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Digital Literacy, Media Literacy, Science Literacy, and the Problem of Microplastics in the Ocean: A First-Year Writing Media Critique

Background: First-Year Writing, Digital and Media Literacies, and Lateral Reading

First-year writing is a required two-course sequence in most American colleges and universities. The courses focus on a range of writing modalities, such as research-based academic reports, argumentative or persuasive essays, personal narratives, critical analyses, and multimodal responses to literary works. The ability to produce such texts increasingly relies on sharpening digital and media literacy skills, which are seen as distinct but overlapping forms of literacy. In his overview of literacies, Tibor Koltay refers to the European Commission's 2007 definition of media literacy as "the ability to access the media, to understand and to critically evaluate different aspects of the media and media content and to create communications in a variety of contexts" (Koltay, 2011). The Commission delineates skills such as "better exploiting the potential of media for entertainment, access to culture, intercultural dialogue, learning and daily-life applications (for instance, through libraries, podcasts)" and "having a critical approach to media as regards both quality and accuracy of content." Koltay (2011) goes on to identify recurring digital literacy competencies, two of which are internet searching "coupled with critical thinking" and content evaluation.

Both of these are important parts of lateral reading – a task employed by fact checkers – and a natural extension of digital literacy. In their 2019 study, “Lateral reading and the nature of expertise: Reading less and learning more when evaluating digital information,” Wineburg and McGrew attempt to take digital literacy skills a step further, noting the need to identify increasing amounts of misinformation. They point out that “even if states mandate media literacy, we still face a thorny problem – what, exactly, to teach.” Their approach compares the online reading habits of university students, historians, and fact checkers. As they note in their findings, fact checkers’ lateral reading habits allowed them to discern between misinformation and facts more deftly than their peers in the study. Rather than deeply reading the text and questioning each sentence, fact checkers glanced at the site in which it is housed, then opened new browser tabs to find out more about the content and the site itself. They drew upon their knowledge of different outlets and supporters, as well as their ability to search for similar information on the topic. These contextualization skills echo digital literacy competencies emphasized by Koltay (2011). They also allow readers to fill in gaps left by sources on the same topic or notice discrepancies that may signal inaccuracies. They are helpful in a fast-paced, crowded, fragmented media landscape – the very landscape in which most contemporary college students have come of age.

The purpose of the first-year writing course sequence is increasingly called into question with the advent of generative AI. Although the impact of such technologies on writing instruction is vigorously discussed, there is no particular call to eliminate this skills-based course; in fact, its importance seems more crucial than ever. One common strategy is to ask students to include their point of view in a written critique supported by evidence and textual analysis. Such assignments lay a foundation for inquiry and objectivity, which are also two hallmarks of the sciences. Since a first-year writing course may also support writing across the curriculum, it is a natural step to notice the rhetorical choices made in science communication meant for the general public. Students in the ENC1101 course at St. Petersburg College write three to four essays in a semester in iterative phases. The unit in this case study culminates in a critique of sources about the problem of microplastics in the environment. While it is an issue that few students may have briefly encountered in school, most note that they are vaguely aware of it through social media exposure and casual news consumption. The intersection of competencies in digital, media, and science literacies informs this critique and the exercises leading up to it.

News Consumption Skews Digital

Younger generations are bombarded by hundreds of messages by the minute, and overwhelmingly access news and information about issues through mobile-based social media. According to a Pew Research Center survey from September 2025, “News consumption across all platforms,” 93% of respondents aged 18–29 report using their digital devices to access news “sometimes or often” over television, radio, or print media. Respondents aged 30–49 were just behind them at 92%, which was the same percentage for respondents of all ages with a college education or higher.

