



ACTIVITY 5

Reducing Cognitive Biases

INVESTIGATION

ACTIVITY 5

Reducing Cognitive Biases

ACTIVITY SUMMARY

Students explore four common cognitive biases they may experience in their daily lives. These include confirmation bias (introduced in Activity 4), conflict of interest, conformity bias, and emotion bias. Students then practice recognizing these cognitive biases in stories from the Southsland fever scenario. This investigation helps them reflect on how to apply an actively open mindset to cognitive biases to support evaluating information in decision-making.

ACTIVITY TYPE
INVESTIGATION

NUMBER OF
40-50 MINUTE
CLASS PERIODS
2-3

KEY CONCEPTS & PROCESS SKILLS

- 1 There are many cognitive biases that shape the way people make conclusions, including confirmation bias, conflict of interest, conformity bias, and emotion bias. Recognizing these biases can lead to improved reasoning.
- 2 Cognitive shortcuts and cognitive biases can lead to cognitive errors that affect how one chooses and reasons about evidence related to a claim.
- 3 Confirmation bias is a common bias that leads to faulty reasoning. It is a result of the unintentional misuse of evidence to support an existing belief.
- 4 An actively open mindset helps reduce errors from cognitive biases and cognitive shortcuts by deliberately seeking out new ideas and information that could change one's mind.

CONCEPTUAL
TOOLS



VOCABULARY DEVELOPMENT

cognitive bias

an unconscious and systematic error in thinking

conflict of interest

a situation in which an interest in the outcome may compromise a person's actions or conclusion

conformity bias

a tendency for a person to change their thoughts and actions to fit in with the other people around them

emotion bias

a tendency for a person to depend on their emotions to make a conclusion

TEACHER BACKGROUND INFORMATION

Cognitive Biases

Psychologists have identified over 150 different cognitive biases that arise from the attempt to speed up decision-making by simplifying information. Cognitive bias is most present in fast thinking but can also be part of slow thinking. For example, while researching an essay with slow thinking, cognitive biases can affect how you select and evaluate evidence, resulting in missed facts and possibilities. Cognitive biases can lead to

- ignoring competing explanations.
- misinterpreting details.
- mistaking random patterns and coincidence as meaningful.
- accepting misinformation in order to justify one's ideas.

Conflict of Interest

Although conflict of interest is not always considered a cognitive bias, there is some research that suggests that it may be. With conflict of interest, the existence of a competing interest for someone in a position of power creates a strong risk that their objectivity will be undermined, leading to other potential biases, unfair advantage, or a breach of trust.

Conformity Bias

Conformity bias is the tendency to change your thoughts and actions to be like others, often to fit in. This bias can take the form of informational conformity (assuming the group knows best) or behavioral conformity (choosing to act like others, often to fit in socially). This bias is thought to be caused by a subconscious desire for connection, often resulting in the mimicry of others' languages and mannerisms.

Emotion Bias

Emotion bias is actually a set of several biases that are governed by emotions. Often, someone's emotions can unconsciously steer their choices away from objective facts or rational analysis. This is because strong emotions such as anger, sadness, joy, and love can make it difficult for us to think logically about the benefits and drawbacks of the different options. For instance, loss aversion—the tendency to feel the pain of a loss more strongly than the pleasure of an equivalent gain—is a common emotion bias. For example, this cognitive bias could cause a person to hold onto poorly performing investments too long despite what objective evidence suggests. These biases are generally more spontaneous and persistent than other cognitive biases, making them particularly difficult to overcome.

MATERIALS & ADVANCE PREPARATION

FOR THE TEACHER

- VISUAL AID 5.1
"Cognitive Biases"
- VISUAL AID 4.1
"Actively Open Mindset"
(OPTIONAL)
- VISUAL AID 2.1
"Developing
Communication Skills"
(OPTIONAL)

FOR EACH GROUP OF FOUR STUDENTS

- SET OF SOUTHSAND
FEVER STORY CARDS
(7 cards)

FOR EACH STUDENT

- STUDENT SHEET 5.1
"Evaluating Cognitive
Bias in Southsand
Fever Stories"
- STUDENT SHEET 5.2
"Framer Model:
Cognitive Bias"
(OPTIONAL)
- STUDENT SHEET 1.3
"Unit Concepts
and Skills"
(OPTIONAL)

TEACHING NOTES

Suggestions for **discussion questions** are highlighted in gold.

