How the Scientific Method Invalidates "Fake News"

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Abstract:

This chapter examines the process of science and the ways that "breakthroughs" are sometimes inaccurately reported in the natural sciences. Scientific ideas are evaluated within the scientific community through an iterative process. They are rarely dependent on one key experiment. Errors in communication can occur at many points after the research has been completed. In evaluating science communication, seek independent confirmation of the information and seek the primary research report. Within a primary report of research, look for transparency about conflicts of interest, details about participants or population studied, and author discussion of weaknesses of the study.

Keywords: information literacy | fake news | scientific method | scientific reporting

Chapter:

*****Note: Full text of article below**

CHAPTER SEVENTEEN

HOW THE SCIENTIFIC METHOD INVALIDATES "FAKE NEWS"

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ABSTRACT

This chapter examines the process of science and the ways that "breakthroughs" are sometimes inaccurately reported in the natural sciences. Scientific ideas are evaluated within the scientific community through an iterative process. They are rarely dependent on one key experiment. Errors in communication can occur at many points after the research has been completed. In evaluating science communication, seek independent confirmation of the information and seek the primary research report. Within a primary report of research, look for transparency about conflicts of interest, details about participants or population studied, and author discussion of weaknesses of the study.

Introduction

What is Science?

In order to discuss the processes involved in scientific research, we must first have a solid understanding of what science is. From the Latin background of the word *scientia*, meaning knowledge, to the standard definition of science from Merriam-Webster, "knowledge concerned with the physical world and its phenomena," it is clear that "science" is what we know.[1] What is lacking from many definitions, and many people's understanding, is the process of *how* we know. Science is a process of learning, not merely a collection of facts. "How scientists know and explain the natural world and what they mean by explanation and knowledge are both directly related to the processes, methods, and strategies by which they develop and propose explanations."[2] The explanations of the natural world all start similarly. Whether it be atoms, minerals, or organisms, the initial data to support the explanation must be collected through observations or experiments. These observations "are the meat and potatoes of science. We start a research project with observations made either in the field, the library, or the laboratory. How these observations are collected, classified, interpreted, and used as the basis of theorizing (from a hunch to a eureka) is, more or less, what science is about."[3]

Science does not stop at simply observing. If it did, then science *would* just be a collection of facts. Instead, the observations lead to questions and a desire for explanations and interpretations. Scientists use the data they collect to "introduce ideas, develop theories, or generate hypotheses that suggest connections or patterns in nature that can be tested," adding to the overall knowledge of the topic. This process of acquiring knowledge is the basic scientific method that all science is based on.[4]

The Scientific Method

"The scientific method was first introduced to American science education in the late 19th century, as an emphasis on formalistic laboratory methods leading to scientific facts."[5] These principles were introduced in elementary school: ask a question, form a hypothesis, conduct an experiment, and come to a conclusion. Each of these steps can be expanded as students gain more critical-thinking skills. *Asking a question* will also include background research to inform the question being asked and to help refine the question. Students are also eventually taught that when you *form a hypothesis* that it should be testable and answerable through your experiment. *Conducting an experiment* involves numerous steps from experiment design, controlling variables, and recording results, just to name a few. *Coming to a conclusion* is not the end of this very basic version of the scientific method. This linear perspective is problematic.

The issue with portraying the scientific method as a linear set of steps "is that the reader may assume that [this process] is written in stone and therefore is to be followed step by step. In the real world, however, this is not the case. Science is not a linear process because it does not have to start with an observation or a question. Moreover, science often does not include experiments. Science is more fluid and dynamic (never static) and evolves around input obtained from the natural world, from studying the work of others, from interfacing with colleagues, or from experience."[6] Instead of fixed steps that scientists always follow, there are general features of scientific inquiry that include similar processes, techniques, and characteristics across disciplines. The National Academies of Sciences sums these features up nicely, stating that "scientists introduce ideas, develop theories, or generate hypotheses that suggest connections or patterns in nature that can be tested against observations or measurements (i.e., evidence). A published scientific article allows other researchers to review and question the evidence, the methods of collection and analysis, and the scientific results."[7] These conversations around research are what makes science a dynamic and iterative process. As questions are posed and explanations suggested, more complex questions arise and the conversation around a topic continues to grow and evolve.

