

## Questions

How do you recognize a faulty or erroneous argument? How do you rebut such an argument? What constitutes evidence?

## Materials Needed

For this activity, you will need the following materials:

- a pencil (do not use ink)
- the ability to read and follow directions
- familiarity with the glossary

## Points To Remember

Unless otherwise explicitly instructed, your responses must not contain personal opinions. All of your responses must be in the form of complete sentences; the fewer sentences the better. Spelling and grammar must be correct. Effective communication is essential for both learning and doing science.

Don't ask instructors for answers to questions posed in activities; you won't get them. You may ask questions regarding the clarity of the instructions or the soundness of your reasoning. If you encounter a word you are not familiar with, don't ask the instructor about it. Look it up first in your glossary and then a dictionary or some other source if necessary. Ensure that all definitions are unanimously agreed upon before proceeding. There are, of course, sound reasons for these policies. See the instructor if you have questions, but do not complain about these policies. They are not negotiable.

## 1 Recognizing Fallacies

The names of persons in the following pages are all fictitious. Any similarities to name of students in this class are purely coincidental. Feel free to change them.

### 1.1 Shifting The Burden

Steve: I was abducted by aliens and taken aboard one of their spacecraft.

Sarah: Wow! I don't believe you though.

Steve: Can you prove I wasn't abducted?

Sarah: Nope.

Steve: If you can't prove me wrong, I must be telling the truth!

1. What evidence did Steve attempt to provide to back up his claim?

In science, there is an unwritten rule requiring the person making a claim responsible for producing evidence backing up that claim. The persons hearing the claim, call them *listeners*, have no such responsibility. The listeners usually do not have the background knowledge or other sufficient information to reliably judge the claim. Steve knows in advance that Sarah doesn't know anything about aliens, so instead of backing up his own claim, he shifts the burden of backing it up onto Sarah. Steve asserts that her inability to back up his claim means it must be true and unquestionable. Steve is using the fallacy of **shifting the burden** to win the argument.

**STUDENT NOTE: Shifting the burden happens when you make someone else responsible for providing evidence support your claim. The more outrageous the claim, the more supporting evidence is required.**

## 1.2 Appeal To Emotion

Jane: Did you see that concert to raise money for the earthquake victims?

Jack: Yeah I did. Did you donate any money?

Jane: Yeah. I gave fifty dollars.

Jack: I don't have that kind of money.

Jane: You should contribute something! Didn't you see the photos? Those people looked so sad! The photos pushed me over the edge.

Jack: Oh I saw the photos, but it takes more than sad photos to make me part with fifty dollars.

2. What evidence did Jane attempt to provide to justify her monetary contribution?

3. Should Jane's evidence be trusted? Explain briefly.

4. Does Jack have a point or is he just being mean? Explain briefly.

5. By being skeptical, is Jack implying that charities in general are not worthy of financial contributions?

Emotions should never be used as evidence in science. Emotions can be manipulated by someone who knows how effective our responses to them can be. Jane is using the fallacy of **appeal to emotion** to justify her charitable contribution.

**STUDENT NOTE: Appeal to emotion involves manipulating emotions to make someone behave a certain way or to do something they normally would not do.**

6. What evidence, not based on emotion, could Jane have used to convince Jack to donate some money?

### 1.3 Appeal To The Past

Barry: Basic physics hasn't changed in over a hundred years. I see no reason to change the way it's taught.

Becky: Haven't you heard of new pedagogical techniques?

Barry: Yeah, but it's been done the same for generations so we shouldn't change that.

7. What evidence did Barry attempt to provide to back up his claim?

8. Should Barry's evidence be trusted?

Just because something, in this case teaching physics, has been done a certain way for a long time does not mean that way is good. It also does not mean that way is bad either. Barry is using the fallacy of **appeal to the past** to justify not changing the way physics is taught.

**STUDENT NOTE: Appeal to the past is a justification based only on the way something has been done in the past.**

9. What evidence could Barry have cited to convince Becky his claim is true?

#### 1.4 Appeal To Novelty

Lisa: Teaching science by inquiry is a relatively new pedagogical strategy. It's better than existing methods.

Liam: So, what are you suggesting?

Lisa: I'm suggesting that we should adopt inquiry-based instruction. After all, it's the newest thing.

Liam: Change isn't a bad thing. Let's do it!

