Lesson

Online Information Literacy: Applying the CRAAP Test to Vaccine (Mis)information

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Abstract
Teaching scientific literacy skills can help combat the propagation of misinformation online. This lesson is intended to give students practice identifying reliable scientific information on the Internet, in the context of vaccine safety. It was designed for a first-year seminar taught fully through remote instruction but can be adapted for any in-person or blended course. It can also be easily modified to use for other biologically-relevant topics and is especially well suited for controversial topics. This lesson consists of three activities. First, students review an article about identifying reliable Internet resources and search online for vaccine safety information. Then, students meet in small groups to review and rank the resources that each of them found from most to least reliable, referencing the criteria laid out by the CRAAP test (Currency, Relevance, Accuracy, Authority, Purpose). After ranking each resource, students reflect on how their thinking about online resources has changed during the activity and how they will evaluate scientific information online in the future. Finally, students use the reliable resources that they and their classmates compiled during the activity as references to write about how the biology of vaccines relates to the five Core Concepts. Following this lesson, 100% of student groups were able to correctly identify at least one reliable and unreliable online resource and 95% of groups were able to articulate particular qualities of resources that helped them establish their reliability. Further, 100% of groups could articulate how their thinking had changed throughout this activity.

Learning Goals
Students will:
◊ understand criteria for reviewing and evaluating the reliability of scientific information that they read online, including blogs, popular press articles, government websites, and scholarly articles.
◊ use the online resources they find to describe how vaccines relate to the biology Core Concepts of Evolution, Structure and Function, Information Flow, Exchange, and Storage, Pathways and Transformations of Energy and Matter, and Systems.
◊ work collaboratively in small groups and practice consensus-building.

Learning Objectives
Students will be able to:
◊ locate online resources about vaccines.
◊ evaluate the reliability of scientific online resources.
◊ explain how vaccination relates to the Core Concepts, using online resources for information.

INTRODUCTION
Scientific and information literacy are foundational science skills and include the use of data and scientific information and the ability to locate, retrieve, effectively use, and critically evaluate sources of information (1–3). These skills are critically important for young adults, who frequently use the Internet to access health information (4), especially because information found online is unregulated and often inaccurate. Health misinformation is prevalent on most platforms and can generally be characterized under the following domains: vaccines, diet, drugs and tobacco products, communicable and non-communicable disease, and medical treatments and health interventions (5). Thus, university students are likely to turn to the Internet for health information and to come across misinformation related to health. Studies have shown that university students lack the skills to differentiate credible and non-credible sources (6, 7). Teaching scientific literacy skills can
help students distinguish between misinformation and reliable scientific sources online. Interventions that educate students to critically assess health claims have been demonstrated effective in combating online misinformation (8–10).

Some lessons that give students the opportunity to practice critically assessing resources have previously been published. The Comics Project is one such activity, in which students learn about identifying reliable resources and use those resources to create a comic about the topic they researched (11). In another lesson, students play the Credibility Game, which guides them in evaluating evidence and discerning credible from non-credible ‘experts’ to practice media literacy (12). The lesson outlined here is similar to previously published lessons that help students build skills around media literacy. However, this lesson differs in its focus on health information and its design for a fully online or remote instruction course. The focus on vaccines in this activity gives students the opportunity to practice searching for and evaluating health information on the Internet and is especially salient in a time when vaccine uptake and vaccine hesitancy are so intrinsically linked with the current COVID-19 pandemic (13).

This activity addresses the need for students to discern accurate resources from inaccurate resources online using the CRAAP (Currency, Relevance, Accuracy, Authority, Purpose) test (14, 15), and specifically addresses misinformation around vaccines, which was one of the primary domains of health misinformation identified by Suarez-Lledo et al. (5). The Strategic Advisory Group of Experts (SAGE) defines vaccine hesitancy as, “delay in acceptance or refusal of vaccines despite availability of vaccine services” (16). Although vaccines are often lauded as the most important achievement of public health to date (17), vaccine refusal, delays in vaccination, and vaccine hesitancy are on the rise (18, 19). Some of this increase can be attributed to the use of the Internet as a platform for anti-vaccination advocates to spread misinformation on a global scale (20, 21). Through this activity, students will practice skills like searching for vaccine information online and evaluating the veracity of online resources they encounter. This is related to the core competency and practice of “understanding the relationship between science and society” and educating students in civic engagement and responsibility (1). This activity guides students in engaging with a variety of Internet resources that make claims about vaccines; students will apply the CRAAP test to evaluate the quality of web resources that claim that vaccines are safe and effective, as well as resources with a vaccine hesitant viewpoint. The aim of this activity is to strengthen the vital skills of searching for health information online, while also ensuring that students have the skills to differentiate accurate and reliable resources from inaccurate resources containing misinformation.