Regardless of the discipline, sharing findings is the most important part of the process as scientists are constantly building on the work of their predecessors, incorporating feedback from others, and revamping their own research. This "communication and collaboration within and between sub-disciplines of science are key to the advancement of knowledge in science. For this reason, an important aspect of a scientist's work is disseminating results and communicating with peers."[8] Another reason why sharing and publishing research is the most important part of the scientific process is the opportunity it provides for other scientists to repeat the experiment. One experiment (or article) about a topic is not enough to be accepted by the scientific community. The process must be repeated by others and have reasonably similar results. Independent verification is an important part of accepting scientific findings. This is why the descriptions of experiments are so robust and detailed, so others can perform the same experiment to see if they have the same results. For this reason, when news outlets report on "a new study," the findings hold little weight in the scientific community yet may add confusion to the public as journalists "rarely inform the public when [initial studies] are disconfirmed—despite the fact that around half of the studies journalists write about are later rebutted by follow-up studies."[9] This may contribute to why the media reports publish conflicting statements over the years, especially with regard to health reports. Schoenfeld and Ioannidis demonstrate the absurdity of relying on a single study in "Is Everything We Eat Associated with Cancer? A Systematic Cookbook Review." Their study of published research on the cancer risk effects of forty common ingredients found that "associations with cancer risk or benefits have been claimed for most food ingredients [and] many single studies highlight implausibly large effects, even though evidence is weak."[10] Without being reproduced independently, these single study claims of X ingredient being associated with an increased/decreased risk of cancer should not be picked up by the media at all. Understanding why is crucial in the battle against scientific miscommunication.

Communicating Scientific Research

It is important to have context about scientific communication. This includes understanding whether a paper has been critically evaluated by impartial experts and being aware of systemic issues that might affect evaluation or reporting of research. Science research is often communicated first to other researchers. This might happen via preprints, conferences, and/or peer-reviewed journal articles.

Preprints

Preprints are preliminary research reports made freely available online before publication. Preprint repositories are intended for "rapid sharing of new research results" without waiting for peer review and other publication steps that can take a year or more.[11] The practice of posting preprints online is well established in math and physics. Repositories are also available for other fields: arXiv (https://arxiv.org/, physics, math, computer science, quantitative biology, statistics), bioRxiv (https://www.biorxiv.org/, biological sciences), medRxiv (https://www.medrxiv.org/, health sciences), OSF Preprints (https://osf.io/preprints/, multiple disciplines), and Preprints.org (https://www.preprints.org/, multiple disciplines).[12] Some researchers have been cautious of posting preprints. They have concerns about being scooped, difficulty getting the paper published, or releasing a paper that has not yet been through peer review. Mistakes could be found. A non-expert public might see the information and jump to hasty conclusions, especially if the researchers have not clearly stated the uncertainties involved in the study or placed the study in the context of other work in that area.

Conferences

A great deal of conversation takes place in conferences. Preprint repositories can facilitate this by providing a doi, stable link, date stamp, etc.[13] Conferences are an important channel to present early-stage research to peers. Scientists present methods, data, and sometimes also-needs and negative results. They get feedback on their projects and might even find collaborators. Conference presentations and papers can facilitate research progress, but there are several important things to keep in mind. Conference submissions are usually not subject to the same rigorous peer-review process as are journal articles.[14] Conference materials tend to be preliminary. Reported sample sizes, estimates of treatment effect, and even results might differ from what is later published in a peer-reviewed article.[15]

Scherer et al. examined hundreds of conference abstracts and other meeting summaries. They found that "less than half of all studies …initially presented …at meetings [were] published as journal articles in the 10 years after presentation."[16] They also noted reporting bias. Studies with positive results and studies originating in North America, Europe, or in an English-speaking country were more likely to be published. Skewed or selective communication leads to gaps in the scientific record. This might not contribute directly to errors in science news, but it is something that an informed public should be aware of.

Peer Review

The Understanding Science tutorial shows basic steps in publishing peer-reviewed science.[17] Researchers write up results and submit them to a journal. Then peer reviewers evaluate the research and tell the editor whether it is appropriate for publication. Authors might be given an opportunity to revise their article and resubmit. Ideally, "only articles that meet good scientific standards (e.g., acknowledge and build upon other work in the field, rely on logical reasoning and well-designed studies, back up claims with evidence, etc.)[18] are selected for publication. Manuscript rejections are inevitable. Researchers with a rejected manuscript can incorporate the useful parts of the review, update their manuscript, and submit it elsewhere.