Strategies for the **equitable inclusion of diverse students** are highlighted in light blue.

GETTING STARTED (10 MIN)

1 Review the concept of confirmation bias introduced in Activity 4.

- Have students participate in a simple game to review the concept of confirmation bias introduced in Activity 4.
 - First, let students know that you have a rule in mind for a number sequence. It is their job to figure out your rule. The actual rule (which you keep to yourself) is simple: Each number in the sequence must be larger than the one before it.
 - Students try to figure out the rule by providing a set of 3 numbers and asking you if their proposed set obeys the rule. You may not give them any information about the rule, but students can guess it, and you may tell them if it is correct or incorrect.
 - Begin by providing the sequence 2, 4, 8 and ask for student guesses for the rule. Most students will try to confirm a rule they already have in their head, such as ascending even numbers, rather than guess 3 numbers that would disprove the rule they are considering. For instance, someone who believes the rule is that the sequential numbers are doubled might guess 4, 8, 16 or 10, 20, 40 instead of trying an incorrect sequence such as 8, 4, 2 to see if they were wrong. Incorrect guesses are essential in the game to illuminate the correct rule efficiently.
- When the game is over, ask, **How was the experience in the game related to confirmation bias?** Students should recognize that if they were only testing numbers that fit with a rule they had in mind (searching for a yes to their idea), they were only seeking information based on their pre-existing belief instead of asking questions that would have proved them wrong (searching for a no). The exercise is an example of confirmation bias in that people want to confirm the truth with similar data (pattern matching) instead of getting to the truth by proving false data (edge-case detection). Both approaches have value, but the latter is critical. In science, experiments are designed to disprove ideas. When they can't be disproven, it may lead to an incorrect hypothesis.

2 Introduce the focus of the activity on additional common cognitive biases.

- Have students read the Introduction in the Student Book. The Introduction can be shared with the class in multiple ways. Read the Introduction aloud to the class or have individual students read it aloud while others follow along with the text (either as a whole class or in small groups).
- Reading the Introduction aloud can better support comprehension for many students, including neurodiverse students and emerging multilingual learners who often have more highly developed listening and oral skills than reading comprehension skills. Alternatively, students can read the scenario independently.

PROCEDURE SUPPORT (30 MIN)

3 Support groups as they work with the cards to learn about Southsland fever stories.

- In Procedure Step 1, distribute the set of Southsland Fever Story cards to each group and have each group member read one of the cards aloud until all 7 cards have been read.
- For students who need support reading the cards, have students divide into pairs and preread them. They can describe the content of each story by using whatever modality is most comfortable, such as verbal (story) or visual (drawing). If there is time, students could find a generic picture on the Internet that matches each description.
- For students who struggle with the amount of reading on the cards, another option is to limit the cards to Cards A–D, which provide one story per cognitive bias.
- After students have learned about four various cognitive biases in Procedure Step 2, you may want to briefly discuss the term *cognitive bias*. Ask, **How do you think cognitive bias is related to the common term *bias* that is used in everyday language?** Students should understand that bias refers to when someone's thinking, actions, or memories are influenced, either consciously or unconsciously. Unlike the scientific use of *cognitive bias*, the familiar term *bias* is often associated with social factors such as stereotypes and prejudices that can result in inequitable treatment.
- In Procedure Step 3, hand out Student Sheet 5.1, "Evaluating Cognitive Bias in Southsland Fever Stories," to each student. Circulate and support students as they sort the cards related to the different biases. Encourage students to explain their reasoning about how different cards relate to each of the different biases.
- Some students may have strong negative experiences with bias in their lives. This might include experiences related to racism, sexism, and discrimination based on their socioeconomic status. Listen to and validate student's experiences if they are willing to share.