**Intended Audience**

This lesson was initially designed for a disciplinary first-year seminar called Exploring Biology at the University of Wisconsin-Madison. The course aims to help aspiring bioscience majors develop skills in scientific thinking and communication, as well as become familiar with the biology Core Concepts (22). This is an introductory lesson, most appropriate for first- or second-year college students but could be adapted for more advanced students. This lesson is suited for any course aiming to teach resource evaluation in a health-information context and would be appropriate in bioscience majors and non-majors courses.

**Required Learning Time**

This lesson takes approximately 2.5–3 hours to complete and includes synchronous and asynchronous learning activities. It includes three parts: an Individual Online Resource Comparison (60–75 minutes), a Small Group Online Resource Comparison (60 minutes), and a Core Concepts and Vaccines Discussion (30 minutes). It was first implemented in a fully online course but could be adapted as in-class activities or a combination of pre-class preparation and in-class discussion in an in-person course.

**Prerequisite Student Knowledge**

Students should have a basic understanding of using search engines like Google to locate information on the Internet. For students without this background, this lesson could be adapted to include additional instruction about how to use Google or another search engine to locate information. In addition, students will use the biology Core Concepts in this lesson (1). Prior to completing this activity, students should be introduced to the Core Concepts and should see examples of them. In our course, students receive a mini-lecture that briefly introduces the five Core Concepts and provides examples of how they apply to different biological phenomena. They also receive a resource sheet that defines each concept and lists the associated conceptual elements (23), revised slightly to be accessible to first-year bioscience students.

**Prerequisite Teacher Knowledge**

Instructors need to know the Five Core Concepts (1) and must be able to explain how the Core Concepts relate to the biological basis of vaccination. Therefore, instructors would benefit from basic knowledge about vaccines and how they work to stimulate immune response. Prior to implementing this lesson, the instructor should also become familiar with the CRAAP test and be able to apply this framework to identify reliable and non-reliable resources on the Internet.

**SCIENTIFIC TEACHING THEMES**

**Active Learning**

This fully online lesson actively engages students with content and with one another through a three-part activity. First, students read an article about characteristics of trustworthy online resources, locate resources of their choice, and apply the criteria from the article to determine the trustworthiness of online resources. After evaluating resources individually, students work cooperatively to rank their online resources from most to least trustworthy, which requires them to actively engage not only with the criteria from the initial article but also with a group to determine which criteria are most important. This part of the activity emphasizes student-student interaction, which is especially important in a fully online course where students don’t often have spontaneous opportunities to interact. Furthermore, this type of group work is an example of cooperative learning; by providing students with specific group roles, a task, and a structured agenda, this activity promotes active learning and inclusive student-student dynamics (24). Next, students reflect as a group on
their experience, engaging with the activity metacognitively to write a reflection about how their thinking has changed throughout the activity and which criteria they will consider in the future when evaluating online resources. Incorporating questions about how students’ thinking changed during the activity is similar to the reflective journal strategy for promoting metacognitive thinking suggested by Tanner (25). Finally, students use the online resources that they or their classmates determined to be the most reliable to write about how the one of the Five Core Concepts relate to the topic of vaccination.

Assessment

This activity incorporates both group and individual-level assessment that provides students with feedback. The instructor evaluates each group’s work by reviewing a brief summary written collectively by the group and assigning group grades. The final part of the activity, in which students write individually about the biology of vaccines and the Core Concepts, is assessed by the instructor using a rubric. The instructor also comments on student posts about the biology of vaccines to point out misconceptions. For both assessments, prior to completing the activity the instructor provides students with the rubric used to assign grades. Examples of these rubrics can be found in the Supporting Materials.

Inclusive Teaching

There are several ways that this lesson incorporates principles of inclusive teaching. In the individual portion of the activity, students select which online resources they work with. Incorporating student choice is part of a learner-centered approach that promotes student engagement (26). The lesson also includes different types of engagement by incorporating individual and group components. Students prepare for group work by completing individual work at their own pace, which promotes equitable participation during the group work (27). The group work features several cooperative learning characteristics meant to promote inclusive student-student dynamics, including the use of assigned group roles, a specific task for the group to complete, and a structured agenda with space for all students to present their ideas (24). Providing students with clear assessment criteria in the form of a rubric before they begin working on the assignment also improves the inclusivity of this lesson. Research shows that increasing transparency in college courses benefits all students, and in particular, underserved students (28).

