Lesson Plan

DIGITAL PUBLIC SQUARE

MediaSmarts

Grades: 9-12

About the the Author:
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Duration:
2 1/2 to 3 hours, plus time for the assessment task

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Consensus or Conspiracy?

This lesson is part of *USE, UNDERSTAND & ENGAGE: A Digital Media Literacy Framework for Canadian Schools:* https://mediasmarts.ca/teacher-resources/use-understand-engage-digital-media-literacy-framework-canadian-schools.

Overview

In this lesson, students learn the **definition of *scientific consensus*** and **distinguish it from conventional wisdom.** They explore how consensus is formed and how new data can lead to it changing. Students then use digital tools to identify the consensus on a topic. Next, students learn how fringe theories can do harm and learn the characteristics of a conspiracy theory. Finally, students show their learning through creating a graphic organizer; in an optional activity, students then adapt the graphic organizer to a poster showing how to recognize a conspiracy theory.

Learning Outcomes

Students will:

- Use digital tools to identify whether or not there is a consensus on a particular topic and, if so, what it is
- Identify and reflect on social and cognitive influences that may inhibit critical thinking
- Understand how false and misleading information can do harm
- Find information needed for their tasks and avoid unwanted or irrelevant content
- Actively seek out information that provides new perspectives and viewpoints
- Search or navigate within a source to find and select relevant information
- Identify relevant and irrelevant and more or less valuable information
- Find information that supports or challenges a position or point of view
- Compare and evaluate arguments, evidence, models and theories
- Evaluate the expertise or authority of a source of information

- Understand the benefits and drawbacks of collectively authored information sources such as wikis and review
- Take active steps to make conscious use of networked tools
- Contribute to a positive information landscape

Preparation and Materials

Prepare to distribute the parent information sheet *Know It Or Not?* Background for Parents and Guardians

Prepare to distribute the following handouts:

Know It Or Not

Scientific Consensus

Changing Consensus

Checking Consensus

Conspiracy Theories

Prepare to project or distribute the following graphics, or access them as slides at www.learn.knowitornot.com**:**

Defining a Concept

Defining a Concept: Vaccines

Defining a Concept: Consensus

Prepare to distribute the assignment sheet *Defining Conspiracy Theories*

Ensure that students have access to internet-capable devices and can access the *Know It Or Not* game www.learn.knowitornot.com.

Review the following teacher backgrounders:

Know It Or Not (Teacher's Version)

Changing Consensus (Teacher's Version)

Defining a Concept: Consensus (Teacher's Version)

Talking About Controversial Issues in the Classroom

Procedure

Know It Or Not? Facts and Myths About COVID-19

Distribute the worksheet *Know It Or Not* and have students complete the *Know It Or Not* game. Depending on what devices and internet access are available, you may choose to have students complete the game and worksheet individually or in pairs.

You may wish to have students complete the game and worksheet at home the night before rather than in class. (The game takes about five to ten minutes to complete.)

Take up the *Know It Or Not* worksheet. After reminding students that they do not have to share any answers they do not want to, take up the questions on the worksheet and then ask:

- Which of the claims (either true or false) had they heard (or read or seen) before?
- Had they heard more true or false claims before? If so, can they remember where? Had anyone seen a news story (either in print, online, in other media such as TV or radio, or shared on social media) that included one?
- Was there anything in the game that surprised them? Why or why not?

Now ask students how we know that the facts in the game are correct. How do we know that a vaccine is safe and effective? How do we find out if a new medical approach, like mRNA vaccines, works and has minimal side effects? How can we be sure that our understanding of how diseases work – which is the basis for the use of vaccines to prepare the immune system to fight viruses – is correct and earlier theories that we've abandoned are not?

Scientific Consensus

Let students discuss this for a few minutes and then, if no student has mentioned it, introduce the idea of scientific consensus. First ask students what they think the word consensus means (general agreement on a topic) and then explain the difference between consensus in the everyday sense and scientific consensus:

- consensus in the everyday sense means what most people think is true or correct (for instance, nearly all Canadians agree that you should have to be vaccinated against COVID-19 to do some jobs or activities);
- *scientific consensus* means what the *weight of evidence* in a field suggests is most likely true. There can be consensus on a *fact or on a theory* (an explanation of how something works or why something happens.)
  - Public health authorities draw on the scientific consensus to make decisions about how to prevent people from getting sick and how to treat diseases.

Now distribute the worksheet *Scientific Consensus* and go through the first section together with the class:

- Scientific consensus isn't only found in science. Any field that bases conclusions on evidence will have consensus. For instance, there is a *historical consensus* about what happened in the past that is based on the sources that are available to us (documents, artifacts, oral traditions, etc.) and that may change if new evidence is discovered.
- We can look at science as a constant process of testing the consensus. Each new piece of evidence either helps to *build* a consensus (if there wasn't one before), *supports* an existing consensus, or *challenges* it. But evidence that challenges the existing consensus doesn't automatically support a different theory!
- In medicine, the consensus that a treatment works and is effective initially comes through *clinical trials*.
  - By the time a treatment has been through clinical trials and found to be safe and effective it will have been tested on many people.
  - All COVID-19 vaccines approved by Health Canada have gone through every step of clinical trials and were tested with over 100,000 people.
  - Public health authorities also measure effectiveness and watch out for side effects after a treatment has been rolled out.
  - There have been nine billion doses of different COVID-19 vaccines administered worldwide.
- Consensus is not absolute. Depending on how much evidence there is, consensus may be stronger or weaker on different topics. As well, new evidence can challenge the consensus.
- Consensus can change when we have new evidence. However, while a single piece of new evidence is sometimes enough to change the consensus, in general the consensus won't change until the evidence against it outweighs the evidence for it.

- Sometimes, what looks like consensus is really conventional wisdom – a belief based on tradition and "common sense" in a field rather than actual evidence. Because *conventional wisdom* isn't actually based on evidence, it can often be harder for new evidence to change it than it is to change genuine consensus.
- The scientific consensus isn't always right, but because it's based on the weight of evidence, a claim that is supported by the consensus is much more likely to be right than one that isn't. If you're not an expert in a particular field, the best way to find out if a claim is likely to be true is to ask these questions:
  - Is there a scientific consensus on this? (Remember a scientific consensus is based on evidence, not just "conventional wisdom.") If so, what is it? How strong is it?
  - If there is a consensus, does this claim support it or challenge it?

If there is a consensus and the claim supports it, the claim is likely to be true.

If there is a ***strong*** consensus and the claim challenges it, the claim is unlikely to be true.

If there is a ***weak*** consensus and the claim challenges it, find out who is making the claim. If they are an expert **in that field**, the claim *may* be true. If they are **not** an expert in that field, it probably isn't!

Changing Consensus

Next, read through the capsule articles *Stomach Ulcers* and *Five-Second Rule* with the class.

After each one, ask:

- What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?
- What is the current consensus? How strong does it seem?
- What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?

Use the teacher backgrounder *Changing Consensus* (Teacher's Version) to take up the questions.

Now place students in pairs and assign one of the remaining examples to each pair. (It's all right if more than one pair reads the same example.) Have students read their example and answer the same questions, then take them up with the class using the backgrounder *Changing Consensus: Teacher's Version*.

Next, ask students if they noticed any patterns in the stories. Make sure the following points come up:

- Scientific consensus usually changes fairly quickly when the evidence is strong
- In a quickly changing situation, like when a new virus is spreading, the consensus may change several times as new evidence appears
- Even though conventional wisdom isn't based on evidence, it's often harder to change it than to change scientific consensus
- Scientists are more resistant to challenges to the consensus that come from scientists outside their field. However, when the evidence is convincing the consensus will change

- In those cases, though, it's important to note that the challenges to the consensus still came from scientists.
    - A change in scientific consensus does not always mean that the general public will change what they think or believe. People who have an interest in undermining the consensus sometimes do things to slow down acceptance of the scientific consensus.

Now project or distribute *Defining a Concept*, and explain that you will be making a graphic representation of the idea of "consensus." Explain that this graphic will have five parts: the name of the idea (in the middle), some examples of the idea, some things that are similar but not examples, the essential elements of the idea, and the most interesting or relevant facts about the idea being described.

Next, project or distribute *Defining a Concept: Vaccines* and go through it as an example of this graphic organizer.

Then project or distribute *Defining a Concept: Consensus* (or draw it on a blackboard) and have the class work together to develop a graphic explanation of the idea of "consensus." (You can either use the template included in this lesson plan or access the Google Slides version at www.learn.knowitornot.com.) Your final product should look similar to the *Defining a Concept: Consensus (Teacher's Version)* teacher backgrounder.

Checking Consensus

Point out to students that since you need to check any new claim against the consensus in that field, it's important to be able to find out what the consensus is. How can we do that?

- Some students are likely to suggest using a search engine such as Google. Ask them why this might not be the best way to find scientific consensus.
- Make sure the point is raised that because Google and similar tools search the whole internet, it can be hard to tell if the results you see come from an expert or authority on the topic.
- As well, groups that spread misinformation use different techniques to "game" or manipulate results on search engines and video sites, then encourage you to "do your own research."
    - Searching just sources that you know are reliable is a good way to find consensus, but expert sources are often aimed at experts (who already know the consensus) and are usually written at a very advanced reading level.
    - Ask students if they can suggest any sources that they know are reliable but are written for general audiences (for example, magazines for adults such as *Scientific American* or *National Geographic*, or ones aimed at younger readers such as *National Geographic Kids*.)
- Encyclopedias are all about consensus because they try to give an overview of what experts on a subject think.
    - There are traditional encyclopedias (like Encyclopedia Britannica) available online, but many students turn to Wikipedia first. A good Wikipedia article reflects the consensus between the editors who have worked on an article, but not all Wikipedia articles are good. Ask students if they know how to tell if a Wikipedia article is reliable.