Staggering totals like these speak to the need for solid digital and media literacy skills. Videos and articles on social media are designed to attract the finite, and often scarce, attention spans of users, with headlines or images crafted to evoke visceral reactions and ledes buried to keep users on the page a few seconds or minutes longer. They are queued up by algorithms one after another at a rapid speed to keep that attention from wandering off-screen. Users do break out of it to participate in the ongoing conversations, though. They share stories and memes about current events, get involved in rabid discussions, and identify their political affinities. While global issues and events may seem far-off or abstract, plenty of local circumstances give users a chance to take action. Hans Martens and Renee Hobbs explored this in their 2015 study, “How Media Literacy Supports Civic Engagement in a Digital Age.” Their sample focused on 400 high school students participating in media literacy programs at an American high school, and their study explores the interplay of digital media use and civic participation. Their findings imply that “media literacy programs have potential to support the development of news analysis skills, build background knowledge of media institutions, audiences, messages and effects, and thus contribute in an important way to the development of meaningful civic engagement among adolescents” (Martens and Hobbs, 2015). While it is not a direct or simple solution, they go on to assert that “to promote civic engagement, especially among less academically well-prepared students, it is important to support students’ intellectual curiosity and their ability to critically analyze and evaluate media messages through school-based media literacy education” (Martens and Hobbs, 2015).

Why Add Science Literacy?

Beyond the traditional high school years, informal exposure to scientific concepts or applications comes through media use for most citizens. Yet they will also come into contact daily with issues related to their health

or environment that require a baseline of science literacy. Misinformation about topics related to the sciences is widespread, especially as such issues are complex. In response, a recent article in the *Proceedings of the National Academy of Sciences* proposes integrating science literacy with media and digital literacies as part of a three-pronged approach. Howell and Brossard (2021) juxtapose civic science literacy, which they define as “[u]nderstanding how science is produced, and what that means for how science relates to broader society,” with digital media science literacy, or “understanding how science information appears and moves through media systems,” and cognitive science literacy, or “understanding how people interpret science information when they come across it,” for a powerful approach to combating misinformation about the sciences.

As a form of assessment, essays of various modalities still dominate many subjects in higher education, whether undertaken during an exam or developed in a multi-stage process in and outside of the classroom. They are an exercise in metacognition since students must examine their thinking as they justify their claims and conclusions. However, the recent emergence of text-based generative AI has led instructors to become reticent about assigning the form, and has entirely upended first-year writing as a course sequence and discipline. Responses and strategies vary. Many instructors have shifted from a product-oriented course to a process-oriented course. Still others design assignments to discourage generative AI use. The media critique assignment sequence discussed below falls under both strategies.

The Study and Its Objective: Critiquing Media Representations of a Scientific Topic

The following unit was designed as a four-week process to develop a short critical essay. Over the four weeks, students participated in class discussions and activities, and wrote individual topic proposals, outlines, a short rough draft, and a final draft. The instructor selected sources, led the class discussions and activities, observed student participation, and read and gave feedback on the phases of student work.

Exposing students to a range of media formats and media analysis questions allowed them to develop competencies in digital search and content evaluation and gave them a list of critical questions they would be able to use beyond the scope of the course. In addition to improving these facets of digital and media literacies, the focus on an environmental issue exposed them to technical terminology and the scientific processes used by professionals studying and attempting to solve the problem. This enhanced their scientific literacy.

The Topic: Microplastics

St. Petersburg College is in a coastal area and evidence of the problem is visible daily. Not only is plastic pollution a problem in the broader environment, but trips to the beach and walks along other local waterways are littered with plastic containers, shopping bags, toys, lost socks, and fragments of uncertain origin. Early in the unit described here, students were asked what they had observed and what they knew about the issue. It was nearly unanimous that students had seen plastic pollution in the local environment. Few were familiar with the finite process of plastic breaking down into smaller and smaller particles, though never entirely being subsumed back into the natural environment. As it is not an emotional issue, it was a good topic to discuss at length. Students recognized that they could take action in their daily lives by making choices to minimize plastic consumption or finding organic alternatives.