LESSON PLAN

This lesson is designed for a course taught entirely via remote instruction. Students complete a series of synchronous and asynchronous online activities over several days. The lesson includes three parts: Individual Online Resource Comparison, Small Group Online Resource Comparison, and Core Concepts and Vaccines Discussion. Each of these pieces of the activity are described in detail below (see Table 1 for suggested teaching timeline).

Instructor Preparation

To prepare for this activity, the instructor should select and assign a reading about the CRAAP test (S1, Online Information Literacy – CRAAP Test) (14). We used a webpage created by the UW-Madison Library (29). The instructor may want to use a resource developed by their own institution to encourage students to become familiar with and use library resources. If this lesson is taught fully asynchronously, the instructor should also prepare detailed instructions that will guide students through all activities and share these with students before they begin. These instructions can be shared via assignment pages in a Learning Management System (LMS). Examples of LMS pages for each activity are included in the Supporting Materials. Individual pages are needed for each activity included in this lesson: the Individual Online Resource Comparison, the Small Group Online Resource Comparison, and the Core Concepts and Vaccines activities. To communicate expectations, the rubrics that will be used to assess student work should also be shared with students prior to completing the activities. Examples of the rubrics we used are included in the LMS pages in the Supporting Materials. To prepare for the Small Group Resource Comparison, the instructor will also divide students into randomly assigned groups of four or five. The group size is important for the ranking of resources that students will do for part of this activity (described below). These groups can be set in the LMS to facilitate students connecting with one another outside of class to set up a synchronous online group meeting.

Individual Online Resource Comparison

To prepare for the Individual Online Resource Comparison Activity, students read an article about the CRAAP test to become familiar with how to evaluate scientific information online. Students may want to take notes or can refer to the article throughout the activity. After reviewing this information, students work individually to locate online resources on the topic of vaccine safety, using any search engine they prefer. In an asynchronous course, students can read detailed instructions for the activity in the LMS. A sample page introducing this activity is available in the Supporting Materials (S2, Online Information Literacy – Individual Online Resource Comparison). In the Individual Online Resource Comparison Activity, students locate two different resources—one which supports the idea that vaccines are safe and effective, and one that claims that vaccines may be harmful, or which includes some element of vaccine hesitancy. Students may choose any type of online resource for either of their two articles—blog post, popular press article, scientific journal article, or others. While articles supporting vaccine safety and efficacy are generally easy to find, if students have trouble locating resources that support vaccine hesitancy, they can be provided suggested search terms like “vaccine danger”, “vaccine choice”, and “vax info start here”. Depending on the level of the students, more guidance may be needed; the instructor should consider whether students will need additional information or performing a basic Internet search. If needed, these instructions could be provided in the assignment description.

After locating both online resources, students will take notes about the resources they have chosen using an online tool that supports collaboration. Students will create their own note files, which can then be shared or copied into a group document during future activities. Depending on the course modality, a variety of collaborative online tools can be used including Padlet, Google Docs, Box, or other software.
that students are familiar with and will support note-sharing between group members. Students’ notes should include:

- A link to each resource,
- The type of resource (e.g., blog, popular press article, etc.), and
- A comment on how the resource performs on each of the five aspects of the CRAAP test.

Small Group Online Resource Comparison

This activity is designed for students to meet synchronously in small groups using a video-conferencing tool that allows synchronous online engagement, such as Zoom. Students schedule their own meeting times and meet without the instructor present. Student groups can meet any time after they have completed the Individual Online Resource Comparison activity. In our course, students were given three days to complete both the Individual Online Resource Comparison activity and the Small Group Online Resource Comparison activity. Within that time frame, students were able to allot their time in whichever way worked best for their group.

In preparation for this activity, the instructor will have assigned students to small groups of four or five. While meeting in their groups, students rank all online resources that individual group members located during the Individual Online Resource Comparison activity. The recommended group size of four or five students ensures that the task of ranking resources is manageable (i.e., that there would not be so many resources that students could not reasonably discuss every resource during their one-hour meeting), but enough so that students will be exposed to a variety of resources with varying quality, viewpoints, and criteria for ranking. The instructor can share a detailed suggested agenda to guide group meetings; see the Supporting Materials for an example (S3. Online Information Literacy – Small Group Online Resource Comparison).