- After Procedure Step 3, you may want to pause the class to formatively assess that students understand the cognitive biases they've been investigating. Review student responses to Student Sheet 5.1 and clarify any questions that students have about the cognitive biases. A sample student response for Student Sheet 5.1 is found at the end of this activity.
- Support students, particularly emerging multilingual learners, in sensemaking and language acquisition by adding additional terms for the unit to the word wall. Record the terms *cognitive bias*, *conflict of interest*, *conformity bias*, and *emotion bias* and provide an example as needed. For more information on a word wall, see [Appendix 1: Literacy Strategies](#).

4 Students brainstorm ways to reduce cognitive bias in the Southsand fictional scenario.

- In Procedure Steps 4 and 5, support students as they discuss a few strategies to reduce the cognitive bias described in each story. Remind students that the primary way they were able to combat shortcuts earlier in the unit was to increase the amount of evidence they were considering. In the case of cognitive biases, confirming the credibility of the source of evidence is also helpful in reducing cognitive biases.
- If students need help coming up with ideas for reducing cognitive bias in the stories, you may want to model how to do this, using one of the sample student responses on Student Sheet 5.1.
- If helpful for completing Procedure Step 6, remind students to look at the Actively Open Mindset summary in the Student Book.

Sample Student Response, Procedure Step 6

How representative are the Southsand fever stories to real-world behavior?

The stories from Southsand fever are similar to real-world stories. The stories have fictionalized people and situations, but the cognitive biases are the same as what we find everyday.

How might you apply the strategies from Step 4 in your everyday life?

Checking the credibility of the sources is a good way to reduce bias. Looking at evidence for both sides is also helpful. Most of all, using an actively open mindset is the best way to try to reduce biases. This metacognitive tool can help me identify when there is bias in a conclusion.

- When students share their experiences in Procedure Step 7, lead a discussion that helps connect the biases in the Southsand fever scenario with the real world. Students should find similarities between our everyday experiences and the stories they read, and that using an actively open mindset is an important strategy to reduce cognitive biases of all kinds.
- Conclude the discussion by asking, **What experiences from this activity have you had with cognitive biases in your daily life?** Responses will vary depending on student experiences. In particular, students are likely to relate to the conformity bias and recognize its similarities to peer pressure. Their responses may include experiences of giving in to what their classmates and friends want so they can fit in. When sharing experiences, students may notice that confirmation bias online can be very difficult to spot compared to other biases, unless the claim is obviously outrageous.

SYNTHESIS OF IDEAS (10 MIN)

5 Consider the role of credible sources to reduce bias.

- Although not covered directly in the activity, using credible sources are part of an actively open mindset. When discussing the ways to reduce bias, the reliability of a source may come up. Especially with short online postings, using a credible source can reduce bias.
- If appropriate for your students, review some specifics about credible sources, which were presented in Activity 3 and as shown in the following table.

MORE TRUSTWORTHY SOURCES	LESS TRUSTWORTHY SOURCES
• written by scientists or other experts who study the topic • written by journalists that frequently focus on the topic • include references and links to actual data, scientific research, or primary sources (such as interviews) • published by news or research organizations	• do not contain any data, research, primary sources, or references • provide links that go to websites that do not provide research or data • not written by experts • written by someone whose experience is not relevant to the topic • published on social media, blog sites, or by influencers

- If it hasn't come up, point out to students that the presence of bias in a source does not necessarily mean the information isn't useful. However, they should be aware of it and always keep its shortcomings in mind.

6 Connect the concept of cognitive bias to fast thinking and slow thinking.

- When students were introduced to cognitive shortcuts in Activity 3, one of the main points was that shortcuts are closely related to fast thinking. In contrast, cognitive biases can be present with either mode of thinking. Slow thinking is not immune to cognitive biases—they can occur even when someone is looking at any amount of evidence. For example, cherry-picking data examples from Activity 4 are a type of confirmation bias that can occur when there is ample evidence. Equally common is to have a bias, such as emotion bias, when there isn't enough evidence. Conclusions or claims using cognitive biases are most likely to occur when there is
 - too much information (information overload).
 - not enough information (ambiguity).
- Emphasize that cognitive biases can often lead to weak conclusions, regardless of whether fast thinking or slow thinking is used.