Project or distribute the worksheet *Checking Consensus* and go through it with the class. Point out that by only looking at sites that are known to be reliable, the Consensus Search Engine makes it easier to find out the consensus on a topic.

Consensus or Conspiracy?

Now have students return to their pairs and do the "Who built the pyramids?" exercise on the *Checking Consensus* worksheet, with each pair competing to be the first to find out the consensus on who built the Egyptian pyramids (the ancient Egyptians; the consensus is strong, with no significant alternate views), what they were built for (there is a strong consensus they were tombs) and how they were built (there is not a strong consensus; recent evidence suggests many of the materials were moved by barges or on moistened sand and then put in place with ramps of earth, but this is not certain.)

Now ask students if they have ever heard of the theory that the pyramids were built by space aliens. There are many books, websites and videos that suggest this, but it's not mentioned in the Wikipedia articles or any of the other sources that the School Search Engine looks at.

Remind students of the attempts to undermine consensus around tobacco and lung cancer and climate change they read about during the *Changing Consensus* exercise.

Explain that when there is a clear consensus, giving time to fringe theories can actually do harm because if people don't realize how strong the consensus is, they might not do things that will help them or other people (for instance, spreading doubt about the consensus on tobacco and lung cancer meant a lot of people kept smoking and later got cancer and other diseases like emphysema.)

Tell students that sometimes people try to spread doubt about a consensus because they genuinely believe it is wrong, but often – as in the case of tobacco or fossil fuel companies – it is for money as well.

Besides protecting an industry's bottom line, people can make money selling "alternate" treatments – one vaccine denier makes 15 million dollars a year selling treatments, books and other products – and also by selling advertising on their website or their videos.

Tell students that another harm of denying a clear consensus – even if someone says they're "just asking questions" – is that it implies there is a conspiracy at work to cover up the truth or suppress debate.

For example, if you believe the world is really flat, then a lot of people – from scientists to mapmakers to airline pilots – must be covering it up; similarly, while it is true that some pharmaceutical companies have acted unethically in the past, COVID-19 vaccines have been approved by health authorities in dozens of countries, which would all have to be "in on" any conspiracy.

Distribute the handout *Conspiracy Theories* and go through the characteristics of a conspiracy theory with the class.

Assessment Task: Defining Conspiracy Theories

Distribute the assignment sheet *Defining Conspiracy Theories* and go through it with the class. Have each student complete a graphic organizer that describes conspiracy theories in the same way.

You can use the *Defining Conspiracy Theories* rubric to assess both their graphic organizer and their contributions during class.

Optional: Have students create posters or infographics that communicate how to spot a conspiracy theory.

Know It Or Not?

Background for Parents and Guardians

Dear Parent / Guardian

Your child's class will soon be participating in one or more of the lessons in ***Know It Or Not?***, a program developed by **MediaSmarts**, Canada's Centre for Digital and Media Literacy, and **Digital Public Square**, a not-for-profit dedicated to helping communities become more inclusive, responsive, and better equipped to change lives with good technology.

Know It Or Not? has been created to help students in Grades 7 to 12 become more resilient to misinformation and common misconceptions related to public health. Our goal is that by providing effective and tailored refutations of COVID-19 vaccine misinformation, we can begin to build media literacy skills including reflection, discovery, and investigation, that help build resilience to future misinformation.

The Program

The ***Know it or Not?*** program is designed for the classroom and to be delivered by your child's classroom teacher. It includes both teacher training materials and lesson plans. The lessons your child may be participating in include:

Do Sharks Love Ice Cream?: This lesson will teach students how science is represented in news media. Students will learn how science news articles are written and how to critically analyze them, and then use these skills to write a news article about a scientific discovery.

Consensus or Conspiracy?: This lesson teaches students what scientific consensus is, how it can change as part of the scientific process, and how to identify the scientific consensus on a topic and to compare new claims or discoveries to the consensus. Students also learn how fringe beliefs can contribute to belief in conspiracy theories and then explore how to recognize the hallmarks of a conspiracy theory.

Why We Created the Program

In 2020, Digital Public Square developed and evaluated two digital game interventions to correct misinformation related to COVID-19 in Canada and the US. These tools include *It's Contagious*, which is focused on COVID-19 misinformation, and ***Know It Or Not?***, which is designed to counter misinformation and misconceptions about COVID-19 vaccines.

Almost 200,000 participants played these gamified platforms, and two randomized control trials assessed the effects of each digital game intervention. We found that the games helped participants learn and remember important information about COVID-19 and vaccination. These findings held true for a range of key demographics, including young participants aged 15-24 and those who self-identified as Métis, Inuit, or First Nations.

The ***Know It Or Not?*** program was created to help students find and recognize good information about health and science, understand the risks of misinformation and disinformation, and providing them with the tools they need to make good choices about personal and public health. Both of the lessons have been designed to meet learning expectations found in the official curriculum of your province or territory.

We hope that you will talk with your child about the activities they will be doing during these lessons. If you would like to try playing the ***Know It Or Not?*** game, either by yourself or with your child, you can access it at www.learn.knowitornot.com. Within the game you will be able to access the Privacy Policy and Terms of Use. Together, we can help them develop the positive skills and attitudes they need to become resilient to misinformation.

To learn more about MediaSmarts and Digital Public Square, visit their websites at www.mediasmarts.ca and www.digitalpublicsquare.org.

If you have any questions about this program, please contact MediaSmarts by email at **info@mediasmarts.ca** or by phone at **1-800-896-3342** (toll-free in Canada).

Resources for Parents

If you have concerns or would like more information about finding and recognizing reliable information on science and public health, here are some good sources:

Check First, Share After (https://checkthenshare.ca/) provides information on how to find good sources and stop the spread of misinformation.

It includes a custom search engine (which you can access directly at http://bit.ly/publichealthsearch) that searches more than a dozen public health authorities in Canada and around the world.

Break the Fake (https://mediasmarts.ca/break-fake) teaches four simple ways to find out if something you see online is true or not. It includes quizzes, short videos, tipsheets, a workshop and a self-directed tutorial featuring the North American House Hippo.

How to Tell Fact from Fake Online: A Reality Check guide (https://mediasmarts.ca/teacher-resources/how-tell-fact-fake-online-reality-check-guide) offers fact-checking tips that will take you a minute or less to do.

How to Search the Internet Effectively (https://mediasmarts.ca/tipsheet/how-search-internet-effectively) explores search skills so that you don't end up overwhelmed with too many search results, underwhelmed with too few, or simply unable to locate the material that you need.

Navigate Online Information, one of MediaSmarts' DigitalSmarts workshops, teaches search skills, how to choose different online sources of information for different needs, and how to verify information you see online. For more information on the DigitalSmarts program you can visit https://mediasmarts.ca/digital-media-literacy/e-tutorials/digitalsmarts or call 1-800-896-3342 (toll-free in Canada).

Know It Or Not?

How much do you know about COVID-19 vaccines?

Play the ***Know It Or Not*** game at www.learn.knowitornot.com to find out. Once you've played it through, answer these questions. **You will not be asked to share any of your answers if you don't want to.**

1. How many of the things in the game (either **TRUE** or **FALSE** ones) had you ever heard of before? Which were they?

2. Have you heard any of the **FALSE** things from people you know (either in person or online)? If so, which ones?

3. If you have heard any of the **TRUE** things before, where did you hear (or read or see) them?

4. Was there anything in the game that surprised you? What was it? Why did it surprise you?

5. Did you click on the **View Sources** button for any of the questions? If so, what did you learn?

6. If you wanted to find out more about any of the things in this game, how would you do it?

Scientific Consensus

***Scientific consensus* doesn't mean what scientists think is true.** It means what all the evidence on a topic suggests is true.

- Scientific consensus isn't only found in science. Any field that bases conclusions on evidence will have consensus. For instance, there is a ***historical consensus*** about what happened in the past based on the sources that are available to us (documents, artifacts, oral traditions, etc.) that might change if new evidence is discovered.
- We can look at science as a constant ***process of testing*** the consensus. Each new piece of evidence either helps to build a consensus (if there wasn't one before), supports an existing consensus or challenges it. But evidence that challenges the existing consensus doesn't automatically support a different theory!
- In medicine, the consensus that a treatment works and is effective initially comes through ***clinical trials***.
  - By the time a treatment has been through clinical trials and found to be safe and effective it will have been tested on many people
- All COVID-19 vaccines approved by Health Canada have gone through every step of clinical trials and were tested with over 100,000 people.
  - Public health authorities also measure effectiveness and watch out for side effects after a treatment has been rolled out.
- There have been nine billion doses of different COVID-19 vaccines administered worldwide.
- Consensus is not all-or-nothing. Depending on how much evidence there is, consensus may be stronger or weaker on different topics.
- Consensus can change when we have new evidence. However, while a single piece of new evidence is sometimes enough to change the consensus, in general the consensus won't change until the evidence against it outweighs the evidence for it.
- Sometimes, what looks like consensus is really ***conventional wisdom*** – a belief based on tradition and "common sense" in a field rather than actual evidence. Because conventional wisdom isn't actually based on evidence, it can often be harder for new evidence to change it than it is to change genuine consensus.
- The strength of science as a way of understanding the universe is its ability to self-correct. So the fact that the scientific consensus on something has changed isn't a sign that science can't be trusted, it's a sign that science is working the way it's supposed to.
- The scientific consensus isn't always right, but because it's based on the weight of evidence a claim that is supported by the consensus is much more likely to be right than one that isn't. If you're not an expert in a particular field, the best way to find out if a claim is likely to be true is to ask these questions:
- Is there a scientific consensus on this? (Remember a scientific consensus is based on evidence, not just "conventional wisdom.") If so, what is it? How strong is it?
  - If there is a consensus, does this claim support it or challenge it?