10. What evidence did Lisa provide to back up her claim?

11. Should Lisa's evidence be trusted?

Just because something, in this case a teaching method, is new does not mean it is good. It also does not mean it is bad either. Lisa is using the fallacy of **appeal to novelty** to justify adopting a new teaching method.

**STUDENT NOTE: Appeal to novelty is a justification that something is good only because it is new.**

12. What evidence could Lisa cite to convince Liam her claim is true?

## 1.5 Appeal To The People

David: As a creationist, I can tell you that a recent poll shows that approximately half of all Americans think evolution is wrong. That's approximately one hundred-fifty million people! That many people can't be wrong. Therefore, evolution is wrong and should be replaced by something with which more people agree.

13. What evidence did David attempt to provide to back up his argument?

14. Should David's evidence be trusted?

A claim or argument may be wrong regardless of how many people agree or disagree with it. Science is not determined purely by popular consensus. David is using the fallacy of **appeal to the people** or **appeal to the masses** to justify evolution's correctness.

**STUDENT NOTE: Appeal to the people means justifying a claim or argument based on popular consensus.**

15. What evidence could David cite that his conclusion is true?

## 1.6 Appeal To Logic

Karen: How can I prove that sixty-four divided by sixteen is equal to four?

Karle: That's simple. Write  $64/16$  and cancel out the 6. You're left with  $4/1$ , which is just equal to 4.

Karen: Makes sense to me!

16. What evidence did Karle attempt to provide to back up his argument?

17. Should Karle's evidence be trusted?

One might think that logic always leads to correct conclusions, but this is not true! Although one step may follow logically from another, all steps must be correct for the conclusion to be correct. In other words, in a long "chain" of reasoning, every individual "link" must be correct for the conclusion to be correct. No intermediate step can violate an existing or established framework (frameworks are discussed in a previous activity). Every premise must be true. With a false premise, anything, no matter how outrageous, can be logically "proven." Karle is using the fallacy of **appeal to logic** to justify his conclusion.

**STUDENT NOTE:** Appeal to logic is using a seemingly logically connected series of steps to justify a claim or argument, but one or more of the steps or premises is wrong or violates an existing framework.

18. How should Karen respond to Karle?

### 1.7 Appeal To Ignorance

Johnny: Do we have any evidence at all that life exists on other planets?

Lonnie: I've searched the literature extensively and there is no such evidence.

Johnny: So that means we don't know for sure?

Lonnie: It just means there is no evidence that life exists elsewhere.

Johnny: That suggests that it must exist then if we can't establish that it doesn't exist.

19. What evidence did Johnny attempt to provide to back up his argument?

**STUDENT NOTE:** You may find your answer difficult to articulate. Think carefully about it.

The lack of evidence for something is not equivalent to the presence of evidence for neither that something nor an alternative to that something. This can be tricky to think about, so read that last sentence again slowly and carefully. Johnny is using the fallacy of **appeal to ignorance** to justify his conclusion. The words *ignorance* or *ignorant* should never be taken as an insult (although they are frequently intended to be taken that way by people who are ignorant of the words' actual meanings). It simply implies a lack of knowledge. Everyone is ignorant of something; no one knows everything there is to know. Ignorance, lack of knowledge, is never a substitute for knowledge.

**STUDENT NOTE: Appeal to ignorance means using the lack of evidence for something as the presence of evidence for that something or an alternative to that something.**

20. How should Lonnie respond to Johnny?

21. Has Lonnie established conclusively whether or not life exists on other planets? Explain briefly.

## 1.8 Argument By Repetition

Joe: Two plus two equals five.

Steve: You're crazy! Two plus two is four, not five.

Joe: Two plus two equals five. Two plus two equals five. Two plus two equals five. Two plus two equals five.

Steve: Idiot!

Weeks later on a test, Joe asked, "What is two plus two?"

Steve wrote, "Two plus two equals five."

Joe says in class, "Steve has learned that two plus two equals five. I'm a great teacher!"

22. What evidence did Joe attempt to provide to back up his "teaching?" (note the quotes)

This was a rather silly example, but many times in real life people use repetition, rather than evidence, as a way to get their point across and to make other people agree with them. Politicians are especially well

trained in this tactic and regularly exploit it. Much of your previous education was probably based almost entirely upon repetition rather than evidence-based explanations, especially if you attended public schools.