The process is not always this straightforward. Though there are different methods of peer review, such as blind, double-blind, open, post-publication, etc., they are seen by many as an essential part of quality control.[19] The goal of peer review is "to uphold scientific rigor by accepting exemplary articles, improving articles with methodological and interpretive ambiguity, and rejecting problematic articles."[20]

Post-Publication Corrections

Problems are sometimes found in peer-reviewed articles after publication. Coudert points out, "Critique of published articles is a necessary and healthy part of the advancement of science."[21] Minor errors might result in a correction. It is not uncommon to see an online article with a note that links to updated information in a database or on the publisher's website. Sometimes, post-publication critique reveals "serious flaws in the data or authors' analysis, so that the findings or the conclusions …cannot be trusted anymore."[22] The publisher might issue a statement of editorial concern or even retract the article to make it clear that the article should not be considered part of the scientific record.

Unfortunately, the outlets that promote news stories such as "a new study says…" do not often follow up to report on retractions. Problematic research reports have plenty of time to enter the public sphere before they are detected. In a study of 331 retracted papers in chemical and materials sciences, Coudert found that the median time to retraction was two years.[23] It is possible that the information was shared and re-shared by the researchers, by the publicity departments of the authors' institutions, by the journal publishers, and then (if the research had been picked up by news outlets) by journalists, and possibly social media users before the papers were finally retracted. Thankfully, the publication of papers that are later retracted is not common. In an analysis published in 2018, Brainard estimated that "about four of every 10,000 papers" were later retracted.[24]

The information above is not intended to disparage those who seek to communicate research within the scientific community. It is not intended to disparage public relations offices that seek to promote the output of their researchers. It is not intended to criticize professional journalists or social media users. But even in the best scenario, key points can be exaggerated or lost as scientific research is communicated. New information can come to light about a research study.

Science Communication at the Beginning of the COVID-19 Pandemic

In early 2020, little was known about the virus that was causing the COVID-19 pandemic. Researchers, policymakers, and the general public were hungry for answers. The pace of scientific communication increased. As consumers encountered massive amounts of information about the new disease, chronic problems with science communication and science literacy suddenly became acute.

In June 2020, Dr. Sanjay Gupta pointed out that "most of what we've seen [about COVID-19] has come in the form of press releases or pre-print reports …without independent review."[25] This perspective on the state of current scientific understanding is a key part of scientific literacy. Without it, it would be easy to assume that any information related to a research study has been proved, discussed, replicated, and widely accepted.

Press releases are brief public relations pieces. As a health journalist explained, their purpose is to "make your institution …your big name researcher …your drug company and its products, look as good as can be." In May 2020, the drug company Moderna publicized preliminary findings of a vaccine study without including data or methods. This leap to advertise a product led to an investment frenzy and was criticized as "spin and opinion."[26]

Even preprints, which typically provide information for independent review, have been problematic. In the *New York Times*, Bajak and Howe described reactions to a preprint released by Stanford University researchers.[27] Apparently, the researchers reported that the fatality rate for the novel coronavirus could be as low as 0.12 percent, about as deadly as the common flu.[28] Within hours of the posting of the preprint, political partisans were using the document to justify protests against lockdowns and other mitigation efforts. Soon, academics jumped in to critique the recruitment, the tests, and the statistical methods used in the study. Independent critique is a normal part of the scientific process. As one researcher put it, "[This] is what happens when a really important result and an important study gets really put under the microscope by an entire community."[29] Unfortunately, this vital part of the process happened after the preprint had been publicized and widely accepted.

Scientific Reporting

Though the headlines about new findings are entertaining to readers, these reports on single studies are only the initial steps in the process of finding answers. When reading these reports, it is essential to find the original research article. Good science writers investigate the context of a research project and translate technical details into ideas easily understood by the general public. Yet many newspapers no longer employ science journalists who "develop special talents for explaining difficult science to the public."[30] Generalization of methods or findings by the untrained can lead to misinterpretations of what the study actually means. Problems with science communication can also arise or be magnified by the researchers themselves, the journal editors, the peer reviewers, traditional media outlets, or social media users. Some problems are easily spotted by non-scientists. The next section focuses on strategies for critically reading secondary sources and comparing them to primary research reports.