During their synchronous online meeting, groups begin by introducing themselves and designating a facilitator and a note-taker. The facilitator will keep track of the time and ensure that all group members get an opportunity to contribute. The note-taker will take notes on the conversation and will lead the discussion post writing portion of the meeting. Next, students use the notes they prepared on their chosen resource and take turns summarizing their notes about how the resources perform on the CRAAP test. Each group member can copy their individual notes into a shared document so all students can refer to them. After each student has had a chance to discuss both of their selected resources, the group will work together to rank each of the resources from most reliable to least reliable in their shared document. Once the resources have been ranked, the group collaboratively writes a paragraph that answers the following prompts:

- Provide a link to the resource that your group rated the best (most reliable) and the worst (least reliable),
- Describe why you chose to rank these resources the way that you did—were there any qualities that stood out as most important?
- How did your understanding of reliable resources change throughout this discussion? What is one specific quality that you will consider in the future when evaluating whether an online resource is reliable?

Then, each group posts their response to a discussion forum so that students can read other group’s posts. Students revisit the discussion forum in the next part of the activity, as it contains a list of reliable resources about vaccines. The instructor should monitor the online discussion posts and clarify any misconceptions in students’ application of the CRAAP test, or the qualities of their selected resources. For instance, several students had the misconception in their reasoning including stating that a particular article was more reliable because of its recency alone. An example instructor comment could be, “You’re correct in identifying that recency is an important part of determining whether an online resource is reliable or not. However, I see that one of your resources is from 2016 and one is from 2018—these are both relatively recent, and unlikely to be significantly out of date. Were there other factors that also contributed to your assessment of these online resources?” Instructors may also comment to emphasize how important assessing the reliability of resources will be in students’ future coursework.

Core Concepts and Vaccines

To wrap up this lesson, students individually write a new discussion post about how the Core Concepts relate to vaccines (S4. Online Information Literacy – Core Concepts and Vaccines).

Students can use the Small Group Online Resource Comparison discussion posts to which they and their classmates contributed as a resource for reliable sources about vaccines. Students follow instructions in the LMS to choose a Core Concept to write about and explain in 1–3 sentences how something they learned about vaccines during previous activities exemplifies their chosen Core Concept. Additionally, students are asked to try to post a different example from what was already posted by their classmates, so that students will be exposed to many different examples of how vaccines relate to the Core Concepts. For instance, a student might write about how vaccines relate to the Core Concept of Information Flow, Exchange and Storage (IFES) as follows, “After you receive a vaccination, your adaptive immune response kicks in. Cytokines are one part of this immune response and are also a good example of IFES. Cytokines are produced by immune cells, and relay information to the rest of the body that an immune response is needed, and more immune cells are recruited.” An example of a response relating vaccination to the Core Concept of Evolution might be, “The flu virus is a good example of the Core Concept of Evolution. Genetic variation in the population of flu viruses occurs frequently due to mutations during replication. These mutations result in important changes to the virus and explain why we need to get a flu vaccine every year.”

Instructors should interact with the Core Concepts and Vaccines discussion posts by responding to any misconceptions they notice in students’ responses and commenting on excellent examples to reinforce them. A common misconception we noticed that students wrote about was that vaccination could help humans evolve (i.e., vaccination leads to higher fitness, which will change the population over time). An example response from the instructor could be, “While you’re right that vaccines can lead to greater fitness in an individual, the immunity that vaccines provide isn’t something that leads to greater fitness in their offspring (while there is some mother-baby transmission of immunity through vaccination, it doesn’t
last long—only a few months), so vaccination is unlikely to cause evolutionary change on a population level.” We gave students in our course four days to complete the Core Concepts and Vaccines activity.

TEACHING DISCUSSION

Assessment of the Learning Goals

The effectiveness of this lesson was evaluated as part of course evaluation and with the goal of quality improvement, and therefore falls outside of IRB review. Achievement of learning goals and student reactions were both examined as part of this evaluation.

The learning goals of this activity are for students to understand how to locate different types of scientific and non-scientific online resources and evaluate whether these resources are reliable or unreliable based on the CRAAP criteria. To assess whether students achieve these goals, student groups write a discussion post that addresses the following prompts:

1. Post a link to the resource that your group rated the best (most reliable) and the worst (least reliable).
2. Describe why you chose to rank these resources the way you did—were there any qualities that stood out as most important?
3. How did your understanding of reliable resources change throughout this discussion? What is one specific quality that you will consider in the future when evaluating whether an online resource is reliable?