If there is a **consensus** and the claim **supports** it, the claim is likely to be true.

If there is a **strong consensus** and the claim **challenges** it, the claim is unlikely to be true.

If there is a **weak consensus** and the claim **challenges** it, find out who is making the claim. If they are an expert **in that field**, the claim ***may*** be true. If they are not an expert in that field, it probably isn't!

Changing Consensus

Here are some examples of how scientific consensus has changed or developed in the past.

For each of these examples, answer the following questions:

1. What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?
2. What is the current consensus? How strong does it seem?
3. What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?

Stomach Ulcers

Stomach ulcers are breaks in the inner lining of the stomach. They usually cause a painful sensation that feels like burning, and sometimes can cause vomiting or bleeding. For many years scientists thought these were caused by stress and spicy food. Because of this, doctors prescribed antacids and a reduced diet. This reduced the symptoms but did not cure the ulcers.

Starting in 1982, Barry Marshall and Robin Warren began to study the possibility that ulcers might be caused by bacteria. They were able to give rats ulcers by exposing them to the bacteria and also able to cure the ulcers with antibiotics. They found the same bacteria in children with ulcers and published a paper on their findings in 1987. By 1990, antibiotics were part of the recommended treatment for stomach ulcers.

Five-Second Rule

Many kids have grown up with the "five-second rule" that says dropped food only gets contaminated after five seconds on the floor. It was never tested scientifically until 2003, when Jillian Clarke found that some foods, like bread, were contaminated by bacteria as soon as they touched the ground. In 2017 researchers repeated the experiment with different foods and also found that there was some contamination right away. While no later research has challenged these findings, the "rule" is still widely believed.

Heliocentrism

While it was well known that the Earth was round, up until the late Middle Ages most astronomers believed that the sun went around the Earth. This was supported by the observations that were possible at the time, since the sun appears to cross the sky over the course of the day. Better observations of the night sky began to raise problems with this model because some planets appeared to move backwards and go in loops over the course of the year. In the 16th century Nikolaus Copernicus showed that this could be explained by putting the Sun, rather than the Earth, at the center of the solar system. Other astronomers, particularly Tycho Brahe, did not accept his theory and developed other models to explain how the planets moved. In the early 17th century, however, Galileo Galilei used the recently invented telescope to show that other planets had their own moons (which revolved around them and not the Earth).

While Galileo was put on trial by religious authorities for his theory, other scientists quickly recognized that it was better supported by the evidence and by the end of the 17th century it was accepted by nearly all astronomers. While it has since been found that there are other solar systems that orbit around their own suns, there have not been any serious challenges to the model that the Earth and the other planets in our solar system go around our sun.

Climate Change

Fossils found in the 18th century made it clear that the climate had changed repeatedly over the Earth's history. However, it was not clear why this was. In 1820, Joseph Fourier proposed the "greenhouse effect," in which gases like carbon dioxide in the atmosphere can keep it from cooling. Before computers it was not possible to make the kind of complex models that would prove this. Many scientists felt that the atmosphere regulated itself and that climate change over time was caused by different things, though there were always some that supported the greenhouse effect.

Starting in the 1950s, better instruments and powerful computers made it possible to make accurate models of how the atmosphere held or lost heat. It was soon clear that more carbon dioxide in the atmosphere raised the average temperature of the Earth, and that the increase in carbon dioxide from burning fossil fuels would make the world much warmer. These findings were widely accepted by scientists by the 1990s. At the same time, fossil fuel companies ran ad campaigns and other efforts to suggest it was "just a theory." As a result, while 97% of scientists agree that burning fossil fuels is causing climate change, just 80% of the general public does.

Formation of the Continents

Fossils found in the 18th century made it clear that the Earth had changed a lot over its history. Because evidence showed that the Earth's crust had cooled over time, it was generally thought that these changes had been caused by the crust cracking and wrinkling. Other changes were explained by erosion. In 1912 Alfred Wegener, a meteorologist, found that there were very similar fossils and rocks on both sides of the Atlantic Ocean, and developed his theory that the continents had started out as a single mass and then "drifted." He was not sure what could cause this, however.

While some geologists thought his theory was worth investigating, many felt he had not provided enough evidence to support it. It was mostly dismissed for the first half of the 20th century. Some also did not think Wegener understood the subject because he was not a geologist. In the 1960s underwater research discovered ridges on the bottom of the ocean that spread apart as magma poured out of them and created new crust. This led to the discovery of tectonic plates that float on the Earth's molten mantle and are in constant (slow) motion, as Wegener's theory suggested. By 1970 this theory, now called plate tectonics, was the accepted explanation of how the continents change, and it still is today.

Fighting Forest Fires

Indigenous peoples of North America prevented large forest fires by lighting controlled fires. This kept the supply of fuel from building up, so that when wildfires started they did not get too big or grow too quickly. When European settlers took over Indigenous lands, however, they tried to put out all wildfires as soon as they started. Several large fires around the beginning of the 20th century helped form the belief that forest fires should be stopped at all costs. The US Forest Service aimed to put out every wildfire by 10 AM on the day after it started.

In the 1960s it was discovered that wildfires were an important part of the life cycle of forests. For example, new giant sequoia tress could not grow without fires. Indigenous practices were re-discovered as well, and some Indigenous peoples became involved in managing wildfires. In 1978, the Forest Service gave up the 10 AM policy and encouraged the use of controlled fires, as well as letting some natural fires burn on their own. However, many people still find it hard to believe that starting fires (or letting them burn) will prevent bigger fires, and today 98% of wildfires in the United States are put out before they get large.

Tobacco and Lung Cancer

Lung cancer was a very rare disease until the early 20th century. As it became more common, doctors began to study it more closely and found that people with lung cancer were more likely to be smokers. By 1950, studies found that heavy smokers were fifty times more likely than non-smokers to get lung cancer. It was still not clear why smoking caused cancer, but by 1950 the evidence was strong enough for public health authorities to recommend against smoking. The US Surgeon General released a report in 1964 warning of the dangers of smoking, and in many countries (including Canada) heavy restrictions were placed on how tobacco could be sold or advertised.

Tobacco companies responded by funding research that challenged the consensus that tobacco caused cancer or made it look like tobacco was a less significant risk. They even founded a scientific society and a scholarly journal, which mostly published studies that minimized or denied the risks of smoking. In 2006 the US Surgeon General said that the tobacco industry had "attempted to sustain controversy even as the scientific community reached consensus." The same year several tobacco companies were found guilty of trying to cover up the fact that secondhand smoke was dangerous to non-smokers.

What Killed the Dinosaurs?

In the 19th and 20th centuries, scientists had dozens of different theories about what killed the dinosaurs, from climate changes to small mammals eating their eggs. Very little evidence could be found, however, to support any of these theories. In 1981, a physicist named Luis Alvarez found a layer of iridium, a very rare metal usually only found in outer space, in the same layer of earth where the last dinosaur fossils were found. Paleontologists (scientists who study dinosaurs) were skeptical at first. This was partly because there was no other evidence to support the theory. They also thought that Alvarez did not understand the subject because he was a physicist, not a paleontologist. Ten years later, a huge crater was found in Mexico which was made by a meteor that hit the Earth at exactly the time the dinosaurs went extinct. Besides the initial explosion, this sent enough dust into the air to block sunlight for up to a year. This may explain why the largest animals, such as dinosaurs, died off while smaller ones survived.

Most paleontologists now accept that the meteor was at least part of the answer. However, in 1982 paleontologist Dewey McLean suggested that the eruption of a huge group of volcanoes called the Deccan Traps caused the extinction. At the time there was not much evidence for that theory, but since then better techniques for dating rock have found that the volcanoes were erupting at the time the dinosaurs went extinct. Today most paleontologists still believe the asteroid played the biggest part in the extinction of the dinosaurs, but some now think that it may have triggered the volcanic eruption, or that the volcanoes may have made it harder for the dinosaurs to live before the asteroid hit.

Checking Consensus

Before you decide whether a claim is reliable or not, it's important to check it against the consensus in that field. If you don't know enough about that field to judge, it's useful to check reliable, general-interest sources like science magazines or Wikipedia.

You can use this custom search engine to search twenty reliable, kid-friendly sites: www.bit.ly/consensus-search

Encyclopedias are a good way to find the consensus on a topic because their articles, which are often written and edited by several people, are meant to reflect the consensus view.