Spotting Problematic Research Reports

In an attempt to provide a broad objective description, we use terms such as "problematic reports." As researchers have pointed out, the description "fake news" has been used so widely to discredit information that does not support the speaker's point of view that it has become "irredeemably polarized."[31]

There are many challenges that a reader faces when looking at news articles or other secondary reports about research. The Canadian Science Policy Centre explored these challenges when they searched for information on topics popular with the general public.[32] They were most concerned with the inaccessibility of information (paywalls and dead ends),[33] and they found that scientific jargon was a major barrier to assessing the quality of the research and results. Experienced librarians recognize that navigating to specific sources and dealing with unfamiliar terminology should be addressed with undergraduate students.

Carl Sagan, a famous science communicator, described "tools for skeptical thinking."[34] These can be applied to articles written for the general public or for researchers. Some of Sagan's guidelines can be summarized as follows:

- Seek independent confirmation of the information.
  - Does a simple search online or in a library database lead to other results that confirm information from the source under examination?
- Do not rely on authority to prove that something is true; in science there are experts, sometimes they make mistakes.
  - Sagan endorses debate by knowledgeable experts with different points of view
  - We do not, however, encourage librarians or students to create a "false balance" by seeking any perspective at all related to a research topic. As an experienced science writer stated, "It is irresponsible …to portray the views of a lone dissenter as equally meritorious to those reflecting an established scientific consensus, …otherwise every …story involving satellites would include a comment from the Flat Earth Society."[35]
  - For librarians who use the A, B, C test (authority, bias, currency) or something similar,
    - determining signs of authority related to conducting or reporting

research is complex, including context and missing voices[36]
    - authority should be one part of an evaluation, not all of it
- Consider alternative explanations for any data
  - Do not get too attached to your own hypothesis
  - Remember Occam's Razor: if research data support several explanations equally, choose the simpler explanation
  - Librarians say, "Correlation does not equal causation." For example, "Before women got the vote, there were no nuclear weapons."[37]

In evaluating news about scientific research, do you see commentary or perspective from an outside expert who is not affiliated with the research team? Does the writer describe the implications of the study or uncertainties? All research contains some uncertainty. It is the job of the scientist to quantify those uncertainties.[38] A good science writer will find a way to describe this kind of information in their story. If you see science news that makes unbelievable claims or that seems like a promotional blurb about a research study without independent perspective or discussion of how the study fits into current science, then be concerned.

Teaching with "A New Study Says…"

If the report does not include a link to the original research article, there are usually enough indicators mentioned about the study that you can use as keywords to help you locate the article. This will usually include things like

- where the study took place (country, state, region)
- the research entity that performed the study (a research center or university)
- what journal the article was published in
- when the article was published
- the subject of the research

If you look at the article "Why painting zebra stripes on cows could save the agriculture industry major money," some of the factors that are listed in the report are that the experiment took place in Japan, at the Aichi Agricultural Research Center, published in PLOS One, and the subjects were cows (though you could also use additional terms such as *biting insects*, *stripes*, or *flies*).

Once you have found the original research article, what should you look for? Though the actual research may be difficult to read and understand if the subject is outside of your expertise, there are markers within the research that may signify quality research:

- Conflicts of interest. One of the quickest indicators to spot within research may be whether the researchers have a conflict of interest. Articles are required to disclose any funding agencies that supported the research being done. One example of funding that may cause an eyebrow to raise is an article published in the *Journal of the International Society of Sports Nutrition* in which the authors are quoted heavily by the marketing team of Essentia Water claiming the superiority of high-pH alkaline water for athletes, yet the "research study was supported by a grant from Essentia Water, and alkaline bottled water for the study was provided by Essentia Water."[39]

- Participants. Researchers should describe numerous attributes about the participants used within the study. These details are found in the methods section of the paper and will include characteristics such as species, gender, age, how many there were, how they were selected, and many more. The main thing to note about this section is that "bigger is usually better for sample size. The average taken from a large number of observations will usually be more informative than the average taken from a smaller number of observations."[40]

The species used in the study is also another important factor to look at within the article as "animal experiments often do not translate into replications in human trials."[41]

- Limitations of study/transparency. The limitations of the study should always be stated by the scientists. These are sometimes described by researchers as potential weaknesses of their study and are usually found in the conclusions. If a research paper does not describe sources of uncertainty, do not give it much weight as clearly describing the conditions of the research and how the results should be interpreted shows transparency on behalf of the researcher. Common types of limitations that are mentioned include sample size, sample profile, timing of the study, data collection process, and equipment, just to name a few. Stating these limitations is just one indicator of the level of transparency of the report.