- Finally, remind students that more than one cognitive bias may be present in a given situation, influencing a person's judgement or opinion simultaneously. Cognitive biases can also occur at the same time as fast thinking, and these two types of cognition can lead to or exacerbate one another.
- Present an analogy for how cognitive biases are similar to cognition that has become colored or distorted. This is similar to how different kinds of sunglasses can color or distort how you see the world. Display Visual Aid 5.1, "Cognitive Biases," while describing this colored-glasses analogy.
- As with cognitive shortcuts, it's important for students to understand that cognitive biases can influence behavior without a person being aware of it. Since many conclusions are unconscious, it is extremely difficult to confirm that another person was influenced by a bias in a specific situation.

7 Review the role of an actively open mindset to reduce cognitive biases.

- Support student understanding that cognitive biases can be reduced by using an actively open mindset. This metacognitive approach helps someone be more aware of their own ideas and more open to other ideas and possibilities. Review this idea by referring to the Actively Open Mindset summary in the Student Book or by displaying Visual Aid 4.1, "Actively Open Mindset," that you introduced in Activity 4. Relate each of the following items to examples in the Southsland fever stories where the individual items could have reduced the storyteller's cognitive bias:

Sources

Card G: Gill's thinking is dependent on one blog that is not credible. She even says that she doesn't fact-check, so she should look for a more credible source of information.

Evidence

Card A: Santiago's information—that almost 30% of people who were infected had dogs as pets—is very limited. He is selecting only that information and then interpreting the evidence to confirm his beliefs. He would do better to look at more evidence, especially evidence that refutes his idea.

Alternatives

Card F: Trevor did not consider alternative ideas, namely, that his diagnosis may not be Southsland fever. Because he didn't consider other possibilities and waited so long to see a doctor, his illness needed more aggressive treatment.

New information

Card B: Jiwoo is not seeking new information because she earns money through affiliate links, whether the products work or not. Without considering other information, her reviews will not be impartial.

8 Support students' vocabulary development related to cognitive biases.

- To support the development of new vocabulary and concepts during the activity, consider using a Frayer Model with students as shown on optional Student Sheet 5.2, "Frayer Model: Cognitive Bias." For the concept of cognitive bias, the model can be introduced in the beginning of the activity, filled out as the activity unfolds, and reviewed at the end of the activity. For more information about the Frayer Model, see [Appendix 1: Literacy Strategies](#).

9 Build Understanding items and Connections to Everyday Life items can be used to review the main ideas of the unit.

- In Build Understanding item 1, encourage students to do something creative, such as make a video or create a visual. This foreshadows what they will do in Activity 10 when they generate a Public Service Announcement (PSA) and present it to the class.
- In Connections to Everyday Life items 3 and 4, students connect cognitive biases to what they see online. This can be a continuation of the discussion in Activity 2 when students judged their fast-thinking responses to news headlines. Connect the idea of rage bait in item 3 and the personal video format in item 4 with the attempt of social media posters to generate a quick emotional response. Discuss how students can reduce their susceptibility to these posts by using an actively open mindset.
- To conclude the activity, evaluate whether your students are able to answer the Guiding Question, *How do cognitive biases shape everyday decisions?* Use this as a chance to revisit and summarize the key concepts and process skills of the activity as it relates to identifying cognitive biases.
- You may wish to have students revisit optional Student Sheet 1.3, “Unit Concepts and Skills,” and add information about the concept of cognitive bias.

EXTENSION (20 MIN)

10 Use the Extension as an opportunity for advanced learning.

There are an infinite number of examples of cognitive biases that students can find from online information. Encourage students to compare social media posts they find online directly to the cards provided in the activity for verification or to investigate one of the many cognitive biases that were not addressed in the activity.

SAMPLE STUDENT RESPONSES

BUILD UNDERSTANDING

- ① With a partner, come up with your own everyday example for each cognitive bias presented in this activity. Choose one of the following activities to creatively communicate the bias.

- Write a narrative story.
- Draw a picture or diagram.
- Make a short video.

Narrative story

Liam personally finds a certain brand of oversized, brightly colored athletic shoes unattractive and expensive. However, his most popular peers have started wearing these shoes and talk about them constantly. Despite his dislike, Liam asks his parents to buy him the shoes. He worries that if he doesn't wear them, he will be seen as uncool.

