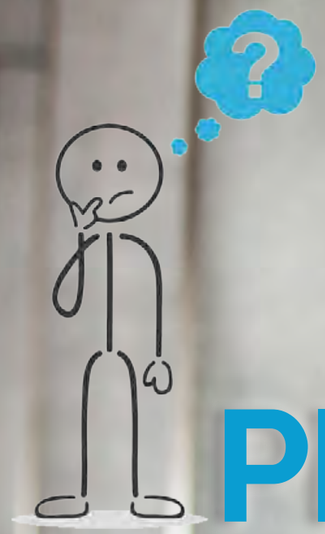

THE TOP 10 PITFALLS OF SCIENCE WRITING

By Jennifer Seavey, Humanities Teacher
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Thomas Jefferson High School for Science & Technology

"Every year, we embark on an exciting and frazzling journey with our sophomores: the crafting of a science essay."

“I fell in love with the Molymod kit at first sight. Its large assortment of brightly colored balls (“atoms”) and plastic white sticks (“bonds”) allowed for endless possibilities of mix-and-match. There is nothing more satisfying than the click of a white stick fitting snugly into the side of a ball.”

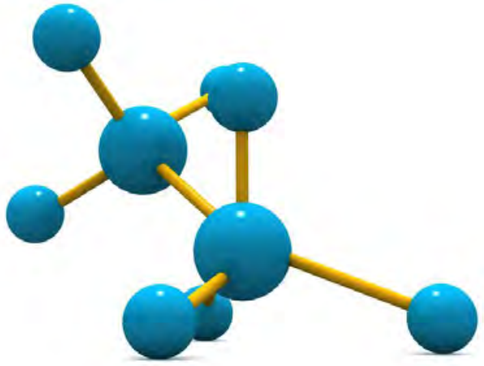
– sophomore first draft opening paragraph, science essay

Every year, we embark on an exciting and frazzling journey with our sophomores: the crafting of a science essay. In the introduction to their essay, students descriptively depict their chemistry lab experience. The example above is one of many histrionic first draft openings we encounter as our students attempt to link their topic to a specific chemistry lab they performed over the first semester.

Students write a compelling, descriptive narrative that presents a real-world problem and describes the solutions scientists are investigating to solve these problems. Students enjoy free choice of a topic limited only by their choice of lab.

Essentially, this project requires students to research cutting-edge science. First, they must find, read, and understand primary science articles. Second, they must translate the scientific nomenclature to make it understandable to an intelligent eighth grader, the same level used by the Washington Post, according to the Gunning Fog Index.

But as any seasoned traveler knows, journeys are sometimes fraught with pitfalls. At the 2018 NCSSS conference in Houston, we presented the top 10 pitfalls we and our students face as we journey through the research and writing process.



PITFALL #1: FINDING PRIMARY RESEARCH

We begin our trip in the library, fueling student knowledge by introducing our sophomores to the library resources available to them. Through our curated research guides, they explore the use of secondary sources such as EurekAlert! They browse breaking science news. To find primary sources, they conduct guided searching in our science databases such as ScienceDirect.

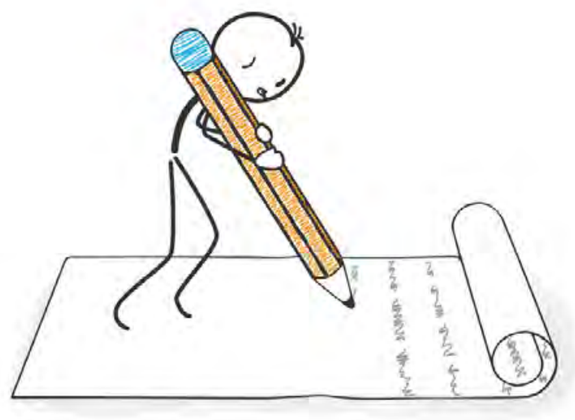
In the search for science articles, students often encounter grey literature such as dissertations and theses, professional presentations, and conference papers so we help them evaluate the validity of such literature. One of our students once found a conference paper that ultimately was rejected by the governing body of that particular science association. It’s important to be hands-on while students research to help them navigate and evaluate the body of science literature.

PITFALL #2: I CAN’T UNDERSTAND IT!

Once the students have their primary articles, they find the language may be very technical and filled with scientific nomenclature. To help students with this pitfall, we share reading strategies, including annotating the article, defining unfamiliar terms, and explaining an article to a classmate. We ask students to translate their article using 5 W’s & 1 H: Who, What, Where, When, Why, & How. This year, we asked students to evaluate their science articles using the CARRDSS criteria: Credibility, Accuracy, Reliability, Relevance, Date, Sources, and Scope. In a survey after the project, 77 percent of students said that using CARRDSS to evaluate their sources helped them to better understand their primary source journal articles.

