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Navigating an Infodemic: Methods for Teaching Critical Reading in the Health Sciences

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Navigating an Infodemic: Methods for Teaching Critical Reading in the Health Sciences

Candace Vance

Introduction

In difficult times, such as the COVID-19 pandemic, it's even more important that students recognize and question their assumptions regarding how knowledge is recognized as legitimate in their disciplines.¹ “When there is no time for proper peer review, each of us must be our own reviewer.”² How can we teach students to recognize flawed methods and data, even when the research may be presented in the top journals as the current best evidence? How do we teach future clinicians to look past the name of the journal or the reputation of the author and learn to discern quality evidence? This chapter discusses an example of a lesson plan in the health sciences that utilizes a retracted article related to the recent infodemic; this lesson plan uses the retracted article as a tool to help students improve their critical reading skills.

In 2020, researchers in the global healthcare community struggled to rapidly create and disseminate new knowledge as they witnessed the spread of the novel Coronavirus and the rising death toll in the SARS-CoV-2—now known as the COVID-19—pandemic. The onslaught of questionable COVID-19 information caused the World Health Organization (WHO) to declare an infodemic in 2020.³ Although the term *infodemic* may not be familiar to everyone, it isn't a new concept; Gunther Eysenbach coined the concept *infodemiology* in 2002.⁴ There are several definitions, but the most relevant and timely considers it as “the rapid spread of information and misinformation that accompanies a

pandemic, which makes it difficult for decision-makers to find reliable sources of information.”⁵ Infodemics may cause serious delays and complications in the diagnosis, treatment, and prognosis of patients with an unknown virus.

Critical reading skills are necessary to negotiate the uncertainty surrounding treatment options during a pandemic-induced infodemic. In 2020, for example, experimental treatments granted emergency approval by the US Food and Drug Administration (FDA)—approval that would normally be subject to a much longer and more rigorous approval process—proved especially problematic. Clinicians had to quickly decide for themselves whether to administer treatments based on emergency FDA approvals, which relied on an unusually weak body of evidence.⁶ As educators, we must stress critical reading skills in the health sciences to prepare students as they begin to take responsibility for patient health care decisions. Students will soon go from reading for academic success to reading for patient success. They must develop the ability to read difficult texts and evaluate them for credibility, to make judgments about the outcomes, and to make relevant inferences for their patients.⁷

Critical Reading Connection

Stephen Brookfield proposes that critical reading consists of three steps: “(1) Understanding the text in terms the author sets; (2) conducting a critical analysis of the text, including identifying and evaluating assumptions; and (3) taking a position.”⁸

How can we teach students to engage in each step of critical reading when they often want to skip the difficult, often uncomfortable step of evaluating assumptions? Brookfield stresses the importance of recognizing assumptions in critical thinking by breaking down the process, including “(1) Identifying the assumptions that frame our thinking and determine our actions, (2) checking the degree to which these assumptions are accurate and valid, (3) looking at our ideas and decisions from several different perspectives, and (4) on the basis of all this, taking informed actions.”⁹

In this chapter, I use retracted articles to provide students with examples to uncover their assumptions regarding scientific scholarly publishing as well as the opportunity to practice their critical reading skills by modeling the scholars’ conversations in the errata. The teaching strategy I describe uses, as an example, an article that was retracted during the COVID-19 infodemic. This lesson plan can be easily adapted to a wide range of timely retracted articles that the instructor feels will best engage their students.

Teaching Strategy

Using a Retracted Article as a Teaching Case Study

Research around COVID-19 overwhelmed the research and publishing sectors and resulted in an explosion of publications in 2020.¹⁰ Quality of methods and conduct in study design may have become secondary to speed. This became apparent with the increase in the number of retracted articles.¹¹

Publishers were faced with two pressures. The *economic* side placed speed above scientific integrity. The *scientific* side required researchers to maintain reproducible methodology, shareable data, and exemplary scientific conduct. Publishers have long struggled with how to address these inadequacies and opposing principles. The pandemic, with the increase in publications and the need for quick answers, aggravated and exposed an ongoing problem.

Clinicians, presented with more articles to read, many of which were of questionable quality, struggled to find the best evidence on how to treat their patients.¹² While understanding the difficulty of conducting research during COVID-19, Alexander and Debono et al. called for the continued need for strong and ethical study designs and data. They argued that there is an absence of credible research for evidence-based medicine in COVID-19.¹³

Quality was also called into question with the rise in preprints, which are posted online without the benefit of the peer-review process.¹⁴ Preprints rely on post-publication peer response, which in many cases is a promising alternative to the traditional pre-publication peer review. According to Richard Sever, co-founder of bioRxiv and medRxiv, preprints are usually only withdrawn at the author's request, unless there is evidence of fraud, ethics violations, dangerous material, or legal issues.¹⁵ But in the clinical sciences, and particularly during a pandemic, it can be all too tempting for clinicians, caught between pre-print and the post-publication peer review, to base patient care decisions on science that has yet to be vetted.

