Spanning Literacy Instruction: A Wikipedia Editing Assignment in an Upper-Level Biochemistry Course

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abstract: The authors, a chemistry professor and a librarian, used a qualitative survey to assess student perceptions of a Wikipedia editing assignment that they included in a large upper-level biochemistry course. The assignment was initially intended as a public-facing alternative to a short research paper, emphasizing information literacy and scientific literacy. The goal of the survey was to use the results to enhance the assignment. The results of the survey and research for the literature review inspired a novel approach to the assignment using the perspective of metaliteracy. This approach encourages students to think critically about their role as scholars in a participatory environment.

Introduction

The main mission of the Chemistry department at Hunter College is to educate and train undergraduates in chemistry and biochemistry to prepare them for graduate and professional schools. Research is the single most important aspect of student, academic, and professional engagement in physical sciences. However, the continued increase in the number of biochemistry majors has put significant pressure on faculty to devise innovative teaching practices to encourage student engagement among a larger population.

In the spring 2017 semester, the authors, a chemistry professor and a librarian, launched a new assignment in a biochemistry course that is offered every fall and spring semester. The assignment provides students who do not typically have chances to work

portal: Libraries and the Academy, Vol. 24, No. 2 (2024), pp. 343–360.

with faculty on research projects opportunities to gain original research experience and enhance their information and scientific literacy abilities. The authors augmented the writing-intensive laboratory course to help students not only understand the research process and differences between their primary research in the lab and secondary sources, but also to learn to communicate scientific information though a Wikipedia editing assignment. As a result of this research experience, students develop critical-thinking skills and enhance their information, digital, and scientific literacy abilities.

In the fall 2019 semester, the authors decided to examine students' interaction with the Wikipedia assignment and its effectiveness as a pedagogical tool and a mechanism for scientific outreach. The authors devised a survey to collect qualitative data and intended to invite students into the study in the spring 2020 cohort. A delayed response from the Institutional Review Board (IRB) amid a semester of upheaval postponed access to the survey until after the semester ended. The late notice to invite participation in the survey resulted in far fewer responses than anticipated to reveal meaningful information. While initially intending to survey students from a single semester, the authors decided to survey students for three semesters (through spring 2021). By the end of the three semesters 118 students out of 241 students enrolled in all cohorts participated, for a total response rate of nearly 49 percent.

The original goal of the survey was to gain an understanding of students' perceptions of the Wikipedia assignment for the purpose of strengthening it for future cohorts. The authors were also interested in exploring other aspects that would potentially provide guidance. The connection between information literacy and scientific literacy emerged as an area to pursue, particularly in the context of a Wikipedia assignment in a science classroom. That pursuit inspired further research into how a Wikipedia assignment can promote multiple literacies holistically.

Literature review

"Wikipedia, for example, challenges our understanding of who produced the information while reinforcing the importance of peer review (the community of writers and editors provide this function in a decentered manner)."[1]

This quote illustrates an important aspect of the assignment that the authors wanted students to acknowledge. Beyond locating sources and editing a Wikipedia page, students should be aware of what it means to participate in collaborative digital environments.

Faculty and student perceptions of Wikipedia can influence the degree of student engagement with a Wikipedia activity. Factors that inhibit Wikipedia's acceptance in academia often point to the absence of a commitment by educators to effectively understand how Wikipedia works in terms of use and interpretation of sources.[2] In addition to questioning the reliability of content in Wikipedia, educators' apprehension to teach the use of Wikipedia may include acceptance of working with new information communication technologies (ICT).[3] Wikipedia adds a level of complexity for consumers as well as for producers of the information contributed to this resource. Consumers should be able to evaluate the sources used in contributions, recognize the role of peer review, and have an awareness of what it means to communicate information in a neutral tone to a broad general audience. Contributors to Wikipedia act in the role of information

producers and, in addition to having a mastery of the abilities required of consumers, should understand the significance of sharing information in this context and have a comfort level with wiki editing technology.[4] Educators who do not make the effort to teach students how to properly use Wikipedia, or who have their own prejudices, may discourage its use completely.[5] When an educator does introduce a Wikipedia activity, student's existing biased impressions may influence their engagement with the activity. However, the results from studies on Wikipedia editing assignments have shown a shift in students' perceptions and a new appreciation for the resource.[6] Students gain an awareness of their responsibility when contributing information to the seventh most visited website in the world.[7]

The authors began a literature review with previous studies that gauged student and faculty perceptions of Wikipedia, along with case studies of its applications in classrooms. The information gleaned from this literature was insufficient to address questions on how the assignment encompasses learning objectives for multiple literacies and thereby develop new pedagogic interventions. The librarian was focusing on information literacy, while the professor of the course was measuring scientific literacy. Further research inspired a broader, holistic approach to instruction for the Wikipedia editing assignment.