In this example, Joe incorrectly assumed that Steve had *learned* simple addition based on a correct answer on a test. More likely, though, Steve knew that to get the credit, he had to give an expected answer rather than a correct and reasoned answer. Sometimes repetition is needed to master certain skills. It is used in this very activity! By itself, repetition is never a good replacement for evidence in arguing one's point.

**STUDENT NOTE: Argument by repetition means using repetition as a substitute for evidence.**

23. How should Steve respond to Joe's claim in class?

## 1.9 Attacking The Person

Senator Snort: This science bill is just another part of the liberal agenda and must be defeated!

24. What evidence did Sen. Snort attempt to provide to back up his claim that the science bill must be defeated?

When arguing against a claim, a common strategy is to associate a negative label to the claim. This establishes a mental connection between the label and the claim and has nothing to do with the claim at all. The negative association is all that matters, and many people will be persuaded to reject the claim based entirely on the label. This is nothing more than an adult version of childhood **name calling**. One would think that adults could argue their points without resorting to such tactics, but name calling is used all the time. Almost all political campaigns rely on it. At this level, we call name calling **attacking the person** or an **ad hominem** attack. It is really nothing more than name calling used in place of evidence.

**STUDENT NOTE: Attacking the person means resorting to name calling, however subtle, as a substitute for evidence in arguing one's point.**

25. How should the bill's supporters respond to Sen. Snort's comment?

### 1.10 Strawman Argument or Changing The Subject

Chana: We discussed the Big Bang model in cosmology class today. Do you know how much of our Universe it correctly explains?

Carol: Hah! It's wrong!

Chana: Why? How do you know?

Carol: The Universe had to have come from something. You can't get something from nothing. You can only get something from something.

Chana: What does this have to do with the Universe?

Carol: Well, it means the Big Bang model must be wrong because it says the Universe, which is something, came from nothing.

26. What evidence did Carol attempt to provide for her claim that the Big Bang model must be wrong?

This is a frequently heard argument against the Big Bang model's content. Carol is subtly, and maybe even unknowingly, changing the subject away from the Big Bang model to another claim entirely, the subject of getting something from nothing. These are two very different claims. After changing the subject, Carol then attacks the **new subject** rather than the original claim that the Big Bang model is incorrect. That way, Carol never has to actually address that claim. Brilliant! This tactic is called establishing a **strawman argument**. It is basically nothing more than changing the subject and then attacking the new subject rather than the old subject.

**STUDENT NOTE: A strawman argument results from changing from one subject to a new subject, and then attacking the new subject while never actually addressing the old subject.**

27. How should Chana respond to Carol?

### 1.11 False Premise

Clark: Everything that happens and that we observe must have a cause. If the Big Bang really happened, then it too must have had a cause. Cosmologists can't tell us what caused the Big Bang. Therefore, the Big Bang model must be wrong.

Rusty: That doesn't make sense.

Clark: Why?

28. What evidence did Clark attempt to provide for his conclusion that the Big Bang model must be wrong?

Sometimes we try to establish a conclusion by logical argument. When any step in the argument is incorrect, we have the fallacy of **appeal to logic** which is described in a previous example. When the very first premise is incorrect, we call this fallacy **false premise**. It is one thing to commit an error within a series of logical steps, but it is quite another to begin with a false premise. If you begin with a false premise, there is no limit to the things which can be incorrectly established.

**STUDENT NOTE: False premise means beginning a logical argument with a premise that is not true.**

29. How should Rusty respond to Clark?

A tactic frequently used by those who rely on this fallacy to support their own conclusion is to forbid others to use this fallacy against them. Consider the false premise in the argument above, namely that everything must have a cause. The people who most often use this fallacy use it to conclude that a supernatural being created and oversees our Universe. However, they refuse to address what caused this being to exist. They answer that this being has just “always been” and thus violate their own premise. They are selectively calling a fallacy on other people’s arguments but not allowing it on their own, which is a common strategy.

## 1.12 Hasty Generalization

Dana: The last science course I took at a community college was a joke. Astronomy will be just as easy.

Dani: Are you sure about that.

Dana: Yep. Why shouldn’t I be?

Dani: Astronomy may be different.

Dana. Nah. All community college science courses are the same.

30. What evidence did Dana cite to back up the conclusion that all community college science courses are the same?

It is easy to let past experiences cloud our judgement of the present, and we tend to do just that. However, a bad experience with one thing in no way means that all such things will also give a bad experience. The same is true of good experiences. We hastily jump to such assumptions in the absence of evidence.