PITFALL #3: NOT REPRESENTING THE CONTENT

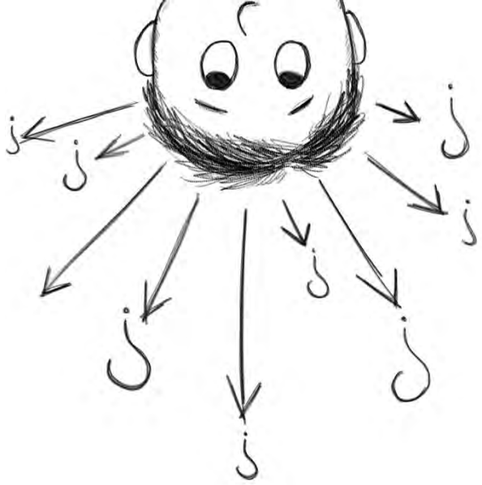
This pitfall causes the reader to choose that snazzy red sports car over the sedate family sedan. Which essay would you rather read: “Star Wars: The Fight Against Space Radiation” or “Radiation and the Environment?” Our favorite this year was, “The Itsy-Bitsy Spider Levitated Up the Water Spout.” We find that sharing student exemplars and professional sources such as The New York Times and The Washington Post science sections, help students circumvent this pitfall, not only with choosing appropriate titles but also with learning to translate the science.



PITFALL #4: NOT TRANSLATING THE SCIENCE

“Because the NETs express a high density of ss2, this makes these receptors ideal to focus on when imaging NETs. Right now, Gallium-68-DOTATOC/-TATE is used as diagnostic imaging radiotracer, but a study done in June of 2018 by Nicholas et al. found that a new radiolabeled tracer, Ga-68-OPS202, could perform better than Gallium-68-DOTATOC/-TATE in radiolabeled imaging.” – sophomore first draft primary research paragraph

When a passage such as the one above appears in a first draft, it signals an opportune time to check for student understanding. In one-on-one conferences, we find that many times, students do understand the primary science articles and can verbally articulate the science for us in layman’s terms, so all they need to do is write it. These conferences are an important way to differentiate our instruction, also. In addition, peer review groups after completion of the first draft are helpful in avoiding this pitfall.



PITFALL #5: PLAGIARISM! THE DOOM OF COPY AND PASTE

"Results showed that the higher the injection rate, and the higher the temperature at which the hydrate was injected, the higher the production rate was for gas hydrates." – sophomore first draft primary source paragraph

We can hear plagiarism in an essay because the student's use of language changes. The words sound different. To avoid this academic integrity pitfall, we find that having students annotate their articles using the 5 W's and 1 H summary and evaluating their articles using CARRDSS helps them put the information into their own words prior to even writing the first draft.

PITFALL #6: LOSING SCIENTIFIC VOICE

Although we want students to translate the science for the general public to understand, students need to use correct, appropriate, and professional terminology and avoid "teen slang." Student examples include statement such as:

- "While fusion may **seem like a long shot**, it really isn't."
- "I **stumbled** upon research conducted by…"

Ways to help students avoid this pitfall is exposure to secondary science sources such as Scientific American, peer review groups, and individual student conferences on the first draft.

PITFALL #7: NONSPECIFIC EXPLANATIONS

Students write generic sentences such as "Thus, scientists have conducted more research and begun to develop more technologies in hopes of slowing down this problem." What research? What technologies? What problem?

We find increasing repetition of nonspecific words such as it, this, these, they and them: "If it is reflected off the earth, it either exits the atmosphere again or is absorbed and reflected. It can also be absorbed by various gases." And perhaps the writers themselves don't know how to change direction so they start to ask rhetorical questions in their essay, a strategy without a real purpose: "Who knows what we'll use light for in the future?"

Our first draft reviews followed by conferences help to bring these problems to the attention of our students.

PITFALL #8: INCOHERENCE, EXAGGERATION, FACTUAL INACCURACY, FABRICATION

Long, run-on sentences, gaps in information, and weird metaphors lend an air of incoherency to the essay and disengages the reader. To be knowledgeable and engaging, sometimes students exaggerate scientific claims losing accuracy. We once had a student, when writing about the importance of blood testing for newborns to screen for potentially fatal health issues, fabricated the death of a baby to make her essay more "exciting." First drafts and peer review groups help provide helpful feedback, and individual student conferences help students revise for clarity.