Wikipedia in Academia

Wikipedia was launched in 2001 as an online encyclopedia to which everyone can contribute information. It quickly became widely used as a reference source by students in all levels of education and a topic of study for scholars, particularly those exploring the perceptions and use of Wikipedia in higher education by faculty and students.[8] Faculty who rejected the predominant negative view of Wikipedia conceived of activities that highlighted its benefit as a pedagogical tool.[9]

An investigation of faculty and student viewpoints published in 2010 used surveys to assess use and awareness. Faculty respondents had reservations about the academic use of Wikipedia due to questionable reliability of content; regardless, students often used Wikipedia for preliminary research. In terms of acceptance by discipline, the results of the faculty survey concluded that faculty from the natural sciences viewed Wikipedia more positively than in the humanities. The investigation included data on the growth of academic papers on the topic of Wikipedia between 2002 and 2007, drawing attention to the heightened interest of its use in academia.[10]

Results from other studies reviewed were comparable in terms of faculty perceptions of questionable reliability of content, the influence of faculty and peer acceptance of Wikipedia use for academic purposes, and challenges for both students and faculty with the use of the Wiki technology.[11] Among faculty, the overall consensus about sharing information was positive, except in cases where study participants were unaware of who owned Wikipedia and concerned about giving away information for free when the organization was profiting.[12] Students majoring in architecture, engineering or the sciences were found to use Wikipedia more for course-related research than respondents in other majors, a study from 2010 concluded.[13] Another study that explored patterns of student use and perceptions of usefulness also revealed that students majoring in

the sciences (physical and biological) were more frequent users of Wikipedia for their academic studies than students majoring in disciplines in the Humanities.[14]

A study conducted between 2012 and 2013 at two higher education institutions in Barcelona, one fully online, found that the number of faculty who used Wikipedia and perceived its positive aspects outweighed those who were skeptical, despite previous literature indicating the contrary. The researchers found that there was more support for Wikipedia's use as a teaching tool when students are using it actively, as in contributing, versus a passive use for research purposes. The study also confirmed other studies indicating greater acceptance by those in the STEM disciplines than those in the humanities and social sciences.[15]

Through its Public Policy Initiative in 2010-2011, Wikimedia Foundation, the nonprofit organization that hosts Wikipedia, organized its first direct effort to engage the academic community in the United States in assigning Wikipedia in classroom projects.[16] Several researchers participating in this effort explored student engagement with editing assignments versus writing traditional research papers, and concluded that students' awareness of writing for a public audience motivated and intimidated them, though they felt more engaged in a Wikipedia assignment.

In an article published in 2008, a reference and instruction librarian stated a case for using Wikipedia to teach information literacy, aligning activities to the Association of College and Research Libraries (ACRL) *Information Literacy Competency Standards for Higher Education*, recommended at the time. Some of the activities suggested were the following: comparing a Wikipedia article to an encyclopedia article to study similarities and differences; initiating a discussion on authority, accuracy, and other criteria used to evaluate information; and the importance of citing sources to avoid plagiarism and other issues related to intellectual property.[17]

There have been numerous published examples of Wikipedia classroom activities since 2008, including editing assignments in information literacy classes and in discipline-specific classes, domestically and internationally.[18] Four of the instructors who participated in Wikimedia's Public Policy Initiative wrote about their assignments in undergraduate and graduate courses in varying subjects in law, the social sciences, and communications. Assignments ranged from adding to existing articles, peer reviewing articles, and editing as a precursor to an in-depth research paper. Students working on these assignments collaborated with others or completed them individually.[19]

Information literacy, though not always explicitly mentioned, was essential for students to evaluate sources to support contributions and understand the nature of sharing information publicly. Going beyond these information literacy abilities, librarians at Oregon State University designed a ten-week course based on Wikipedia's role as an information source and its implications as a community for contributors.[20] Weekly topics ranged from the negative aspects of the Wikipedia editing community to privacy issues, censorship, and gender

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bias. In an Introduction to Psychology course, faculty tested the feasibility of using a Wikipedia editing assignment in a large class, assessing the assignment's impact on information literacy, collaboration, digital literacy, and classroom culture.[21] Pre and post assessments were made in the form of a survey, with questions focused on information literacy concepts and Wikipedia terminology. Students were instructed to write mid-term and final reflection papers based on whether they thought the editing assignment helped them engage with course content, and how they viewed their collaboration on group work, and whether the peer review portion of the assignment was helpful. Results concluded that there was improvement in information literacy skills involving differentiating empirical studies, the quality of their searches in locating sources, and evaluating peer review articles. One of the researchers' recommendations was to build a support team that included librarians.