**STUDENT NOTE: Hasty generalization means assuming that a good or bad experience with a particular thing will be the same for all such things without any evidence to support that assumption.**

Note that this fallacy goes from the specific to the general, and this is the key to recognizing this fallacy in someone's reasoning.

31. How should Dani respond to Dana?

### 1.13 Loaded Question

TV host: Good evening. On tonight's show we take up the topic of evolution and why it should not be taught.

Shawn (watching at home): Just how long are we going to allow science teachers to get away with this fraud that is evolution?

Sharon (watching at home): Well . . .

32. What two issues does Shawn's question address?

Now, something interesting happened here. Consider the possible answers to Shawn's question. Shawn asserts that teaching evolution constitutes fraud, and that should be the main issue here. It isn't though, because Shawn has cleverly (perhaps unknowingly) made the issue one of how long the fraud is to be perpetuated. One week? One month? One year? There is no good answer. Fraud is bad no matter how long it endures. In other words, this question has no satisfactory answer. No answer will appease Shawn because the conclusion has already been established. This is an example of a **loaded question**.

33. How should Sharon respond to Shawn?

**STUDENT NOTE: A loaded question is one for which there is no satisfactory answer to a discreetly implied foregone conclusion.**

Here are more examples of this fallacy: Do you support the troops protecting your freedom? Why are you angry at God? Why are you so angry? Why do you hate America? Are you still an alcoholic?

### 1.14 Taking Offense

TV host: You mean to tell me that your work on extraterrestrial life has never been peer reviewed?

Guest: I'm outraged that you would bring that up! You've offended me and this interview is over!

People sometimes resort to desperate tactics when backed into a corner. Here, the host asked a legitimate question that the guest should be able to calmly answer. Instead, the guest ends the discussion with the claim of being offended. Words can evoke anger, melancholy, rage, happiness, or even comfort. Offense, you must understand, is nothing more than a way of immediately shutting down all discussion. It is frequently used to avoid having to justify claims or arguments or to avoid answering questions. It is the one fallacy for which there is no recovery or rebuttal. It is final, and the person claiming offense always wins, at least in his or her mind.

### 1.15 False Dilemma

Tom: Well, I'll either get an A or an F in astronomy.

Ray: Hmm. I think you're wrong about that.

Tom: How so?

Sometimes when presented with a choice, we forget that there may be more than two options. When we do this, we commit a false dilemma. It's false because there really are more than two options.

34. How should Ray respond to Tom?

**STUDENT NOTE: False dilemma means presenting only two options for a choice when there are really more than two options.**

Be careful! If there really are only two options, then presenting them does not constitute a fallacy.

35. Rephrase Tom's first comment so that is not fallacious. (HINT: Assume that incompletes are not allowed at Tom's college.)

## 2 Evidence

You have been asked a lot about *evidence* in this activity, but you have not been explicitly asked to define *evidence*. One reason is that evidence is rather difficult to define. Take some time now to discuss this in your groups.

36. In the space provided, make an attempt to operationally define *evidence* in terms of what things (for lack of a better word) do and do not constitute valid evidence. For example, would you consider a person's memory of an event to be valid evidence that the event really happened? Would you consider a photograph to be valid evidence? Would you consider a mathematical equation to be valid evidence?

### 3 Responding To Fallacies

In general, a fallacy is an error in reasoning that may or may not lead to an erroneous conclusion. Some fallacies are better classified as distraction techniques or strategies. There are literally hundreds of classified fallacies and you have only seen a small number of them here.

37. For each example you saw, you were asked for a response to the person committing the fallacy. Take a few minutes to compare your responses with those from other groups. Make any notes in the space provided.

Generally, the best way to respond to a fallacy is to point it out. With distraction techniques such as taking offense this is usually all that can be done. In situations where there is evidence to counter a fallacious claim or argument, that evidence should be presented immediately. Some people use fallacies to lure you into discussion or “debate” (note the quotes) to make you look foolish. This is especially true with people addressing the fictitious overlap of religion and science.

38. Take a few minutes to think of some situations where fallacies are used this way and list them here.

———— CHECKPOINT ————

What could be done to make this activity more interesting? Please be honest.

LCTTA Activity  
Student Version