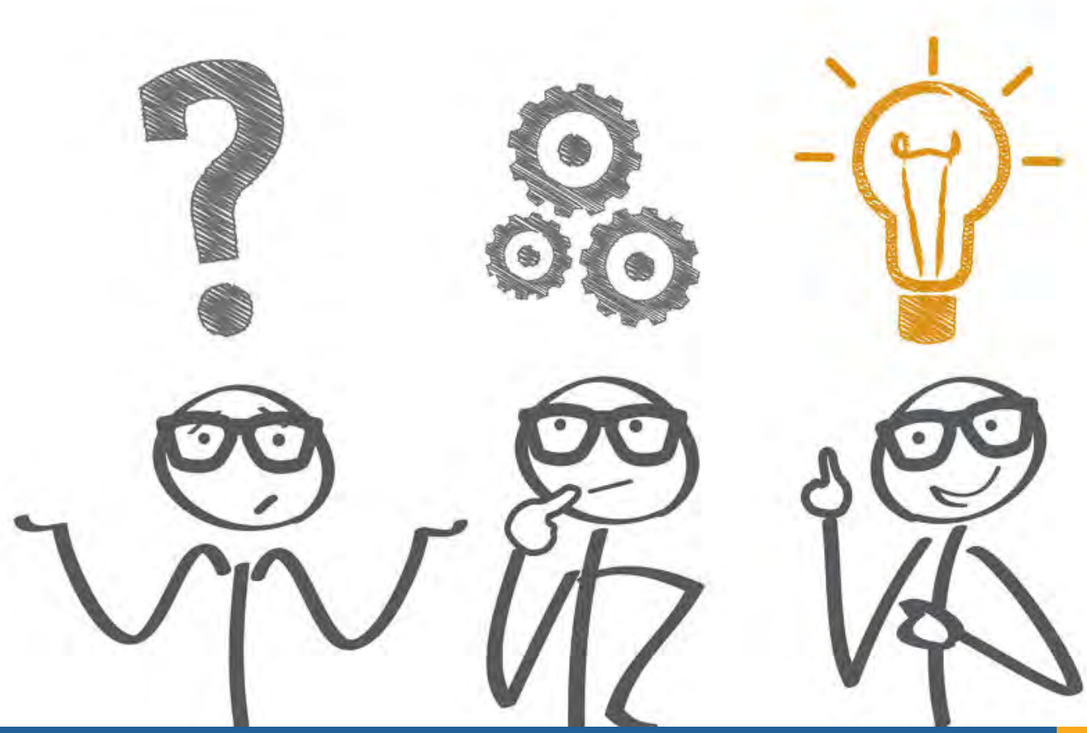
PITFALL #9: HOW DO I CORRECTLY FORMAT AND CITE RESEARCH?

Although directions for citing sources appear to be straightforward, students tend to get detoured when weaving sources into their essay. At Thomas Jefferson, we subscribe to NoodleTools, a research platform for students to record their sources and create their bibliographies. NoodleTools has a function that will show students how to use a source in the body of their paper. We encourage our students to think chronologically and mathematically. Primary research should be discussed in the essay beginning with the oldest article and ending with the newest Every source listed in their APA- formatted references page should be included in their narrative. We find that students understand that direct quotes from sources need to be cited in the paper, but often don't realize that someone else's ideas even when paraphrased need to be directly cited, too. Again, this is where student conferences are very helpful, and feedback is given prior to the final submission of the essay.

PITFALL #10: THE END (YAWN)

For some writers, the journey comes to a screeching halt. For others, it never seems to end. Because we have a minimum word count of 1,000 words, the last two paragraphs sometimes end up as filler with no value. Their narrative is driven into the weeds with banal conclusions and repetition of information. We counsel students to discuss the implications and future applications of their research in their conclusion, and artfully link their new knowledge back to their chemistry lab experience mentioned in their introduction. After all, a superior narrative often has symmetry.

When this part of the journey is over, we hope our students can move on to junior year with a solid foundation in both writing and research, although they're aware the pitfalls will always loom. They read "The Odyssey" as ninth graders so they're aware passing through their research Scylla and writing Charybdis will take much work. We hope we've given them tools to make the journal successful. ■



THE STEMEDGE

A quarterly magazine from NCSSS giving teachers and administrators the competitive advantage in professional development.

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NCSSS MAGAZINE

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FROM THE EXECUTIVE DIRECTOR

The academic year may have ended, but at NCSSS we are not even halfway through. The first part of the year for us always involves implementing the work of our Board Committees. For our Membership Committee, this means an extended outreach campaign to reach non-members, an initiative that is working very productively for us. And for our

"We have school participants from a dozen countries sharing best practices with a similar number of U.S. schools."

Programs Committee, we have finished a Leadership Summit and a Student Research Conference, all with great success. Of course, the big one is yet to come, the Professional Conference in Seattle in early November.

I really like what I am seeing with our two-year-old Global Program. We have school participants from a dozen countries sharing best practices with a similar number of U.S. schools. It has been amazing to watch, and to see our U.S. schools benefit as much as those abroad. If you are interested in learning more, please let me know.

We have been developing partnerships with varying networks of STEM schools, many located in the mid and northwest. These partnerships are part of our ongoing work to broaden our membership base. I hope to have good news to convey to you about this at November's conference.

Speaking of the Conference, we hope to see you there. We are expecting another great crowd of attendees, and we will have some interesting excursions as well as sessions for you.

Let me close by wishing you a relaxing and battery-recharging summer. And I look forward to seeing you in the fall.

All the best,

Todd

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