A Wikipedia article reflects the consensus of all the editors who have worked on an article, but because anyone can do that (with some exceptions) you need to take a few extra steps to make sure it's reliable:

- Look for warning banners. Not all warning banners mean the whole article is unreliable, but they always mean you should take a closer look.
- Check the Talk page to see what the editors are talking about. If there are disagreements about the consensus, you'll see it here. On the Talk page you can also see if an article has been locked to stop vandalism.
  - The link to the Talk page for an article will be at the top left, right under the title.
- You can also check the article's History page. If a lot of major edits have been made recently, it suggests the article doesn't yet show a consensus.
  - To see the History page, click on View History at the top of the article. On a mobile browser, scroll all the way to the bottom and tap the green bar that says "Last edited".

Whatever source you're using, it may be easier to search it than to read the whole article. For example, searching for "DNA" on the Wikipedia article for mRNA vaccines will take you right to the part of the article that explains that vaccines do not affect the body's DNA.

- To search a web page on a desktop browser, use Control-F on a Windows machine or Command-F on a Mac.
- On an iPhone or iPad, go to the website you want to search, then enter the word or phrase to look for in the search bar and select "Find on Page".
- On an Android device, tap the menu button and then "Find in Page".

Give it a try!

Take a few minutes to research three topics:

- Who built the pyramids?
- What were they made for?
- How were they made?

For each of these topics, answer these questions:

- Is there a consensus?
- If so, what is it? How strong is it?
- Are there significant contrary views?

Conspiracy Theories

Have you ever heard that a famous person…

- Had died?
- Had been replaced by a double?
- Was secretly arrested?

Have you ever heard that a video game…

- Made people go crazy?
- Was made to mind-control people?
- Contained hidden, evil content?

Conspiracy theories are common on social networks and video sites. But a conspiracy theory isn't just something that's hard to believe, or a claim that goes against the scientific consensus.

For example, the **false** claim that vaccines cause autism (they do not) is not a conspiracy theory. The claim that a secret group is **covering that up** is one.

People may sometimes start to believe in conspiracy theories when they learn that the scientific consensus doesn't match what they believe, or what they have been told by people they trust. It can be easier to start to believe in the conspiracy theory than to stop believing in something you thought was true.

Take a second to think about this question: **If you flip a coin three times in a row, how likely are you to get the same result (all heads or all tails) every time?**

It sounds pretty unlikely, but there's actually a **one in four** chance of that happening. One of the reasons we're drawn to conspiracy theories is because we don't like to think that things are random. If something happens that seems unlikely to us, we want to believe it means something!

Science and conspiracy theories are both about looking for patterns. But in science you **start with the data and look for a pattern.** Conspiracy theories **start with the pattern and look for data to fit it.**

What about real conspiracies?

There are some good historical reasons to be skeptical of some groups that are painted as villains in conspiracy theories: some doctors have been paid off by powerful industries, governments have conducted medical experiments on people without their consent, and pharmaceutical companies have pushed their products without regard for anything but their own profits.

But real conspiracies are almost always discovered by journalists, whistleblowers or historians, not conspiracy theorists. Real conspiracies usually involve a small number of people, not an ever-growing group of schemers. And real conspiracies usually don't turn out the way the conspirators planned.

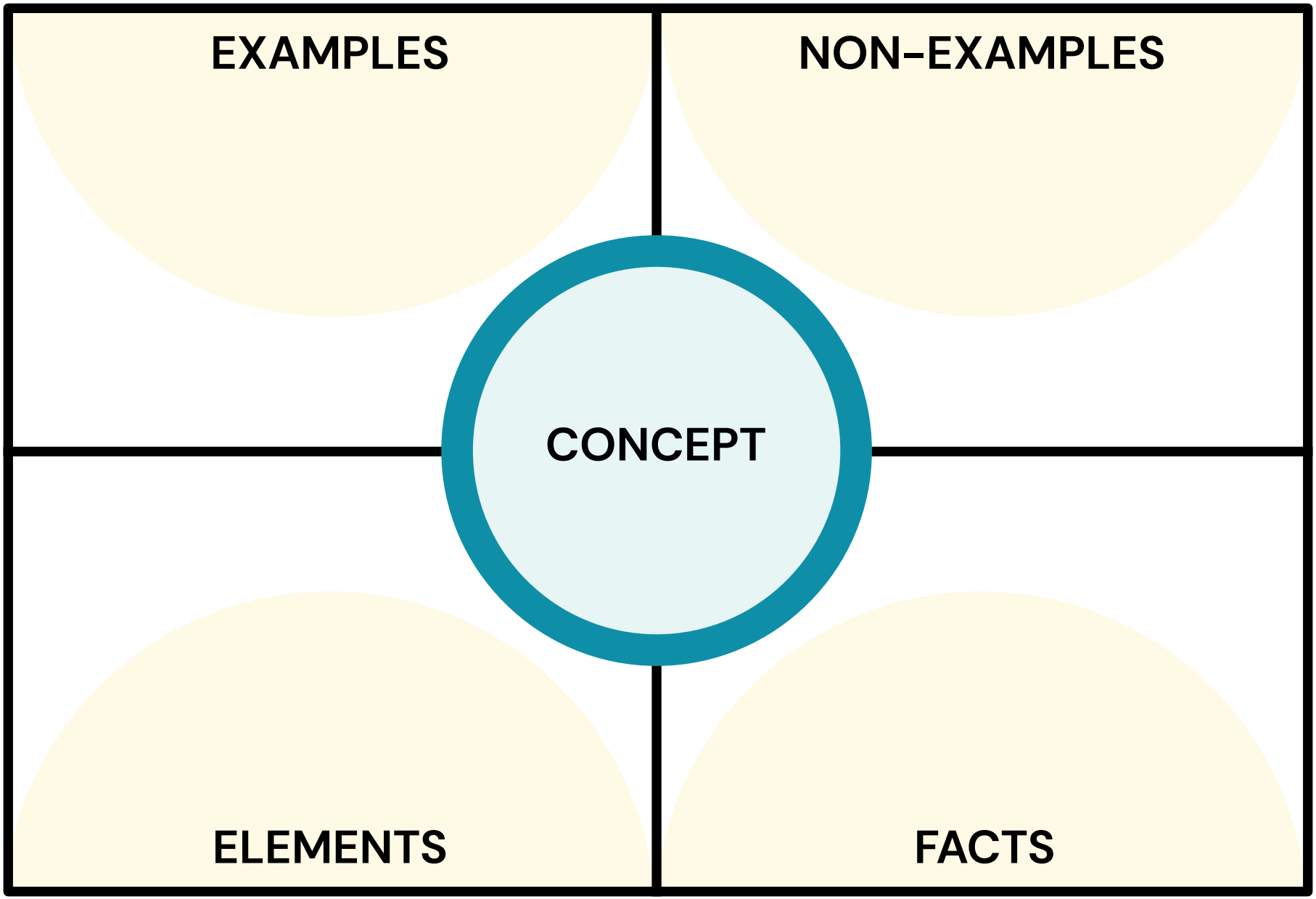
For instance, it is true that in the early 1970s US President Richard Nixon had burglars install listening devices in the headquarters of the Democratic Party and then tried to cover it up. When this was discovered by reporters, Nixon was investigated by Congress and eventually resigned. As conspiracy theory expert Michael Butter put it, "If the American president – commonly dubbed the most powerful man in the world – cannot even spy on his political opponents at their party offices without it becoming public and leading to his eventual resignation, how can anyone be supposed capable of [carrying out a conspiracy theory] and keeping it secret for years or even decades?"

Characteristics of a conspiracy theory

Conspiracy theories:

- claim that an elite group is controlling or trying to control world events, usually for evil reasons
- are told backwards – that the conspiracy exists is assumed; evidence is selected and interpreted to support it
- portray the conspiracy as impossibly powerful (they control everything) but also incredibly careless (they are always leaving clues that people who know the truth can pick up)
- draw heavily on coincidence and supposed examples of "hidden symbolism" for evidence
- assume that everything happens for a clearly explainable reason
- make the world seem less complicated because it is divided neatly into good and evil
- cannot be disproven, because evidence against them is taken as evidence of a coverup
- assume that "big events" always have "big causes": something like a plane crash or a pandemic couldn't happen because of random events
- divide the world into believers in the theory, conspiracy members, and "sheep" (ordinary people who haven't yet seen the truth about the conspiracy)
- make believers feel that they are part of something important and have hidden knowledge most people don't have
- get bigger and more complicated the longer they go on; more and more people and groups are involved and the conspiracy is connected to more and more events
- say that "mainstream" sources of information can't be trusted, because they're either part of the conspiracy or being fooled by it
- give people a community to be part of (other conspiracy theorists) but often isolate people from family and friends who don't believe in the theory
- make people less likely to take part in regular politics, because they feel it's "all a sham" and because conspiracy theorizing feels like doing something
- can sometimes make people more likely to commit violence for political reasons

Defining a Concept



Defining a Concept

CONCEPT
VACCINES

EXAMPLES

Smallpox vaccine (1796)

Polio vaccine (1952)

Chickenpox vaccine (1984)

COVID-19 vaccine (2020)

NON-EXAMPLES

Antibiotics (only kill bacteria)

Antiseptics (kill microbes on the outside of your body)

Antivirals (kill vires after infection)

