A Writing-to-Learn Approach for Improving Students' Evaluation of Science Web Sources

RECOMMENDED FOR *AP Biology*

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ABSTRACT

Writing skills remain in high demand even as trends like class-size increases discourage faculty from assigning students opportunities to practice the craft. At the same time, students live in a world in which scientifically suspect claims spread more rapidly than their debunking. We crafted a scaffolded, low-stakes assignment sequence addressing both needs, one that requires relatively little grading. Approaches like this one may prove useful in college and AP classes.

Key Words: *scientific literacy; critical thinking; writing; peer review; reflection.*

○ Introduction

Writing remains among the most prized "soft skills" on the job market (College Entrance Examination Board, 2004; Burning Glass Technologies, 2015; Hart Research Associates, 2015). Yet, according to a report by the American Association of Colleges and Universities, only one in four college graduates writes well enough for the careers they will encounter (Burning Glass Technologies, 2015). Research suggests that a single writing-intensive course is insufficient to build such skills (Gladstein & Fralix, 2017) – that students need repeated practice with written work to benefit (Arum & Roksa, 2011). Writing should also be important to educators, for it is a medium ideal for nurturing critical thinking and learning (Emig, 1977; Klein, 1999; Bean, 2011; Scott, 2016).

Strategies for creating better writing assignments and managing the resulting grading workloads are well studied (Hillocks, 1986; Bean, 2011) but poorly circulated. Bean (2011) champions a writing-to-learn approach in which classes across the curriculum use written activities to improve learning and critical thinking. It is important to note that this method improves writing through improvements in the critical thinking behind the activity, not through correction of textual infelicities. Although many faculty unfamiliar with the empirical scholarship on writing instruction deem it impossible to improve writing unless they are "correcting" student work, meta-analyses over several decades show consistently that correction and focus on error can make students worse writers, not better (Hillocks, 1986; Graham & Perin, 2007; Graham et al., 2012), and that what more reliably improves communication is thinking-as-writing and interaction with real interlocutors (Hillocks, 1986; Graham & Harris, 2016). Ironically, because "correcting" is labor intensive, many faculty assign less writing as a result, compounding the matter. Put another way, most faculty are at once over-grading and under-assigning written work, and students would be better off if they simply wrote more often to each other without having to worry about a red pen.

> *"Our low-stakes assignment leverages writing-to-learn strategies to help students view online sources of scientific information more critically."*

Here, we describe a scaffolded, low-stakes writing activity aimed at improving students' evaluation of scientific information found online. The world is awash in false and disproved scientific claims carried virally on digital highways (Bonney, 2018). The challenge of telling sound from unsound science is pressing yet difficult for non–science majors. Young adults' abilities to critically evaluate scientific claims have often proved alarmingly limited (Manuel, 2002; Norris et al., 2003; Murcia, 2009; Lin, 2014). Our low-stakes assignment leverages writing-to-learn strategies to help students view online sources of scientific information more critically. Though created for students in lower-division general-education biology courses, it is suitable for high school and AP students.

Table 1. Website Analysis Form.

Questions	Initial Source	Opposing Source
1. URL		
2. Author's expertise: (a) What do the authors do, professionally? Are they journalists, scholars, government officials, independent authors?		
(b) Do the authors have the credentials to be experts on the topic?		
(c) What organizations or institutions are the authors affiliated with, if any?		
(d) Is there a conflict of interest for the authors?		
3. Professional scientists are often tentative and specific ("A compound in orange peels may mitigate metabolic syndrome") while less reliable sources are often sweeping, general, and confident ("Eating orange peels can cure cancer!"). What kind of language does your source use? Extreme or cautious? Sweeping or specific?		
4. Looking over your answers above, identify which of the two sources you think is most credible.		
5. In 100–150 words, explain why you think that source is better.		

○ Assignment Outcomes

Students successfully completing the assignment should be able to

- discriminate among contradictory sources by analyzing the sources' features; and
- reflect on their thinking and learning process, drawing insights that can help them evaluate sources they will encounter in the future.

○ The Assignment Process

The process described below scaffolds learning with interactivity and short, focused writing prompts. Its enumerated steps comprise two in-class activities, each 20–30 minutes long, in addition to four steps that students complete outside class before attempting an individual capstone assignment.

1. Each student team of three to five students chooses a controversial article or video from an assigned list, ideally with no topic covered by more than one team. The list can be found at http://shorturl.at/lAGS1.

2. In class, the instructor models how to analyze two conflicting sources – the well-known "dihydrogen monoxide" satire site and its corresponding *Snopes.com* entry – using the Website Analysis Form (Table 1). Students look at the sites, which are not on their own list, ahead of discussion, and the instructor demonstrates how to use the form to tease out important details.

3. Each student team evaluates the site it selected following the instructor's example, using questions 1 to 3 in the "Initial Source" column in Table 1. The student team then finds a web page that disagrees with the source we provided and

fills out questions 1 to 3 in the "Opposing Source" column in Table 1.

4. On their own, outside of class, student teams now analyze their pair of sources, completing questions 4 and 5 on the same form. It is important to emphasize to students that this team step is a valuable "practice" stage, so that later, when they work on their own assignments alone, they know what is expected.

5. Teams bring printouts of their two articles and their completed Website Analysis Forms to the next class, where they exchange materials with another team and conduct team-level peer reviews using our Feedback Scale (available at shorturl.at/txV39), which focuses student attention on the most pertinent issues and, through use, helps students better internalize faculty expectations. Note that the *giving* of feedback matters more than the *receiving* does. Students learn more from what they explain to others than they do from what peers tell them (Webb, 1985). It often helps to tell students this – and that the activity will retain its impact even if the class runs out of time to return feedback to evaluated teams. Indeed, students are often more blunt and honest if they know that peers will not see their comments.

6. Individual students now reflect (in or out of class) on what they learned, using our Reflection Prompt (located at shorturl.at/joCIK). Students often fail to transform experience to learning without some kind of reflection (Zhao et al., 2014).

7. Finally, working independently, each student chooses a new topic from the list, one that they have not already written about or evaluated. Each then finds a source that disagrees with the one we provided and writes up their own analysis, again using the Website Analysis Form.

⭘ "Grading" the Activities

Despite its seven steps, the above sequence requires relatively little grading. Steps 1 through 6 are all credit (they did the step) or no-credit (they didn't do it, or didn't do it honestly), or they can be counted toward participation. Step 7 is not so much graded as it is *assessed*, using the Feedback Scale. Students have already received a demonstration, practiced, and provided feedback ahead of writing the step 7 version, and those activities handle most of the coaching. For step 7, we simply note the score. For work rated "needs improvement," we remark that the student should seek us during office hours to talk about it. For "exemplary" work, we ask permission to share it with the class as a model. Lessons are then reinforced through the discussion of those model assignments.

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