The pandemic's effect on the traditional peer-review and publication process is also evident in the unusually high number of retractions of published COVID-19 research. As of fall 2022, "Retraction Watch," a blog that tracks and attempts to increase the transparency of retractions, listed 260 retracted COVID-19 papers.¹⁶ Two of those retracted papers from two of the top medical journals have come to represent the infodemic of 2020. "Hydroxychloroquine or chloroquine with or without a macrolide for treatment of COVID-19" was published by *The Lancet*, and "Cardiovascular disease, drug therapy, and mortality in COVID-19" was published by the *New England Journal of Medicine (NEJM)*.¹⁷ Both papers concerned possible treatment options for COVID-19 and both relied on electronic medical data managed by Surgisphere Corporation, a small Illinois-based company owned by a vascular surgeon, who was also one of *The Lancet* article's coauthors, Sapan Desai.¹⁸

The lesson plan presented in this paper focuses on *The Lancet* article and the use of hydroxychloroquine or chloroquine as a possible COVID treatment, although the lesson plan can easily be applied to a different retracted article. In my experience, students are more likely to respond to topics that have a current societal or personal impact.

Although the authors, peer-reviewers, and *Lancet* editors failed to adequately question the data in the hydroxychloroquine study, post-publication readers quickly did. How could such a small data company gather and analyze such an astounding amount of hospital records? And if so, how could they manage to collect and evaluate so many records ethically within privacy laws? In a letter of concern addressed to the authors and the editor of *The Lancet*, 146 clinicians, medical researchers, statisticians, and ethicists highlighted ten main concerns and anomalies.¹⁹

In October of 2020, in response to the hydroxychloroquine article retraction, *The Lancet* published an editorial entitled “Learning from a retraction” in which they reported the changes they would make in their editorial process to prevent another similar incident.²⁰ Changes included requiring authors to sign a statement indicating that at least one author had accessed and verified the data for their manuscript. They would also require a data-sharing statement detailing what data would be shared, when it would be available, and the access criteria. Manuscripts based on large datasets would also need to be accompanied by reviews from experts in data science.²¹

Lesson Plan Using a Retracted Article Case Study

The Libraries at Murray State University (MSU), a four-year, public master’s level institution with approximately 8,500 students and a recently added doctoral program in nursing, offer an information literacy minor. Besides undergraduate and graduate programs in nursing, MSU also has undergraduate and graduate programs in communications disorders, athletic training, exercise science, and nutrition, dietetics, and food management. One of the Information Literacy (INF) minor classes I teach provides for these areas: INF 310—Health Information for Practitioners and Consumers.

This information literacy lesson could work well for nursing, allied health, or pre-professional or professional students in the health sciences. This lesson should be given later in the semester after students have acquired the necessary skills to search discipline-appropriate databases, evaluate scholarly information, and have a basic understanding of methodology in the health sciences.

At the end of the session, students should be able to

- apply proper search techniques to find known articles and full-text;
- explain how an infodemic can influence the peer-review process and publication process;
- examine and explain the importance of implementing more open data requirements in publishing;
- examine their personal assumptions regarding scientific scholarly communication; and
- analyze the veracity of a scientific study to enable appropriate health care decisions for their patients.

Earlier class sessions address peer review, the shortcomings of data review in the publication process, and retractions. This lesson plan asks, “How can we critically read with these shortcomings in mind during a public health crisis and still feel confident in our decisions based on the evidence that’s available?”

After an overview of the ADIR(M) method of reading scholarly articles—Abstract, Discussion, Introduction, Results,²²—as well as the importance of reading any errata associated with a retracted article, the assignment requires students to first search for the original hydroxychloroquine article in the MEDLINE database in class prior to discussion and find the full text of the article. Students then read the article and answer questions

about the integrity of the study. Class discussion and assignments have already addressed how difficult it is to detect problems when all the data is not available, and I have already introduced the importance of FAIR data policies for publishers and researchers, which require data to be findable, accessible, interoperable, and reusable.²³ They must also indicate why they think the article was retracted. Instructors can substitute other retracted articles and secondary articles, adjusting the prompts accordingly.