- ② The presentation of information may contain cognitive bias. Does that mean you should always doubt the information it provides? Why or why not?

No. The information itself might still be good information, but you should pay attention to the claims that are made from the information. It would also be important to find additional evidence about the claims to put the information into perspective.

CONNECTIONS TO EVERYDAY LIFE

- ③ **Rage bait is a type of content that is designed to get a strong reaction from the viewer. The purpose is to spread ideas (often misinformation) or to generate engagement on social media. Explain which cognitive bias(es) from this activity could influence someone's reasoning when they see rage bait.**

I think emotion bias, because rage bait is trying to make people feel strong emotions in order to influence their thinking. I also think confirmation bias could be involved because when people have really strong feelings about their existing beliefs, sometimes they get really mad or worked up about them.

- ④ **Many social media platforms use a format of a short video where the person posting speaks directly to the camera, which mimics having a personal conversation with the viewer. In addition, influencers often share stories about their lives, which makes their posts feel authentic and relatable.**

- a What cognitive bias(es) does this kind of format promote? Explain your answer.**

I think it is the emotion bias, because you feel like you know this person and they are your friend. You have an emotional connection to them, which could make you more likely to believe what they say.

- b What might be some of the consequences of this cognitive bias?**

It may be misleading if you trust this source of information without a lot of evidence. You might be likely to pay more attention to other information they say, while ignoring or undervaluing information that conflicts with their ideas. This reinforces and spreads what the influencer is claiming, even if it is not accurate or trustworthy information.

STORY	COGNITIVE BIAS	HOW BIAS APPEARS IN THE STORY	STRATEGIES TO REDUCE THIS BIAS
CARD A Santiago			
CARD B Jiwoo			
CARD C Mohamed			
CARD D Maria			
CARD E Georgia			
CARD F Trevor			
CARD G Gill			

STORY	COGNITIVE BIAS	HOW BIAS APPEARS IN THE STORY	STRATEGIES TO REDUCE THIS BIAS
CARD A Santiago	confirmation bias	<i>He interpreted the data in a way that fit with his idea about Southsand fever.</i>	Look for more information from other sources.
CARD B Jiwoo	conflict of interest	<i>She gives good reviews to products because she earns money through affiliate links.</i>	Check other online reviews of the products. Look for a review that doesn't have affiliate links.
CARD C Mohamed	conformity bias	<i>He had been wearing a mask everywhere but then went to a party and didn't want to stand out, so he took off his mask.</i>	Don't worry about it. Try to ask others why they are not wearing masks to understand their reasons.
CARD D Maria	emotion bias	<i>Maria donated all her money because she felt bad for the sick patients.</i>	Research other charity organizations to see if any of them would be better to donate to.
CARD E Georgia	confirmation bias	<i>She only selects information from the Southsand Chronicle to read, because she believes they report what she knows to be true.</i>	Look at other newspapers to see if they are reporting the same facts.
CARD F Trevor	emotion bias	<i>He didn't want to go to the doctor because he was worried that a diagnosis of Southsand fever would ruin his planned trip.</i>	Don't let your emotions keep you from evaluating the evidence you have. Consider other explanations for symptoms.
CARD G Gill	confirmation bias: biased selection, conformity bias	<i>She only used information that came from the conspiracy blog site and matches her existing ideas. She believes the hoax because her relatives believe it.</i>	Look for more trustworthy sources. A blog about conspiracy theories is probably cherry-picking data. Consider other explanations for Southsand fever and evidence for and against the idea of it being a hoax.