Preparing to Write a Media Critique

Although college students are encouraged, and sometimes required, to keep their reading and research to scholarly articles, most enter college with little to no experience or guidance on how to search for, retrieve, and actively read such sources. Academic writing is part of an ongoing conversation among experts. First-year writing students simply have not been part of that audience and have rarely been exposed to such formal writing styles and conventions. They often undergo a library database orientation as part of first-year writing courses. Expanding their skills in search and retrieval of relevant information within and outside the databases expands their digital literacy skills. Being exposed to a variety of sources on the same topic also exposes them to the concept of lateral reading.

Eighty-six students across three semesters participated in this four-week unit. The class began with a discussion of their knowledge of the subject. Next, students read an academic article from the College's library database about microplastic pollution in the world's oceans. For example, the first time this unit was run, the initial reading was "Plastic waste inputs from land into the ocean" by Jenna Jambeck et al. (2015). This brief 4-page article from the journal *Science* features maps and visuals to supplement the authors' investigation and estimate of waste dumped into the ocean by various countries. Devoting class time and discussion to the abstract and a general overview of the article's structure, information density, and tone gave students a chance to understand what is housed in the raw knowledge engine of the world. While students observed that it read as reliable, logical, and

well-supported, the technical nature of the subject, along with its diagrams and charts, perplexed most people in the room.

The second day of the sequence involved a trip to a campus biology lab. A lab instructor gave an overview of the problem of microplastics in our waters, and then led the class through a hands-on lab exercise. Students pumped water samples through filter papers to capture any debris and viewed the filters under a microscope to look for nanoplastics, microplastics, and microfibers. This allowed them to see the structure and work of lab science and its necessity for context, a testable hypothesis, an array of equipment, and variation in outcomes. The 75-minute lab reinforced for students the care and attention to detail that scientists need to take when gathering data and testing a hypothesis. At this point, students conceded that people do not have the time or facilities necessary to invest in every single process, topic, or experiment, which is why they must rely on mediated information provided by journalists and content authors.

Directions for Students: Reading, Listening, Viewing, Critiquing

Next, students were directed to a curated reading list of ten sources. These came from a broad range of authors, publications, agencies, and producers. The instructor updated the list each term as some sources became inaccessible or new information emerged. Since every entity can now become a content provider, these sources were not limited to major news media outlets. Students were also supplied with a list of media analysis questions that have become a standard in media literacy education.

The most recent source lists from the last three semesters included text-based articles with images, video options, an audio source, and an interactive game. The articles were journalistic in nature for a range of audiences, rather than targeted to technical or academic audiences. Outlets ranged from universities to popular media sites for general consumption. For example, the videos were produced by a range of entities: the US National Oceanic and Atmospheric Administration (NOAA), the United Nations (UN), and a team at educational platform TED-Ed. Two were affiliated with nonprofits. The Seaquel Initiative promotes practices of up-cycling plastic into clothing and fabric, and Heal The Bay advocates for the health of coastal waters in California. All sources varied in tone, from playful to fearful to satirical.

One recent addition to the list was an interactive game that teaches about AI training. Players trained an AI model to select and remove plastic trash from the sea. As cartoon sea creatures and pieces of litter appeared, the player needed to specify which was which, and the rote nature of the task

often led to players making mistakes that became part of the model's dataset. Periodically, facts about plastic pollution popped up during the training process. A second phase of the game showed how some training choices lead to bias in a model, as students selected for color, shape, or orientation of trash and marine life icons. While the course unit was designed to avoid AI usage in the assessment, the adjacent exposure to how AI models are trained was a potential new media literacy skill.