Within our example research article, "Cows painted with zebra-like striping can avoid biting fly attack," many statements could be highlighted to prompt a discussion on the importance of sample size and the amount of data you are using:

- "Six Japanese Black cows were assigned to treatments" (abstract).
- "Three of the six cows were used in August and September 2017 and the other three in October 2018" (materials and methods).
- "The cows were arranged side-by-side…. Each cow was observed twice a day (am/pm) and a total of six observations were obtained for each cow and treatment" (materials and methods).
- Each cow was observed for 30 minutes, twice per day (materials and methods).

Other points within the paper could lead to other discussions:

- "The treatments consisted of black-and-white painted stripes, black painted stripes, and no stripes as a control" (materials and methods).
  - Discuss why scientists painted the black stripes (to account for a reduction of bites based on the paint itself, not the stripes), and how this is good experimental design.
- "Painting is usually considered a short-term marker …the development of more effective techniques …may be necessary in order to apply this method to animal production sites" (discussion).
  - Example of limitations of this technique to prevent biting flies on a large scale.

After examining each article, we can now compare what each actually states. This can easily be done in the table provided in the worksheet "A new study says…".

- The news article states, "Japanese scientists said the results suggest a promising, pesticide-free alternative to protecting livestock from biting flies."
- The research article states, "This work provides an alternative to the use of conventional pesticides for mitigating biting fly attacks on livestock."

Though the statements are very close, the term "promising" may be exaggerated. The news article quotes a comment about "when are we getting zebra clothes for humans?", yet a single study based on six cows is far from conclusive. We are not suggesting discounting the article completely, but it may not be time to invest in a stripe-painting apparatus for cows. By understanding that the scientific method relies on replication, we should instead be excited for future studies on this topic.

The process of comparing statements from the news article and original research article, you may also encounter many opportunities to expand on this lesson.

- Ask who is the author?
- Instead of using the link provided by the news outlet, we can practice picking out keywords to find the original research article. This is a useful exercise for live news reports!
- Search for the original article.

While the main learning activity for this chapter compares a news story to the original research article, instruction related to science communication could take other approaches. For instance, altmetric.com is a website that tracks attention paid to research papers. It provides overviews of news, reviews, and social media coverage of research studies.[42] Interested readers could investigate how a study has been reported and received, perhaps choosing from the annual Altmetric Top Articles list.[43] Retraction Watch is a blog created by science journalists that reports on retractions, peer review, and related issues. The writers produce annual lists such as The Top Retractions of 2019.[44] Learners could read a Retraction Watch commentary then investigate how a retracted article has been treated on the publisher website and in science databases such as PubMed. ResearchGate, a social media site for academics, is another rich source of information about issues involved in the production and dissemination of findings.

The misuse of scientific information is an area with great potential. SciCheck.org focuses on false scientific claims. Corporate front groups like the American Council on Science and Health debunk studies that might affect profits for their industry. Sometimes this group identifies actual flaws in research or reports, sometimes not. Angela Saini, a science journalist from the UK, has spoken widely about the spread of science misinformation online. Her book "Superior: The Return of Race Science" was on the journal *Nature*'s list of Top 10 Books of 2019. If a library doesn't own Saini's books online, an accessible snippet of her written work is the essay, "The Internet is a Cesspool of Racist Pseudoscience."[45]

Conclusion

There are several messages that we would like to reiterate to anyone looking at reports of scientific research. Science is a process, not a collection of facts. Anyone outside of a specific science discipline relies to some extent on quality control processes such as peer review. The peer-review system has flaws, so information should be verified by an independent source. Primary reports of research and replication studies are written for scientists but are important parts of the chain of evidence. Non-scientists can look for exaggerated claims, faulty logic, lack of discussion about uncertainty in a study, etc. Uncertainty is a part of science, just as much as careful measurement and reporting should be. Look for expertise in researching or reporting, but don't rely on authority to provide the correct answer. Be curious, think for yourself, and evaluate sources critically.

Learning Activity

How the Scientific Method Invalidates 'Fake News'

Topic: A New Study Says…

Student learning outcomes:

1. Students will be able to pick keywords out of a news report to find the research article that the news is reporting on.
2. Students will be able to identify common problems with news reporting of scientific research.

Brief description of activity:
This learning activity involves evaluating a news report about a scientific study. Students will learn how to find the specific study that the reporter is referring to by picking out key terms within the report and using those to find the original research article. Students will then examine the specifics of the experiment and open conversations to standards of quality research, such as sample size, faulty logic, or even funding biases.