ELEMENTS

"Teach" your immune system to fight off infection

Some use weak viruses, some use messenger RNA to start an immune response

FACTS

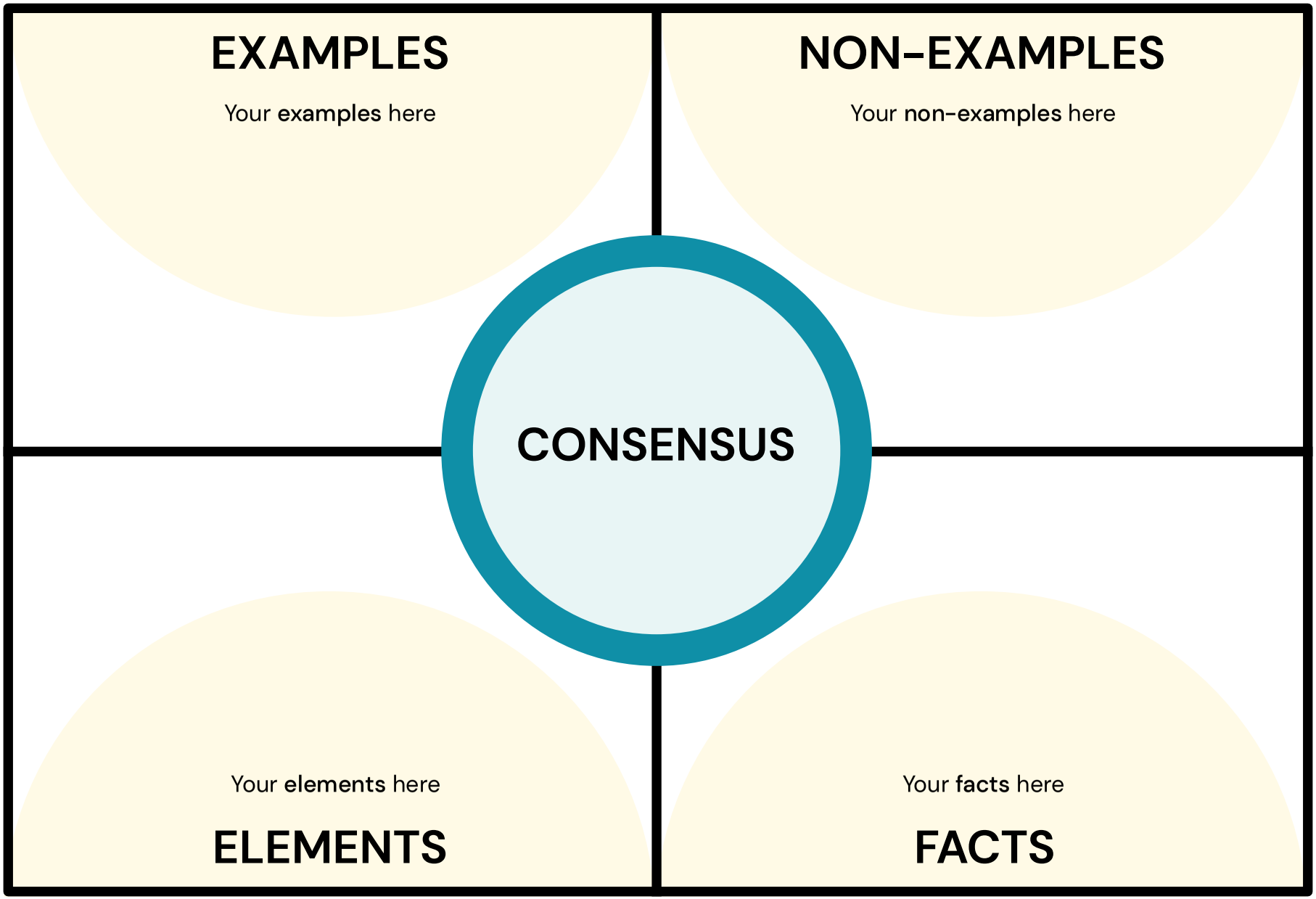
Are rigorously tested in clinical trials

Don't stay long in your body

Make infections less severe even if you do catch something

Help population reach "herd immunity" where viruses can't spread, protecting people who can't be vaccinated

Defining a Concept



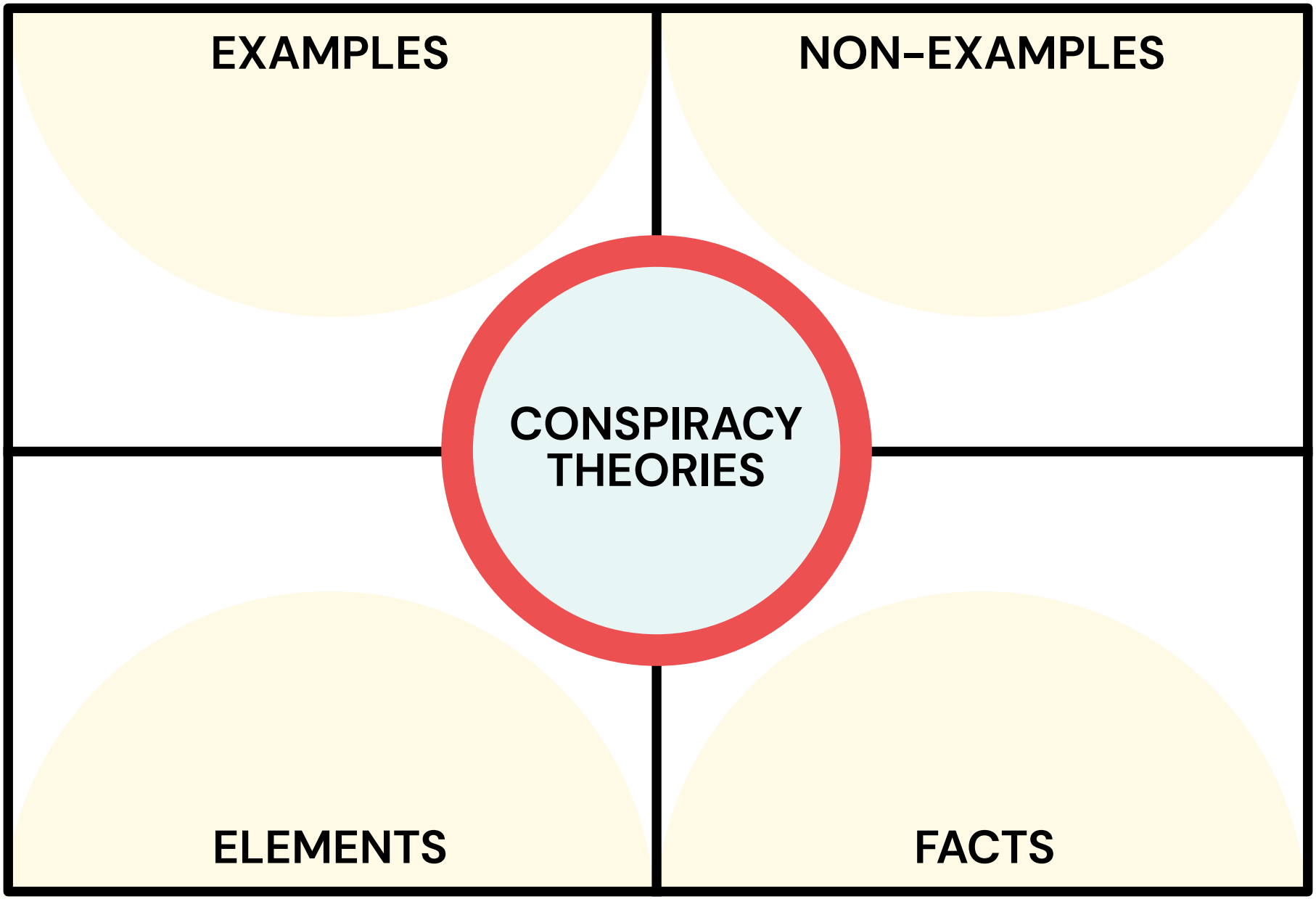
Defining Conspiracy Theories

For this assignment, you will create a definition of conspiracy theories using a graphic organizer, in the same way we defined "scientific consensus" in class.

Start by using the template on the other side of this page.

- In the top left section, list some ***examples***. These can be actual examples of conspiracy theories or types of conspiracy theories.
- In the top right section, list some ***non-examples***. These should be things that might be confused with conspiracy theories but aren't.
- In the bottom left section, list what you think are the most essential ***elements*** of a conspiracy theory.
- In the bottom right section, list what you think are the most interesting or relevant ***facts*** about the idea.

Assignment



Rubric

	LEARNING EXPECTATIONS	ACHIEVEMENT
Access	**Finding and Verifying** • Find information needed for your task and avoid unwanted or irrelevant content • Actively seek out information that provides new perspectives and viewpoints • Search or navigate within a source to find and select relevant information	**Insufficient** (R) **Beginning** (1) **Developing** (2) **Competent** (3) **Confident** (4)
Use	**Finding and Verifying** • Identify relevant and irrelevant and more or less valuable information • Effectively use the navigation features of a media tool • Find information that supports or challenges a position or point of view **Making and Remixing** • Use digital and other media tools to share your learning	**Insufficient** (R) **Beginning** (1) **Developing** (2) **Competent** (3) **Confident** (4)
Understand	**Finding and Verifying** • Use digital tools to identify whether or not there is a consensus on a particular topic and, if so, what it is • Compare and evaluate arguments, evidence, models and theories • Evaluate the expertise or authority of a source of information • Understand the benefits and drawbacks of collectively authored information sources such as wikis and reviews **Ethics and Empathy** • Understand how false and misleading information can do harm	**Insufficient** (R) **Beginning** (1) **Developing** (2) **Competent** (3) **Confident** (4)
Engage	**Finding and Verifying** • Reflect on one's information practices • Identify and reflect on social and cognitive influences that may inhibit critical thinking • Effectively respond to misinformation **Community Engagement** • Take active steps to make conscious use of networked tools • Contribute to a positive information landscape	**Insufficient** (R) **Beginning** (1) **Developing** (2) **Competent** (3) **Confident** (4)

Know It Or Not?