Complete Source List From the Three Semesters, Fall 2024, Spring 2025, and Spring 2026:

- A. "The majestic plastic bag," Heal the Bay mockumentary ad campaign
- B. "We're drowning in plastic trash. Jenna Jambeck wants to save us," NPR article/audio
- C. "Tracking Microplastics from sea to body," Stanford Report article
- D. "SEAQUAL Initiative & upcycled medical: Eco-fabrics against ocean plastic pollution," video
- E. "This floating ocean garbage is home to a surprising amount of life from the coasts," NPR audio
- F. "Contaminants in the urban environment: Microplastics," UF-IFAS Extension article
- G. "Microplastics are undermining the ocean's power to absorb carbon," Science Daily article
- H. "Rowing challenge participants make troubling discovery among national coastline: 'Worrying and... detrimental,'" TCD/The Cool Down article
- I. "The nurdles' quest for ocean domination," TED-ED talk video
- J. "Plastic ocean" UN video (does include necropsy of seabird)
- K. "Trash talk," NOAA suite of videos
- L. "The oceans are drowning in plastic – and no one's paying attention," Huffington Post article
- M. "Microplastics everywhere: Are we facing a new health crisis? And what can be done about it?" World Economic Forum article
- N. "AI for oceans," Code.org interactive game

Media Analysis and Comparative Reading

In her 1998 article "The Simpsons meet Mark Twain: Analyzing popular media texts in the classroom," Renee Hobbs lists ten questions devised to compare two texts. Although Hobbs' original application involves comparing works

of fiction, these questions have become central to media literacy education and are included in the National Association for Media Literacy Education's framework, "Key questions to ask when analyzing media experiences." Asking these questions of just one source allows for plenty of details for analysis, while the ability to compare two or more sources based on the same criteria allows students to realize that some sources are more complete or articulate. The original questions are:

1. What is the author's purpose? Why was this made?
2. Who made money from or paid for this message, and how did that exchange take place?
3. Which ideas, lifestyles, values, information, and/or points of view about human nature and society are represented in this text? Are some overt/implied?
4. In what ways is this message realistic or unrealistic?
5. What techniques are used to attract and hold your attention? (This includes the uses of text, audio, and images.) Which themes are present?
6. Which historical, political and social events does this text connect to?
7. What is being omitted that you found elsewhere?
8. What does the author appear to really believe about some of the issues represented in this text? (This refers to bias or slant.)
9. Who is the target audience, and what are they being urged to do?
10. Which sources are listed, if any? (Hobbs, 1998)

Students chose five to six of the questions to develop specific criteria they would consistently apply to two or three sources and evaluate them. The most commonly chosen were questions 1, 3, 4, 5, and 10 or iterations thereof. During class discussions, as well as the topic proposal phase of writing, it became clear that many students initially thought they were to write an argumentative essay on the dangers of plastic pollution. To mitigate this, additional class time was spent on looking at sources found on social media and recent headlines and applying several of the questions. This reframed the discussion to become more analytical, evaluative, and nuanced. By viewing these together, students began to understand the nature of critiquing and the need to choose relevant and consistent criteria.

As students compared the sources during class discussions, they first identified what caught their attention – a headline, an image, a strong opening statement, music, the color palette, or white space. They were also asked to identify the audience, purpose, authorship and relevant credentials, examples, information density, evidence, references, and use of image, audio, text, and layout. Part of this discussion introduced the lateral strategies of checking context, site authorship, and the nature of different media outlets. They began to notice not just what was being said, but how it was being

presented. They noticed appeals to logic and emotion and the level of detail. Some students who were analyzing videos realized the impact of opening music, sound effects, ambient noise, audio quality, and voice timbre. Others noticed the onslaught of images in one article that were not from consistent settings, which added to the sensational tone of the article and undermined its credibility. The startling images and dramatic headlines caught readers' attention, but they were presented out of context, deeming it an unreliable source.

Results: New Reading, Analytical, and Critical Skills, and Deeper Understanding

Across all three semesters, students enhanced their science literacy skills as they gained an in-depth understanding of the issue of plastic pollution. Looking at different portrayals of the problem, its origin, and solutions reinforced their understanding of the complexity of the issue and of the media landscape. This was reflected during class discussions. Students became more adept at critiquing the sources and the way they presented content about the problem, and began to consistently use the terminology and describe relevant processes.