In our course, students demonstrated that they were able to differentiate reliable from unreliable resources; 100% of the discussion posts correctly identified at least one reliable and one unreliable online resource on the topic of vaccines. 95% of the discussion posts were additionally able to articulate how the CRAAP criteria helped them differentiate reliable and unreliable resources. Some student examples include:

• “We chose this as our least reliable source because […]. One of the authors is using it to sell his brand of vitamins and dietary supplements.”
• “We chose this article to be the best because it is describing a scientific study […].”
• “We think this one is the least reliable because it does not include any authors for the post. It also does not have a date when this was published.”

In identifying one specific quality they would consider when evaluating online resources in the future, 63% of groups mentioned that they would evaluate the resource's date of publication or revision (Currency), 13% mentioned that they would consider the whether the article pertained to their question (Relevancy), 53% said they would check the author’s credentials (Authority), 30% said they would consider the sources cited and types of evidence used to support claims (Accuracy), and 37% mentioned that they would evaluate the intent of the author or resource (Purpose). The results of these discussion posts demonstrate that students were able to successfully apply the CRAAP criteria to evaluating online resources, though groups were the least likely to say that they would consider the relevance of a resource when looking for information online in the future.

All groups could articulate how their understanding changed. Some examples of student responses included:

• “One way our understanding of reliable sources changed throughout the discussion was that we noticed reliable resources contained data to reinforce their findings.”
• “Now we know that looking at the dates of the articles are important […]. We also look at how relevant the information is to our question, making sure it clearly explains what we are researching.”
• “Our understanding of reliable resources changed because we realized that the intended purpose (whether to inform or persuade) can affect the level of bias in a source.”

The goal in the third part of this activity, Core Concepts and Vaccines, was for students to use the online resources that they had located previously to describe how vaccines relate to the Core Concepts. To assess whether they had achieved this goal, students wrote a paragraph explaining how vaccination related to one Core Concept of their choice. On average, students earned a score of 92% on the Core Concepts and Vaccines piece of the activity, indicating that the majority of students were able to successfully identify and explain a connection between the Core Concepts and the process of vaccination.

Student Reactions

Students completed a survey at the end of the overall unit that included this lesson. In response to the questions “What was most effective about this unit?” and “What has been most helpful for your learning in this class so far?” multiple students specifically commented on elements related to this lesson. Of all comments that relate to elements of this lesson, students most frequently mentioned that they appreciated the group work, describing how it was helpful to get to know classmates in a fully online course and how the group work enhanced their understanding of what they were learning. Representative student comments include, “Having the chance to hear other’s ideas and discuss was very effective for my learning. I always learn more when I get to hear others speak and get the chance to reflect on my thought processes,” and “Being able to actually talk to people and discuss ideas has made this online class feel a little bit more normal.” Other things that students mentioned as being effective that specifically relate to this lesson include using Padlet to organize ideas, clear instructions on Canvas pages, and learning about evaluating online resources.

Students also described challenges they faced on the unit feedback survey, answering the question “What is one way this unit could be improved?” Of comments that related to elements featured in this lesson, several students described challenges related to group work, reporting difficulty finding times to meet and preferring to work individually. Some students also indicated that they would have appreciated more information about the Core Concepts.
Lesson Improvements

Student performance and feedback suggest several ways this lesson could be improved. In this activity, we intentionally gave students the opportunity to choose their own resources and resource types. However, this may have resulted in some students having resources that described different sub-topics of vaccines and vaccine hesitancy. For example, some students’ resources focused on the safety of one vaccine specifically, or on the logistics of how vaccines are distributed, rather than the biological process of vaccination as we had originally intended. While instructors were able to comment on students’ discussion posts to clarify any misunderstandings, we recommend that future instructors teaching this lesson make a final wrap-up discussion post or video to reinforce the main take-aways of the lesson and enhance instructor presence. For instance, we would have liked to include a video at the end explaining in detail several ways that vaccines relate to the Core Concepts. This final wrap-up video or discussion would also allow the instructor to reinforce any evaluation criteria that students didn’t seem to grasp as well. For example, in our class students may have benefitted from review of the importance of relevancy since they listed this much less frequently as a factor they would consider in the future.

Another consideration for future improvement is reducing barriers to group work. To support students finding time to meet with classmates, the instructor could give students time during a synchronous class session to meet their group members and find a meeting time, or the instructor could make groups based on schedules that students provide in advance. The instructor should also be explicit in instructions about why this lesson incorporates group work and how the individual elements are intended to support or reinforce their collaborative learning. While most students indicated they greatly appreciated the group activities, these strategies could help promote greater buy-in from all students.