Below are the questions and answers from the *Know It Or Not?* game, along with the sources for each answer. The questions are randomized so students will all see them in a different order.

Please note: The information and sources in the game may be updated as further evidence emerges.

COVID-19 vaccines have strong support across Canadian society.

TRUE: A large number of groups, including the Black Heath Alliance, First Nations Health Authority, Canadian Red Cross, Canadian Paediatric Society, and AboutKidsHealth support the use of vaccines to bring an end to the pandemic.

Sources:

Black Health Alliance: https://blackhealthalliance.ca/covid-19/#Benefits

First Nations Health Authority: https://www.fnha.ca/what-we-do/communicable-disease-control/coronavirus/covid-19-vaccine

Canadian Red Cross: https://www.redcross.ca/how-we-help/current-emergency-responses/covid-19---novel-coronavirus/vaccination-for-covid-19---frequently-asked-questions

Canadian Paediatric Society: https://cps.ca/tools-outils/covid-19-information-and-resources-for-paediatricians

AboutKidsHealth: https://www.aboutkidshealth.ca/covid-19

It's safer for most healthy people to wait and see how COVID-19 vaccines perform than it is to get it right away.

FALSE: Over ten billion doses have already been administered worldwide. People who get vaccinated don't just protect themselves, they also help to protect people who can't be vaccinated or don't get full protection from vaccines.

Sources:

Health Canada: https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/effectiveness-benefits-vaccination.html

Vaccinate Your Family: https://vaccinateyourfamily.org/why-vaccinate/vaccine-benefits/community-immunity

Bloomberg: https://www.bloomberg.com/graphics/covid-vaccine-tracker-global-distribution/

WHO: https://covid19.who.int/

All the Health Canada approved COVID-19 vaccines have been tested in full clinical trials.

TRUE: All Health Canada approved COVID-19 vaccines went through each step of clinical trials and were tested for safety and efficacy with over 100,000 people. Since then, long-term continuous monitoring has confirmed their safety and effectiveness.

Sources:

Reuters: https://www.reuters.com/article/factcheck-covid-vaccines/fact-check-covid-19-vaccines-are-not-experimental-and-they-have-not-skipped-trial-stages-idUSL1N2M70MW

Health Canada (video): https://health.canada.ca/en/public-health/services/video/how-covid-19-vaccines-safe.html

WHO: https://covid19.who.int/

Even a mild COVID-19 case can cause real problems that last for months or longer.

TRUE: Even among young people with mild cases, COVID-19 can damage the heart, lungs, and kidneys. It can make you lose your sense of smell, and act like a concussion or traumatic brain injury, giving you mental fogginess, anxiety, and depression.

Sources:

Long Covid Canada: https://longcovidcanada.ca/

The Lancet: https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(21)00299-6/fulltext

Johns Hopkins: https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/covid-long-haulers-long-term-effects-of-covid19

Bill Gates and his foundation planned the COVID-19 pandemic so that he could inject people with microchips.

FALSE: The rumour that Bill Gates created COVID-19 is a hoax. A diagram of a microchip that was shared as evidence turned out to be a circuit for an electric guitar pedal.

Sources:

Popular Mechanics: "Conspiracists Say This 5G Chip Is in the COVID Vaccine. It's Just a Guitar Pedal." https://www.popularmechanics.com/technology/a35122832/5g-conspiracy-chip-covid-19-vaccine-guitar-pedal/

Serious side effects are common for COVID-19 vaccines.

FALSE: Only 1 in every 10,000 people vaccinated report a serious side effect. Many people do have a headache or fever for a short time after getting vaccinated. This is a sign that the immune system is working to build your protection.

Sources:

Health Canada: https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/safety-side-effects.html

Governmemt of Canada: https://health-infobase.canada.ca/covid-19/vaccine-safety/summary.html

World Health Organization: https://www.who.int/news-room/feature-stories/detail/side-effects-of-covid-19-vaccines

It's still not easy to get a COVID-19 vaccine.

FALSE: Pharmacies and drop-in clinics are offering walk-in vaccine appointments all across Canada. Find a vaccine centre near you by selecting the "View Sources" option.

Sources:

Provincial Booking: https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/how-vaccinated.html#a1

Who is eligible: https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19/vaccines/how-vaccinated.html#a2

Most Canadians have gotten vaccinated against COVID-19. This means that only a small portion of Canadians are declining the vaccine offer.

TRUE: Eight in ten eligible Canadians have gotten fully vaccinated for COVID-19. This means that only a small portion of Canadians are declining the vaccine offer.

Sources:

Health Canada: https://health-infobase.canada.ca/covid-19/vaccination-coverage/

mRNA vaccines have been studied for decades.

TRUE: mRNA vaccines have been studied for decades. They have been found to be safe and effective in people with HIV, rabies, and flu. mRNA does not enter the nucleus where DNA is kept so your genes are not changed in any way.

Sources:

Health Canada: https://www.canada.ca/en/health-canada/services/drugs-health-products/covid19-industry/drugs-vaccines-treatments/vaccines/type-mrna.html

CHOP: https://www.chop.edu/news/long-term-side-effects-covid-19-vaccine#skip-to-content:~:text=mRNA%20vaccine,-Although

Getting natural protection to COVID-19 through infection is less risky than vaccination.

FALSE: While there is evidence to show that getting infected with COVID-19 provides natural protection for a period of time, getting vaccinated minimizes the health risks that come with the virus itself. If you have previously had COVID-19 you have some protection, but this protection is much stronger if you are also vaccinated.

Sources:

SickKids: https://www.aboutkidshealth.ca/article?contentid=3937&language=english

Nature: https://www.nature.com/articles/d41586-022-00177-5

Hospitals have had to postpone non-urgent medical operations at times during the pandemic.

TRUE: Surges of hospitalizations from COVID-19 infections can overwhelm hospital resources, resulting in the postponement of non-emergency surgeries. While delaying surgeries allows for beds to remain available for patients with COVID-19, it can mean prolonged pain and illness for those who have been told they must wait for their operation or treatment.

Sources:

Canadian Institute for Health Information: https://www.cihi.ca/en/covid-19-resources/impact-of-covid-19-on-canadas-health-care-systems/hospital-services

CTV: https://www.ctvnews.ca/health/coronavirus/with-more-than-500-000-fewer-surgeries-due-to-covid-19-delayed-surgeries-cost-some-their-lives-1.5700480

Young children's immune systems can be easily overwhelmed by a COVID-19 vaccine.

FALSE: In clinical trials testing vaccine safety and efficacy, 5- to 11-year-olds receive a third of an adult's dose, or 10 micrograms. This is because children are not only smaller than adults, but their immune systems are a little stronger, and can get the same level of immunity from a smaller dose.

Sources:

CBC: https://www.cbc.ca/radio/whitecoat/dose-covid19-vaccines-children-1.6211257#:~:text=In%20the%20clinical,level%20of%20immunity.%22

Kaiser Health News (KHN): https://khn.org/news/article/scientists-examine-kids-unique-immune-systems-as-more-fall-victim-to-covid/

Getting a COVID-19 vaccine can lead to infertility.

FALSE: There is no evidence to suggest a link between COVID-19 vaccination status and fertility. COVID-19 vaccines stimulate an immune response against proteins that are specific to the virus. Several studies have concluded no unexpected outcomes associated with the vaccine during pregnancy or in infants.

Sources:

Women's Health Research - University of BC: https://womenshealthresearch.ubc.ca/blog/covid-19-vaccines-and-infertility-fact-or-fiction

ScienceUpFirst: https://www.scienceupfirst.com/project/lets-talk-covid-19-and-fertility/

It is safe to get a COVID-19 vaccination while pregnant.

TRUE: COVID-19 vaccines are both safe and recommended for those who are pregnant. Pregnancy can increase the risk of severe cases of respiratory illnesses, including COVID-19. Research shows that vaccines give significant protection against the virus for pregnant women, especially in preventing hospitalization.

Sources:

Johns Hopkins: https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/the-covid19-vaccine-and-pregnancy-what-you-need-to-know

ScienceUpFirst: https://www.scienceupfirst.com/project/lets-talk-covid-19-and-fertility/

The Omicron variant is not concerning for public health.

FALSE: While Omicron is often described as being 'mild', this can be misleading. There is good news from emerging evidence that Omicron may cause less lung damage. However, it is more transmissible than other variants and therefore, the total number of people hospitalized and in ICUs is rising.

Sources:

Preprints with The Lancet: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3996320

Health Canada Epidemiology update: https://health-infobase.canada.ca/covid-19/epidemiological-summary-covid-19-cases.html

CBC: https://www.cbc.ca/news/canada/coronavirus-covid19-canada-world-jan9-2022-1.6308866

ScienceUpFirst: https://www.scienceupfirst.com/project/omicron-what-we-know-now/

AboutKidsHealth: https://www.aboutkidshealth.ca/Article?contentid=4000&language=English&hub=COVID-19

Changing Consensus

Here are some examples of how scientific consensus has changed or developed in the past.