In addition, they appreciated the ability to identify elements of questionable media artifacts. The media formats, both familiar and unfamiliar, appealed to a range of needs and even preferences. As they were exposed to a variety of source formats, but had more time to look closely at them, they noticed a contrast in information density and details used to explain the concepts and issues. They identified patterns, commented on data, and noticed gaps and contradictions. Some students were vaguely familiar with the lateral reading strategies of cross-checking media platforms as well as source and site authorship, although they did not know it was a formal process used professionally. Introducing these strategies affirmed for them that such practices were useful and gave all students a simple, portable framework. Students also noted how the affordances of different media formats impacted their understanding of the subject.

The four-stage writing process, which is replicated across units in first-year writing courses, also gave them the chance to grow past initial responses and discover gaps in source material. A media literacy exercise of this type may be adapted in courses other than first-year writing. This form of assessment may be time-consuming for some instructors and courses, especially for those who do not typically evaluate student writing. However, other forms of assessment, such as discussion, annotation, oral presentations by small groups, or revision of sources, may align with course objectives and outcomes.

Synthetic Conclusion

Coming of age in a fragmented media landscape means that students may take at face value whatever a billboard proclaims, a podcaster asserts, or an algorithm queues up for them. Given time and a framework for inquiry, students develop their abilities to analyze and assess not just the messages themselves, but the attention-getting techniques at play. Comparatively reading and viewing sources about a particular subject exposes students to different angles and supporting details on the issue. This is akin to the lateral reading strategies promoted by Wineberg and McGrew (2019).

As to limitations and extensions, they vary based on time constraints and discipline. Four weeks is such a brief time for building lifelong habits, and while infusing media literacy into a variety of disciplines is ideal, Hobbs and Martens (2015) concede that it is difficult to formalize and may be unwieldy to implement. Not all instructors feel comfortable giving feedback on written assessments. As mentioned above, however, instructors may vary forms of assessment to fit the objectives and course outcomes. They may bring their subject matter expertise to the forefront with a look at how course content is linked to a current event, and how that portrayal varies.

This case study also allows students to practice the digital competencies identified by Koltay (2011) and media literacy skills promoted by Martens and Hobbs (2015). Students develop better critical news consumption habits since they know what to question. They become more familiar with different platforms and providers. They also know more about verifying information, pausing when faced with emotional language or claims, articulating their concerns about sources, and raising questions about the purpose of different resources and outlets. Such habits must be built over time. These habits also set a solid foundation for the critical thinking and problem-solving skills that are the most important outcomes of a university education. Finally, such a unit aligns with competencies in science literacy laid out by Howell and Brossard (2021), namely, civic science literacy, or an understanding of how scientific understanding benefits broader society, and digital media science literacy, or how scientific information is portrayed in the media.

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Abstract

Online discussions about science topics and the spread of misinformation have revealed the need for better digital, media, and science literacies, especially where these forms of literacy overlap. In the following case study, students in a first-year university writing course at St. Petersburg College in Florida read and viewed popular sources about a scientific subject and expressed their evaluations in a media critique. The purpose of this four-week unit was to improve their capabilities at the intersection of digital, media, and science literacies. Students were exposed to the concept and framework of media literacy and relevant analytical questions. The instructor in this case study led and observed student discussions during class meetings and gave iterative feedback on a four-phase essay drafting process. A total of 86 students over 3 semesters learned about the topic and produced critical essays comparing digital sources from popular media about the subject of microplastics in the environment. As a result, they had time to study one issue in depth and understand a scientific process. They also became more adept critical thinkers as they questioned a source's audience, purpose, information density, and production, and reflected on creative decisions made by authors. Finally, they became more familiar with lateral reading processes purported to improve digital and media literacy skills.

Keywords: digital literacy, media literacy, science literacy, first-year writing, college teaching

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