peer-reviewed journal.*

*Independent duplication= Two or more scientists from different institutions investigate the same question separately and get similar results.*

*Peer-reviewed journal = A journal that publishes articles only after the articles have been checked for quality by several expert, objective scientists from different institutions.*

What are some clues that scientific information you are reading is biased? Provide examples for each clue type.

- a) *Language: Emotional appeals, scientifically-proven, strong language*
- b) *Appropriate data reported to back conclusions:*
  - *Sample and measurements are appropriate for the conclusions presented.*
  - *Multiple factors are properly accounted for to justify the interpretation of the data.*
- c) *Data Source:*

*Government Research, University Research, Corporate Research, Research done by special interest groups.*

*All organizations produce unbiased data. However, it is important to understand the organization's motivation to be able to identify potential bias. In some situations, the need to promote special interests or make profits may lead to bias.*