Stomach Ulcers

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   Ulcers were caused by stress or spicy food. It was a scientific consensus because there was evidence to support it.

2. **What is the current consensus? How strong does it seem?**

   There is a strong consensus that ulcers are caused by bacteria.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Scientists were able to cause ulcers with bacteria in rats and cure them with antibiotics. The same bacteria were found in children with ulcers. It took about five years for the new consensus to be established.

Five-Second Rule

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   Many people believe dropped food doesn't get contaminated until after five seconds on the floor. It was conventional wisdom because it hadn't ever been tested.

2. **What is the current consensus? How strong does it seem?**

   The current consensus is that food starts getting contaminated right away. The consensus seems fairly strong because two studies have supported it and none have challenged it, but there still has been relatively little research done.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Two studies found over 15 years found that the five-second rule was not true. While there is a weak scientific consensus, the conventional wisdom is still believed by many people.

Heliocentrism

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   The old consensus was that the sun went around the Earth. It was a weak scientific consensus because it was based on observational data but hadn't been actively tested.

2. **What is the current consensus? How strong does it seem?**

   There is a very strong consensus that the Earth goes around the sun. There have been some slight changes to the model (we now know there are other solar systems and galaxies) but the basic consensus has not been challenged.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Better measurements of star movements found problems with the old model, and the new (heliocentric) model solved those problems. Better instruments (the telescope) provided evidence that also hurt the old model, such as finding that other planets had their own moons. It took about a hundred years for the scientific consensus to change, though some religious authorities took longer to accept the new model.

Climate Change

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   There was a consensus that the Earth's climate changed over time, but not about how it changed or whether human activity could cause it. This was a scientific consensus because it was based on evidence (fossils of plants and animals that didn't fit the current climate in different parts of the world).

2. **What is the current consensus? How strong does it seem?**

   The current consensus is that carbon dioxide in the atmosphere can stop heat from radiating into space, creating a "greenhouse effect" that increases the Earth's average temperature. The consensus is very strong, with 97% of scientists agreeing that burning fossil fuels (which releases carbon dioxide) is causing climate change.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Better instruments and powerful computers led to better data on climate and more accurate models of how it changed. It took about 40 years for the new consensus to be fully accepted by scientists, but efforts to cast doubt on it by fossil fuel companies lead many people to underestimate the consensus.

Formation of the Continents

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   The old consensus was that changes in the Earth came from the crust cooling and erosion. It was a consensus because it was based on scientific evidence that the Earth had cooled over time.

2. **What is the current consensus? How strong does it seem?**

   The continental plates float on the Earth's molten mantle and are in constant motion. It is a strong consensus, with no serious challenges.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   New technology led to the discovery of ridges on the bottom of the ocean, which made it clear that tectonic plates were moving. It took about 60 years for Wegener's theory to be accepted, but only about ten years for the consensus to change once the new findings were made.

Fighting Forest Fires

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   The old consensus was that it was better to put out all wildfires as soon as possible. It was conventional wisdom because it wasn't based on any particular evidence.

2. **What is the current consensus? How strong does it seem?**

   The new consensus is that it is better to let some fires burn and to use controlled fires to reduce the amount of fuel in forests. The consensus is fairly strong because there is some evidence to support it and some authorities have accepted it.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Indigenous practices were rediscovered and reintroduced, controlled-burn projects were tested, and the role of wildfires in the ecology of forests became better understood. It took about twenty years for the scientific consensus to change, but in practice many people still follow the old conventional wisdom.

Tobacco and Lung Cancer

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   There was no consensus because lung cancer was a very rare disease.

2. **What is the current consensus? How strong does it seem?**

   There is a very strong consensus that smoking tobacco is the leading cause of lung cancer.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   Correlational studies found that people with lung cancer were much more likely to be smokers than those that weren't. Since it's unlikely that having lung cancer would make people start smoking, and it's hard to think of anything that could cause both smoking and lung cancer, it was almost certain that the cancers were being caused by smoking. It took about twenty years for scientific authorities to accept the new consensus and another fifteen for governments to start regulating smoking. However, efforts by the tobacco industry to cast doubt on research slowed down efforts to regulate smoking and protect people from secondhand smoke.

What Killed the Dinosaurs?

1. **What was the old consensus? Was it a scientific consensus or conventional wisdom? How do you know?**

   There was no consensus among scientists. There were many theories but there was no significant evidence for any of them.

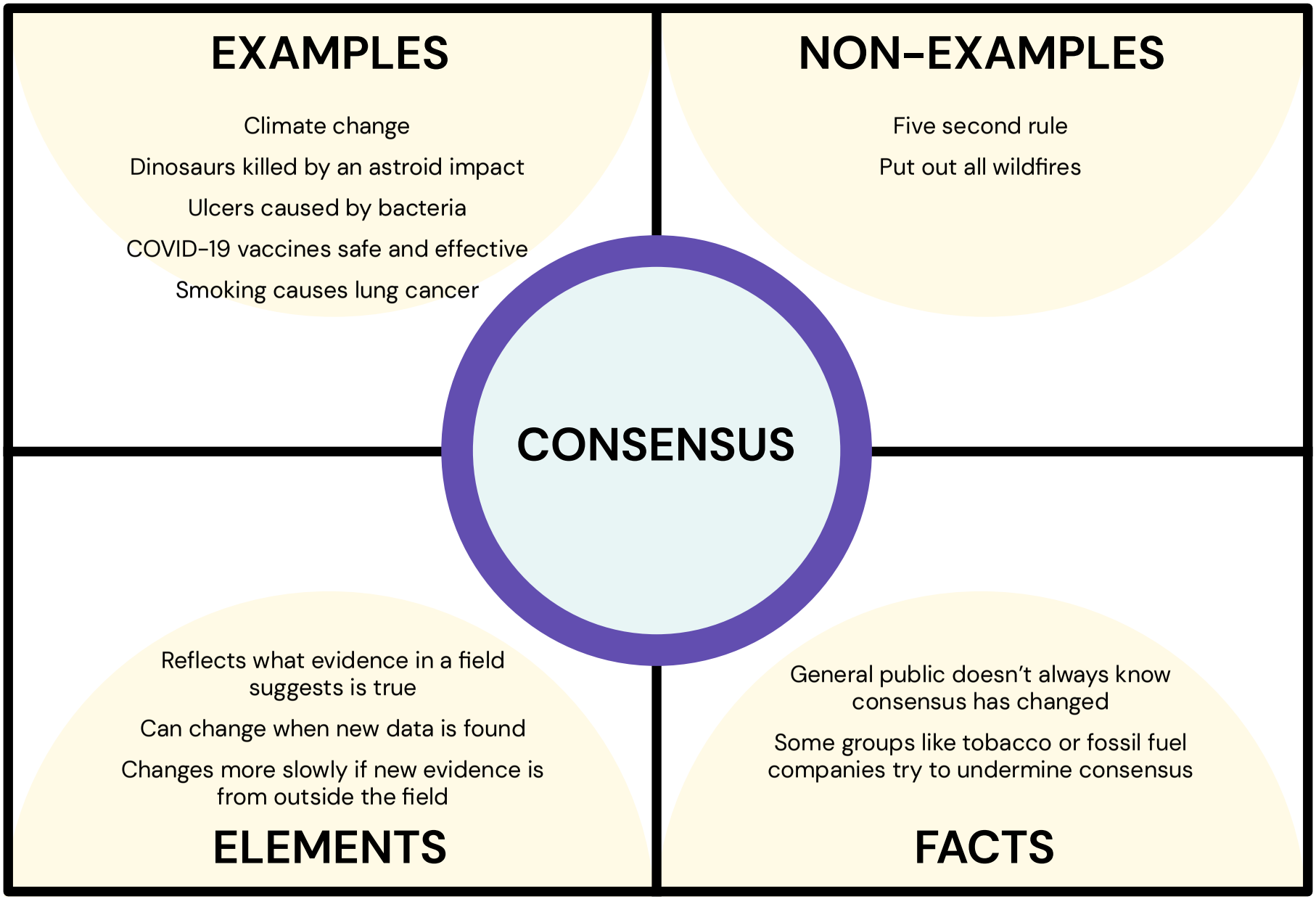
2. **What is the current consensus? How strong does it seem?**

   An asteroid struck the Earth, sending enough dust into the air to block the sun and keep plants from growing for a year or more. The consensus is strong that this happened and that it played a role in the end of the dinosaurs but there is less consensus about whether it was the only or even the main factor.

3. **What evidence led to the new consensus? How long did it take for the consensus to change after the new evidence was found?**

   The discovery of a layer of iridium in the same layer of earth as the last dinosaur fossils led to the theory. The later discovery of the crater where the asteroid hit provided conclusive evidence. After that the theory was accepted almost right away, but other scientists also challenged the idea that it was the main or only cause of the dinosaurs' extinction.

Teachers Version



Talking about controversial issues in the classroom

While every effort has been made to make these lessons a safe and emotionally secure experience, talking about hate and prejudice can nevertheless be a sensitive experience – for both students and teachers.

Teachers are often reluctant to address these issues for a variety of reasons: because they are worried about being seen as preaching to students, because they see the topic as overly controversial or polarizing, or because they are concerned about what students might say in classroom discussions.