DEFINITION

CHARACTERISTICS

WORD

EXAMPLES

NON-EXAMPLES

DEFINITION

an unconscious and systematic error in thinking

CHARACTERISTICS

- *usually done unconsciously*
- *errors are predictable*
- *happens in both fast thinking and slow thinking*

WORD

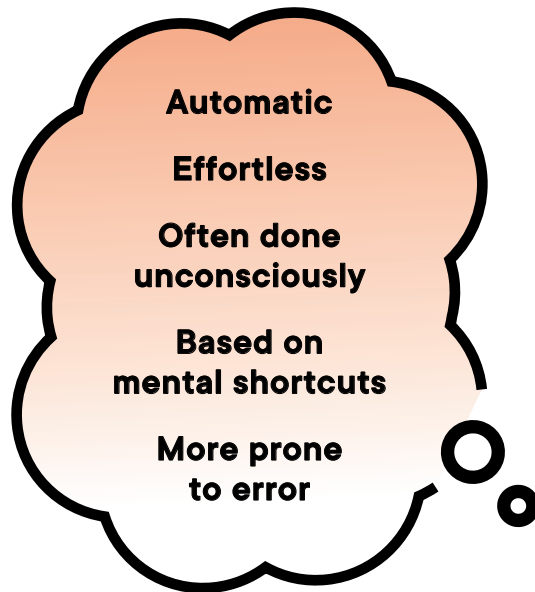
cognitive bias

EXAMPLES

- *confirmation bias: confirming existing beliefs*
- *conflict of interest: money or loyalty make it hard to make fair decisions*
- *conformity bias: changing to fit in*
- *emotion bias: emotions overpower reasoning*

NON-EXAMPLES

- *carefully controlled scientific experiments*
- *trying to prove yourself wrong*
- *updating your ideas when you encounter new information*

FAST THINKING

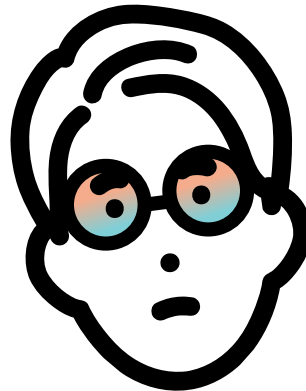
Example of Cognitive Bias Affecting Fast Thinking:

Being overconfident in the accuracy of your judgements when making a quick decision

SLOW THINKING

Example of Cognitive Bias Affecting Slow Thinking:

Only gathering information that favors your existing ideas when researching a topic



Cognitive Bias

can be like wearing colored glasses that distort how you see the world.

CARD A

Santiago believes you can get Southsand fever from your pets. He knew 2 people who got Southsand fever who had dogs. Then he heard on the news that almost 30% of people who were infected have dogs as pets. “See,” Santiago told his friend, “that evidence shows that having a dog increases your chances of getting Southsand fever.”

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD B

Jiwoo has a lot of followers on her social media. She reviews a lot of healthcare products because it generates the largest numbers of viewers. Lately, she has been reviewing supplements that might help fight Southsand fever. While she likes some of the products, she knows that there is not much evidence showing that they cure any disease, let alone Southsand fever. It doesn't bother her though, because she earns money through affiliate links whether the products work or not.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD C

Mohamed was not concerned about the outbreak of Southsand fever. He knew some people were wearing masks, especially while at work, to protect themselves. He didn't know anyone who was sick, but he decided to wear a mask at work and when he was out with groups of people. One day, he went to a large party for a coworker, and he noticed no one was wearing a mask. He felt like he didn't fit in, so he took off his mask and put it in his pocket.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD D

Maria's mom had Southsand fever and was very ill for a long time. Maria was extremely worried and felt helpless in that situation. Several weeks later, Maria was at the store where she saw a flyer. It requested donations for the local hospital to treat patients with Southsand fever. The flyer showed pictures of cute sick kids and elderly patients. Maria felt badly for the people in the pictures and remembered her mom's experience. Maria donated all the money to the hospital that she had planned to spend at the store.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD E

Georgia reads the *Southsand Chronicle*, and only the *Southsand Chronicle*, as a news source. She believes they report what she knows to be true—that Southsand fever is already everywhere. She almost always agrees with the articles, especially since she selects the ones that appeal to her. She sees no need to read other perspectives.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD F

Trevor developed a cough a few days ago. He was worried about getting Southsand fever because he had planned a trip. He refused to go to the doctor even when he started to feel worse. He thought, *If I go to the doctor, I might have Southsand fever and that would ruin my trip.* He ignored his symptoms because he was so worried, but he continued to feel worse. Finally, his friend convinced him to go to the health clinic. He was not diagnosed with Southsand fever, but he waited so long to see the doctor that his illness needed more aggressive treatment.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS

CARD G

Gill thinks that Southsand fever is a hoax because everyone in her family, including her parents, thinks so. She thinks the government made up the disease so they could inject patients with microchips when they go to the hospital. She recently found a blog called *Southsand Secrets* that describes possible government conspiracies. It argues that the absence of any clear evidence for such conspiracies must mean that the city is hiding the evidence. Gill has always felt that there was a conspiracy and that article proved it to her. She believes *Southsand Secrets*, so she doesn't fact-check any of the information from it.