PART 1

Step 1: After conducting a Medline search to find the known full-text article, “Hydroxychloroquine or chloroquine with or without a macrolide for treatment of COVID-19, a multinational registry analysis,”²⁴ students read the article using the ADIR(M) method discussed in class and answer the following questions:

- Does anything strike you as troublesome about the article? What? Why does it trouble you?
- When claims are made, do they appear to be grounded in documented empirical evidence?²⁵ What is the evidence?
- What are hydroxychloroquine and chloroquine normally used to treat?
- Why did they decide to try and use it to treat COVID?
- What other drug do they combine with hydroxychloroquine to treat COVID?
- What adverse effect do previous studies show can occur when these drugs are combined with a macrolide?
- How many participants are included in the study?
- Does that number seem reasonable?
- Is it readily apparent that the article has been retracted?
- Why do you think the article was retracted? What are your assumptions regarding retracted articles?
- Do you have any assumptions regarding the article, the journal, or the authors? What are they?

Step 2: This portion could be combined with the in-class portion or Part 1 of the assignment or used as online discussion or homework for an upcoming class. Students must locate the full record and read the errata, including “An Open Letter to Mehra et al. and *The Lancet*.”²⁶

Further evaluation regarding the article’s errata:

- How many comments do you see in the full MEDLINE record?
- Scanning the comments and expressions of concern, what issue caused the concern?
- Did you consider their concerns when you read the article? Why or why not?
- Did the journal retract the article? Why or why not?

PART 2

Step 1. To model critical thinking, it’s often helpful for students to review published critiques of the work in question.²⁷ Before the next class, students find “The Scientist” article entitled “Lancet, NEJM retract Surgisphere studies on COVID-19 patients”²⁸ A similar secondary article could also be used for this retracted article or other retracted

article used for the lesson. The teacher may choose to focus on peer review, data transparency, or retractions. If focusing on retractions, instructors may also find “Learning from a Retraction” from the editors of *The Lancet* helpful.²⁹

Step 2. Read the two documents and answer the following questions:

- Who was actually responsible for retracting the article?
- What changes in policy has *The Lancet* reported to try and ensure that the problems following the publication of the hydroxychloroquine article will not occur again?
- Do you think those changes are enough?
- What other policy changes do you think should be required?

Step 3. Class discussions and a discussion essay on Canvas involve the critical reading of the hydroxychloroquine article to evaluate data integrity, study design, peer-review process, and health misinformation. The publication and subsequent retraction were costly, delaying research, contributing to health misinformation, and resulting in unnecessary health risks to patients. Discussion on Canvas or in the classroom regardless of the particular retracted article the instructor chooses should focus on the reason the article was retracted and avoidable causes. These sample prompts for discussion can help direct class discussion or Canvas discussion regarding retractions and the hydroxychloroquine article:

- Where does the data reside?
- Did peer reviewers have access to the data?
- When was the retraction published?
- How did the retraction affect further study regarding this treatment?
- Do you think the origin of the data represents a conflict of interest? Why?

Discussion

Brookfield stresses the importance of students learning to include the second step of critical reading—“conducting a critical analysis of the text”—including identifying and evaluating assumptions.³⁰ This comprehension step is necessary before they take a position on the text. Class discussion can address student assumptions regarding the article before they read it.

Instructors may choose to talk about the different types of assumptions. Causal assumptions are based on cause-and-effect thinking. These encourage us to consider the future consequences of certain decisions.³¹ One example is telling our students that comprehending clinical studies is difficult for clinicians and health professionals, too. They have to read them several times. Knowing it is also hard for professionals may discourage students from quitting when reading challenging scientific research. Prescriptive assumptions are based on our ideas of desirable ways of thinking or acting.³² Students may hold assumptions about how a good student or a good teacher acts or thinks in class. They may assume that good students don’t ask too many questions or let the teacher know when they’re confused. The last type of assumption is paradigmatic assumptions. These are the assumptions instilled in us by our culture or society.³³ They are how we order the world

into categories so that it makes sense to us. Brookfield refers to patriarchy, racism, or any dominant ideology we may hold without even realizing it as paradigmatic assumptions.³⁴

After reading the article, part of the exercise should involve asking students to critically examine aspects of a study that are surprising. Ask what specifically is troublesome? Discourage them from shying away from these initial concerns and assuming peer reviewers have already addressed and resolved any questionable aspects. In short, they must recognize if some type of assumption is preventing them from further questioning the text. In the hydroxychloroquine article, the number of participants is surprisingly high. In a different article, red flags may involve an extremely small number of participants, an aspect of the methodology that might seem difficult to reproduce, a leap in logical thinking, or a possible conflict of interest. Of course, it's easy to do this when you're reading a retracted article that's already been questioned and found lacking. But examining retracted articles in the classroom can provide a model for students to learn to recognize their assumptions, decide whether their assumptions are valid, look at different perspectives, and then make informed decisions.³⁵

The first reading of the article might not initially invite students to question the origin of the data. A question regarding the critical analysis of the data in a scientific scholarly article mentioned earlier in the lesson plan could be, "When claims and contentions are made by the authors, are they grounded in documented empirical evidence?"³⁶ This should prompt students to think specifically about the methodology and the origin of the data.