> School is the ideal place to start because if we don't support young people and talk to them and give them spaces to talk about these events, they're going to seek answers where we don't want them to. They'll be caught up in all kinds of fears, anxieties and false ideas.
> *Ghayda Hassan, researcher and practitioner, Université du Québec à Montréal*

The following section provides teachers and other school staff with guidelines about creating a respectful classroom, fostering and managing complicated conversations, and how to manage problematic student responses over the course of these lessons.

Fostering classroom discussion

MediaSmarts' research has found that adults have a key role to play in helping young people discuss difficult issues. They often turn to trusted adults when they need help or advice in finding reliable information, and look to adults as a model of healthy debate and ethical digital citizenship – while also being aware that adults often do not set a good example in those areas.

Here are some guidelines for fostering a safe and positive classroom discussion.

Don't rush it

It's important to make sure that you have enough time to properly explore the issues that come up in these lessons. Make sure that you're familiar with the lesson plans so that you can keep discussions on track. As well, research shows that interventions to reduce prejudice and discrimination work best when they are spread out over time rather than done in a single session.

Encourage open discussion

Remember that difficult discussions are needed for deep learning. Be prepared for students to say things you weren't expecting or share things you didn't know about, and remember that you don't necessarily know what experiences or aspects of their identities they're bringing to the discussion.

Draw the line between classroom discussion and political discourse. Just like you don't want to be seen as pressuring students to share your opinions, students shouldn't just be repeating political arguments they've heard at home or seen in social media either. Make sure that they're listening to other students and are open to other people's perspectives.

Encourage students to ask questions as well as offering opinions. Remind them that the point of discussion is not to convince other people but to learn from them. Focusing on questions can lead us to examine assumptions we didn't even know we had.

Make sure students know that you struggle with these questions as well. Be honest about what you do and don't know and position yourself as a co-learner.

While you do want to give up some of your authority as an expert, you still have a responsibility to make sure the discussion stays on track and that everyone is treated with respect.

Set clear and consistent rules

Key to having an open conversation is to have the class agree on ground rules before you start. Knowing that everyone has agreed on what is "off limits" will make students feel freer to speak because they won't worry about crossing a line without meaning to.

Getting the class involved in developing rules for discussion is a good way to signal how important it is that each person in the class takes their responsibility seriously to create and maintain an open and respectful classroom.

Here are some suggested rules to set for your discussion:

- Treat others with respect. Slurs, stereotypes and personal attacks should all be off-limits.

  "It's OK if participants challenge each other's ideas, but it's no OK to insult one another's identities." *Let's Talk! Facilitating Critical Conversations with Students*

- Avoid generalizations by using "I" statements. Encourage students to talk in terms of their own experiences: "I think that…", "When I go into a store…", "When I post a picture…", etc. Make sure students respect the truth of each others' experiences.

- No interrupting when someone is talking. If a student says something that violates the previous rules, "pause" them to point that out and then ask them if they can make their point in a way that will contribute positively to the conversation.

- Everyone who wants to speak will get a chance to, but not everyone has to speak. Neither you nor other students should put anyone "on the spot" because of some aspect of their identity.

Identify which issues you consider "settled" before the discussion

While you want to encourage an open conversation, spending class time on topics that are not open to debate, or that marginalize or dehumanize people, has the potential to close down the discussion and leave students hurt or more entrenched in their positions. Groups and movements that spread disinformation often try to conceal their positions as "debating" or "just asking questions" about issues such as whether vaccines are safe or effective or whether the Holocaust happened, and students who have been influenced by these may bring these arguments into the classroom.

Rather than pretending to be apolitical or trying to "teach both sides," what is most effective is to approach each topic with open-mindedness and even-handedness, but not neutrality. A key to this – and to avoiding the impression that you're telling your students what to think – is to distinguish between fact and opinion questions and between active and settled questions.

- **Fact** questions are those that can be conclusively answered, proven or disproven: What nutrients does a bag of potato chips contain? Do vaccines prevent viral illnesses, including COVID-19?
- **Opinion** questions are ones that cannot be conclusively answered but can be supported by argument or evidence: Should food companies be allowed to advertise potato chips to children? Should vaccination be required to hold certain jobs or participate in certain activities?
- **Settled** questions are those that either have been conclusively proven or are accepted by society as settled. A settled fact question would be "Why are objects drawn towards the Earth?" A settled opinion question would be "Should all people receive equal rights under the law?"
- **Active** questions are those that are still being discussed. An active fact question would be "Does gravity act through particles in the way other forces do?" An active opinion question would be "How should we resolve the conflicts between the rights of different groups and people?"

Complicated conversations focus on active opinion questions, and they work best when you are clear beforehand that class time won't be used to discuss questions that have already been settled.

"When I have talked to other schools [they say], "You let them talk about what?! You let them write a bill about what?! You let them express what opinion?!" Well, if you don't do it in a safe, structured environment here, they are still doing it at the lunch table. They are still doing it. And if people are still talking about it . . . this at least gives them an appropriate context and a structure with which to sort of deal with some of those charged issues and maybe get an understanding of both sides of the issue." 'Ms. Heller,' high school teacher quoted in *Classroom Deliberation in an Era of Political Polarization*.

For fact questions, teach students to identify the present consensus – not necessarily "the truth," but what most authorities on the topic think is true, given the current evidence – while helping them understand the process by which consensus is developed in different disciplines.

As well as being open about one's own views, it is important to model a critical attitude by encouraging students to always ask:

- What do I already think or believe about this?
- Why do I want to believe or disprove this?
- What would make me change my mind?

"To investigate properly, you have to allow yourself to be wrong." *Digital investigator Jordan Wlldon*

Dealing with issues that arise

As noted above, during complicated conversations students will often say surprising and unexpected things. If you've established clear rules for discussion this usually will not be a problem, but there will be times when you have to pause the conversation and deal with something a student has said.

Press pause. Don't let a problematic word or statement derail the conversation. Tell the student who said it to pause, address it as quickly as possible, and then either use it as a springboard to more discussion or return to the previous conversation. This helps you model for students the idea that it's important to always address prejudiced speech or actions, but we don't have to let people use them to hijack a discussion.

Challenge misleading sources. Many students encounter misinformation and disinformation online, either from social media, from video sites such as YouTube, or from "cloaked" sites that masquerade as legitimate sources of information and debate.

Redirect to an active question and keep it on topic. A lot of the time, when students say something that sounds like it's addressing a settled question they're actually trying to articulate an active question. For instance, a student who says "The government is making the pandemic seem worse than it is" may actually be saying "I am uncomfortable with how individual freedoms are being weighed against collective safety." You can affirm the settled question while redirecting them to something more useful by saying something like "COVID-19 is definitely a serious health issue for all Canadians, but not everyone agrees about the best ways to address it. What might help us decide that?"

Chris Carman, a high school science teacher, responds to students who say climate change is a hoax by saying "I wish it weren't real, but here's the information we have."

If it's clear that a student is trying to debate a settled question, or is arguing in bad faith, simply tell them that the issue is not open for discussion and move on.

If you would like to take a deeper dive into this material, you can use these MediaSmarts resources:

Authentication Beyond the Classroom

In this lesson, students discuss "viral" photos, videos and news stories that spread via social media. They are shown how challenging it is to authenticate these using only their content and are introduced to tools and techniques for gauging their accuracy based on context.

Bias in News Sources

Students are introduced to the key media literacy concept that media contain ideological messages and have social and political implications in considering why it is particularly important to consider possible bias in news reporting. The key concept that each medium has a distinct aesthetic form is introduced as students learn about the "inverted pyramid" structure of news reporting and consider how this may lead to bias. Students then evaluate a variety of news sources with regards to the degree of bias and then demonstrate their understanding of the concept by creating an intentionally biased news report.

Break the Fake: Verifying Information Online

In this lesson, students participate in a workshop that teaches them four quick, easy steps to verify online information. After practicing these four steps they create a public service announcement aimed at teaching one of these steps and spreading the message that it is necessary for everyone to fact-check information we see online every time we are going to share it or act on it.

Deconstructing Web Pages

In this lesson, students apply three techniques to verify sources of information they find online. Assuming the role of a student researching a science project, students must authenticate the information in an online article about the artificial sweetener, aspartame.

Hoax? Scholarly Research? Personal Opinion? You Decide!

This lesson is designed to help students determine the validity of information that is presented to them on the Internet. After reviewing a series of evaluation techniques for online resources, students form groups to assess selected websites based on accuracy and authority, advocacy and objectivity, and currency and coverage.

Mixed Signals: Verifying Online Information

In this lesson, students examine two websites about unlikely animals and learn how to effectively evaluate online sources. They then create a fake website that demonstrates the misleading signals that are often mistakenly taken as signs of reliability.

Reality Check: Getting the Goods on Science and Health

In this lesson, students start by considering the wide range of science and health information they are likely to encounter in news or through social media.

Reality Check: News You Can Use

In this lesson, students consider the meanings of the term "fake news" and learn facts about the news industry that will help them recognize legitimate sources of news.

Taming the Wild Wiki

In this lesson students are introduced to Wikipedia, the user-edited online encyclopedia, and given an overview of its strengths and weaknesses as a research source. They are taught how to evaluate the reliability of a Wikipedia article and then attempt to improve an existing article.

The Hero Project: Authenticating Online Information

In this lesson students are introduced to Internet search skills through researching a personal hero. By focusing on the early parts of the research process, students learn to select well-defined topics, ask relevant research questions and select effective keywords.