Adaptation for Other Contexts

While this lesson was originally designed for a fully remote course with synchronous small group meetings and asynchronous online activities, it could also be adapted for use in other delivery modes, from a traditional in-person course to a fully asynchronous online course. In an in-person course, students could complete the Individual Resource Comparison and Core Concepts and Vaccines Discussion Post as pre- and post-class activities. They could use class time to compare and discuss resources in groups, with the instructor facilitating a large-group discussion of main takeaways. For this lesson to be fully asynchronous, the small group meetings could be replaced with student-student interaction through comments in their shared notes document.

Instructors could also adapt this lesson by integrating it within different biological topics. While this activity was focused on vaccine safety and applying the topic of vaccines to the Core Concepts, an instructor could quickly and easily modify it to focus on any biologically relevant topic with opposing viewpoints. For example, the safety of genetically modified foods or 5G and its relationship to cancer could be substituted for vaccine safety. A further adaptation of the activity could allow students to propose their own topic, further incorporating student choice as part of a learner-centered approach. An alternative topic would still achieve the learning goals of students evaluating online resources and explicitly applying the Core Concepts to a biological topic.

Concluding Thoughts

Overall, this lesson engages students in seeking health information online, differentiating reliable from unreliable resources, articulating qualities that make online resources reliable or not, and using reliable resources to explain how vaccination relates to the Core Concepts. This lesson also incorporates collaborative learning online, which gives students the opportunity to make connections with and learn from classmates, even in a fully remote course. When incorporated in an introductory bioscience course or a disciplinary first-year seminar, this lesson can help more novice college students to develop skills in scientific literacy that they will be able to apply in future courses and in their everyday lives.

SUPPORTING MATERIALS

- S1. Online Information Literacy – CRAAP Test
- S2. Online Information Literacy – Individual Online Resource Comparison
- S3. Online Information Literacy – Small Group Online Resource Comparison
- S4. Online Information Literacy – Core Concepts and Vaccines Activity

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This lesson was developed and taught as part of the WISCIENCE Scientific Teaching Fellows Program at the University of Wisconsin-Madison. This program trains graduate students and postdocs in the principles and practices of scientific teaching, and then they apply their training as instructors in the Exploring Biology disciplinary first-year seminar. The effectiveness of this lesson was evaluated as part of routine and ongoing course evaluation and with the goal of quality improvement. Because this project was characterized as program evaluation (determined in consultation with the UW-Madison IRB), this project did not undergo IRB review. In accordance with federal regulations, it does not constitute research as defined under 45 CFR 46.102(d).

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REFERENCES

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Table 1. Lesson Timeline.

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<th>Activity</th>
<th>Description</th>
<th>Estimated Time</th>
<th>Notes</th>
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<tr>
<td><strong>Individual Reading and Online Resource Comparison</strong></td>
<td>Students asynchronously review a web resource that introduces the CRAAP test.</td>
<td>15 minutes</td>
<td>There are many applicable online resources about the CRAAP test. The one we used was developed by the UW-Madison library (28), but institutions may prefer to use materials produced by their institution. An example of a resource is included in S1. Online Information Literacy – CRAAP Test.</td>
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| Individual Online Resource Comparison         | 1. Individually, students use an Internet search engine to locate two resources about vaccines (can be any type—blog, popular press article, scientific journal article, etc.) with opposing viewpoints—namely, one resource should support the view that vaccines are safe and effective and the other should support the view that vaccines are potentially harmful.  
2. Students summarize the two resources they found using a collaborative online tool (e.g., Padlet, Google Docs), incorporating the criteria in the CRAAP acronym they were introduced to during the preparation for class. | 1 hour          | Instructions to students are available in S2. Online Information Literacy – Individual Online Resource Comparison. |
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|          | • Describe why you chose to rank these resources the way that you did—were there any qualities that stood out as most important?  
• How did your understanding of reliable resources change throughout this discussion? What is one specific quality that you will consider in the future when evaluating whether an online resource is reliable? | 30 minutes | Instructions to students are available in S4. Online Information Literacy – Core Concepts and Vaccines Activity. |

### Core Concepts and Vaccines

**Individual discussion post about Core Concepts**

1. Each student writes a discussion post about how vaccination relates to one of the Core Concepts, using the resources that they or other students determined were reliable during the Small Group Online Resource Comparison activity.