SCIENTIFIC THINKING FOR ALL: A TOOLKIT

UNIT 5: SKILLS TO EVALUATE THINKING, ACTIVITY 5: SOUTHSAND FEVER STORY CARDS



ACTIVITY 6

Evaluating a Scientific Claim

GAME

ACTIVITY 6

Evaluating a Scientific Claim

ACTIVITY SUMMARY

In this activity, students play a game that simulates an epidemiological investigation in the Southsand fever scenario. Students gather and analyze data about the fictional disease to determine the mode of transmission of Southsand fever. The task includes the slow, actively open-minded techniques they learned in the unit so far to investigate a series of hypotheses they develop. The activity concludes when students completely evaluate the evidence and construct a claim about how Southsand fever spreads.

ACTIVITY TYPE
GAME

NUMBER OF
40-50 MINUTE
CLASS PERIODS
2-3

KEY CONCEPTS & PROCESS SKILLS

- 1 Common scientific practices are designed to support slow thinking, which makes scientific conclusions more reliable.
- 2 An actively open mindset helps reduce errors from cognitive biases and cognitive shortcuts by deliberately seeking out new ideas and information that could change one's mind.

NEXT GENERATION SCIENCE STANDARDS (NGSS) CONNECTIONS:

Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues. (*Science and Engineering Practice: Engaging in Argument From Evidence*)

Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence. (*Science and Engineering Practice: Engaging in Argument From Evidence*)

CONCEPTUAL
TOOLS



VOCABULARY DEVELOPMENT

disease transmission

(assumed prior knowledge)

the various ways that infectious diseases can spread

epidemiologist

a scientist who studies the patterns, causes, and control of disease in groups of people

hypothesis

(assumed prior knowledge)

a possible explanation for observations, facts, or events that may be tested by further investigation

TEACHER BACKGROUND INFORMATION

Disease Outbreak Response

Potential outbreaks can be identified by surveillance systems that monitor health-related events and data from sources such as hospitals, clinics, laboratories, healthcare providers, schools, public reports, or even social media trends. A public health team will respond to an outbreak in three major stages that identify the outbreak, find the cause of the outbreak, and then manage the outbreak. The order of these steps and the work needed for each step will vary depending on the outbreak. For example, public health teams will often implement prevention and control measures (e.g., recommending hand washing) before they know the exact cause or source.

Identifying the Outbreak

In the first stage, epidemiologists will compile a list of possible illnesses and establish a public health team. Next, they will establish if an outbreak is actually occurring by comparing the current case count to historical data. They consider the speed and severity of the illness to decide if it is an outbreak. If possible, a laboratory professional will also verify the diagnoses and identify the disease-causing agent. Once an outbreak is confirmed, a detailed case definition is established to identify which individuals are to be considered affected by the outbreak. A public health team then systematically collects and records information on affected individuals including demographics, symptoms, and potential exposures. All the relevant data for each case is compiled in a table called a line list. Biostatisticians will then analyze the data to identify patterns and trends such as similarities in age, location, or activities among cases.

Finding the Cause of the Outbreak

In the second stage, investigators attempt to pinpoint the source of the outbreak. This often involves constructing epidemiological curves, which visualize the distribution of cases over time. By examining these curves, patterns emerge that can suggest the nature of the outbreak, such as a point source, common source, or propagated outbreak. Environmental investigations may also be conducted to identify potential contamination sources. The public health team will develop hypotheses based on relevant information (e.g., usual sources of the disease-causing agent, the cluster or spread of the disease, age groups affected), and a biostatistician will evaluate the hypotheses by comparing the rates of affected