After reading the accompanying errata, students might experience a slight feeling of disorientation or confusion. Jack Mezirow refers to these experiences as disorienting dilemmas.³⁷ Experiencing a disorienting dilemma is part of normal development in adulthood. When we are faced with them, it should force us to consider how our thought processes influence or distort how we handle problems and our relationship to them.³⁸ The realization that the raw data was not examined or even available to the authors of the article or the reviewers might present itself as a disorienting dilemma, which "describes an unexpected situation that forces you to think differently about something you've taken for granted up to that point."³⁹

After reading the concerns from the hydroxychloroquine article, students might ask themselves why they hadn't questioned the data. This is a common reaction. It's the "duh" moment or the *why didn't I think of that* moment. Oftentimes, they did. If students think back to their first reading, they may have thought, *Wow, that's a huge data set*. This presents an opportunity in the classroom. Did they not question it because of assumptions they may hold? What assumptions? Were the authors or reviewers operating under assumptions too? What if different data had been used—accurate, shareable data?

Brookfield points out how difficult it is to uncover assumptions when they are associated with dominant ideologies.⁴⁰ We have already accepted them and aren't comfortable questioning them. Once students have identified assumptions, critical class discussion can involve how accurate or valid these assumptions are. One objective of the lesson plan is for students to recognize that they may possibly hold the assumption that peer-reviewed articles in highly respected journals are beyond reproach. I would argue that educators are often guilty of framing the concept of the peer-review process as infallible. The sanctity

of peer review may be one of academia's dominant ideologies. Of course, we want our students to find peer-reviewed articles, but we need to couple that with critical reading, addressing the shortcomings of the peer-review process, and reminding them to think critically about the methodology and outcomes of a study regardless of where it's been published.

Reading the comments regarding an article that has subsequently been retracted illustrates how clinicians and other researchers read critically and challenge the methodology of their peers. In this case, the 146 researchers did not assume the validity of the data. They questioned it. A study population of 96,032 patients is an unusually large number. They refused to accept the conclusions of the study or to take a position on the results until they were presented with the data on which the study was based. The inability to verify the raw data was cause for the authors to admit their mistake and retract the article.

The flip side of the class or Canvas discussion asks students to identify their assumptions about retracted articles. Readers often assume the findings are wrong in a retracted article, but this is not always the case. In the case of the hydroxychloroquine article, the findings were eventually upheld. The article was retracted because of data issues. The delay in confirming the findings after the retraction may have affected treatment decisions and public health. In the case of *The Lancet* article, the post-publication conversation led to its rapid retraction.

Conclusion

Experience in critical reading should instill in students the confidence to question authority. Teachers must not only permit them to question published ideas but also encourage them to do so by using a guiding framework for asking questions. The second part of this lesson activity prompts students to look specifically at what aspects of a research article they should question. Through critical reading practice, we, as educators in the health sciences, strive for students to question certain elements in texts or to question information they discover in any context.

Brookfield states that each discipline has its own way of determining how knowledge is recognized as legitimate.⁴¹ Once students become familiar with these determinants, they must then critically evaluate them and not only recognize but also question those assumptions. I would argue that *The Lancet* and *NEJM* have long been regarded as purveyors of legitimate medical knowledge. In the health sciences, readers must learn to rely less on authority as a quality indicator and more on the scientific evidence. It is difficult to relinquish these long-held assumptions, but shortcomings in the editorial, peer-review, and data-review processes, especially during this pandemic, require we view the published research in these venerable journals with the same critical eye as we would any research.

Douglas Mann points out that before the pandemic, the current systems for scientific research and publishing had inherent problems that were merely exposed by the pandemic.⁴² The overwhelmed systems were unable to provide timely answers to the health care workers on the frontlines or those who make policy decisions for the frontline workers. Teachers should examine the implications of the past few years to determine how

to ensure our students learn from these mistakes in preparation for the next public health crisis. The number of COVID-19 publications and retractions offer unique opportunities to develop not only students' critical reading skills but also those of practicing clinicians. The objective of this lesson plan is to help students gain the confidence necessary to challenge the status quo. As librarians, we should help equip them with the knowledge, tools, and courage to challenge powerful publishers and problematic practices so they can provide the best health care decisions for their patients.

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