Time to run activity:
~30 minutes

Preparation:

- Optional pre-class assignment: Assign students to watch *Scientific Studies: Last Week Tonight with John Oliver* (HBO) (http://go.uncg.edu/johnolivervideo). Though the language and content of this video should be reserved for mature audiences, we feel that this is a great introduction to get students excited about the topic.
- Print the popular article for students (or create a link to share).
  Craft, Lucy. "Why painting zebras stripes on cows could save the agriculture industry major money." November 20, 2019. Retrieved December 2019, from https://www.cbsnews.com/news/

zebra-stripes-on-cows-could-save-agriculture-industry-millions-experiment-japan-shows-deters-flies/.

- Print the associated research article for students (or create a link to share). Kojima, Tomoki, Kazato Oishi, Yasushi Matsubara, Yuki Uchiyama, Yoshihiko Fukushima, Noatu Aoki, et al. "Cows painted with zebra-like striping can avoid biting fly attack." PLOS ONE 14(10): e0223447 (2019). https://doi.org/10.1371/journal.pone.0223447.
- Print out worksheets: "A New Study Says…"

Teaching plan:

1. Break students into small groups.
2. Give groups either the link or printed copy of the popular article.
3. Give each student a copy of the Activity Worksheet 1: "A New Study Says…" (see Appendix).
4. Direct students to use the worksheet to guide their exploration and discussion of both the popular and research article.
5. Have groups find the original research article (optional). (This may be used as an opportunity to practice searching/finding a specific article if time permits.)
6. Have groups evaluate the research article based on the worksheet: "A New Study Says…" and other information from the lecture.
7. Discuss the implications of the activity on how students might view future news reports.
8. Optional: Lengthen the class by having groups find additional articles on the same topic for comparison.

Recommended readings:

Rao, T. S. Sathyanarayana, and Chittaranjan Andrade. "The MMR Vaccine and Autism: Sensation, Refutation, Retraction, and Fraud." *Indian Journal of Psychiatry* 53 (2) (2011): 95–96. https://doi.org/10.4103/0019-5545.82529.
This short article discusses the retraction of a *Lancet* article about a link between autism and the MMR vaccine. It touches on a number of issues important to understanding science communication.

Resnick, Brian. "Study: Half of the Studies You Read about in the News Are Wrong." Vox. March 3, 2017. https://www.vox.com/science-and-health/2017/3/3/14792174/half-scientific-studies-news-are-wrong.
This source is intended for the general public. It describes communication problems that arise when journalists focus on "a new study."

Saini, Angela. "The Internet Is a Cesspool of Racist Pseudoscience." *Scientific American Blog Network*, July 29, 2019. https://blogs.scientificamerican.com/voices/the-internet-is-a-cesspool-of-racist-pseudoscience/.
This *Scientific American* blog post was written by a science journalist. It has a good discussion of bias and other issues that come up in science reporting.

Sutherland, William J., David Spiegelhalter, and Mark Burgman. "Policy: Twenty Tips for Interpreting Scientific Claims." *Nature News* 503 (7476) (November 20, 2013): 335. https://doi.org/10.1038/503335a.

This list will help non-scientists to interrogate advisers and to grasp the limitations of evidence.

Vosoughi, Soroush, Deb Roy, and Sinan Aral. "The Spread of True and False News Online." *Science* 359 (6380) (March 9, 2018): 1146–51. https://doi.org/10.1126/science.aap9559.

This article reports on research about the spread of true and false news online.

APPENDIX

A New Study Says...

IN THIS ACTIVITY YOU WILL BE EVALUATING A NEWS REPORT ABOUT A SCIENTIFIC STUDY. THE QUESTIONS WILL HELP GUIDE A DISCUSSION ABOUT NEWS REPORTING AND RESEARCH QUALITY.

FIND THE ORIGINAL RESEARCH ARTICLE

Does the report have a link (or a citation) to the research article?

YES

Does the link work?

YES

Great! You have found the original research article.

NO

Use keywords to find the research article.

NO

What keywords can you use from the news report to find the research article?

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EXAMINE THE ORIGINAL RESEARCH ARTICLE

List any methods, statements, claims, or information in the article that you would like to discuss further.

COMPARE THE RESEARCH STUDY WITH THE NEWS REPORT

What does the news report claim?

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What does the research article claim?

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ENDNOTES

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