Wikipedia in science courses

Wikipedia showed early promise for the quality of science articles and led to acceptance in academia in subjects pertaining to the physical and natural sciences.[22] In 2005, *Nature* published the results of its investigation of a comparison of Wikipedia and Encyclopedia Britannica's coverage of science.[23] Among forty-two entries tested by external peer review, the difference in accuracy was minimal. This close comparison is evidence of the scrutiny of science topics in Wikipedia in its earliest years. More recently, Wikipedia was said to shape science. This assertion was based on a study to highlight the prevalence of science information on Wikipedia. The study analyzed scientific content written by subject experts to determine whether there was a difference between the content that was contributed to Wikipedia and other content that was not.[24] The results revealed that the new content on Wikipedia was found to appear in scientific literature more than content not contributed to Wikipedia.

Around the time of Wikimedia Foundation's Public Policy Initiative in 2010, the Society for Neuroscience formally advocated for the improvement of neuroscience-related content in Wikipedia. Taking up the cause, a faculty member in the biology department at Boston College assigned a Wikipedia article construction and revision activity using stubs from the neuroscience category, calling it a "writing intensive and neuroscience related outreach activity."[25] Stubs are articles in the early stages of development and where new contributors to Wikipedia can make the most impact. In 2016, The Wiki Education Foundation declared the year "The Wikipedia Year of Science." This endorsement inspired more faculty, including the authors of this paper.[26] Stuart Fraser wrote about an assessment developed for an undergraduate medical sciences program at University of Sydney.[27] The activity was intended to improve the representation of biomedical scientific information on Wikipedia, while students improved their scientific, information, and digital literacy abilities.

The learning goals of Wikipedia editing assignments in science courses vary by level. In undergraduate courses, enhancing information literacy abilities is emphasized, often with the help of a librarian. An academic library and members of the biology department at the University of Kansas collaborated on a Wikipedia editing assignment to teach the process of scholarly peer review. Students wrote, edited, and peer reviewed content

for Wikipedia articles, and instructors entered the content on Wikipedia pages.[28] In an article in the *Journal of Chemical Education* a chemistry faculty member and a librarian recommended a Wikipedia assignment to improve information literacy skills.[29] The assignment included activities to evaluate existing sources in an article, study the anatomy of pages containing chemical information, and contribute content. The activities were aligned with the frames that comprise the ACRL *Framework for Information Literacy in Higher Education*. The authors concluded that, with proper care, "Wikipedia is a very useful and convenient resource for chemical information" and that the assignment is effective in improving information literacy skills.

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Faculty in postgraduate courses use Wikipedia editing assignments for students to master course content and communicate esoteric scientific information from academic sources to a broad general audience.[30] As early as 2007, an educator advised the practice of making scholarly work publicly available through the use of open access sources to support contributions on Wikipedia.[31] In another paper published the same year, the author suggested that the traditional peer review process be updated and that Wikipedia could be a potential model for dissemination of scholarly knowledge.[32] Advocacy for postgraduate students and professionals to contribute to Wikipedia has amplified.[33]

While librarian faculty collaborations on Wikipedia projects appear more in the literature on activities in undergraduate education, a notable exception led to a study that assessed information literacy, lifelong learning, and aspects of social responsibility in first-year medical students in a school of medicine at University of Hawai'i at Mānoa.[34] The authors of the study concluded that a Wikipedia editing assignment in this context was successful in raising awareness of medical students' information literacy abilities and contributing to a public good. At another medical school, a credit-bearing course was offered to fourth-year students in which students edited Wikipedia articles.[35] In addition to assessing the quality of article improvements, students were interviewed with questions on their impressions of contributing to Wikipedia articles. The results of the interviews revealed that students did find the assignment more challenging than anticipated due to trying to accommodate both an informed audience and a general audience with less knowledge on the topic. Additionally, students contended with modifying existing content in articles to which they were contributing new information.

Spanning Literacies

Information literacy abilities are fundamental across disciplines, particularly in the sciences, where scrutiny of sources and an understanding of the iterative process of discovery are integral to scientific literacy. To investigate faculty perceptions of students' information literacy gaps in the sciences, a reference librarian at Stonehill College conducted a study using interviews with faculty from several Boston-area colleges.[36] The

study revealed that students were challenged by locating, evaluating, and using sources appropriate for the research requirement. The interviews with faculty participants in the study highlight the need for enhancing information literacy abilities in undergraduate science courses. A notable concern for faculty was student use of open access publications. Faculty struggled with evaluating these sources and were not prepared to teach how to use them proficiently.

Librarians collaborating with science faculty on Wikipedia assignments could strengthen instruction by considering scientific literacy beyond the ACRL *Standards for Science and Engineering*.[37] With a greater understanding of what scientific literacy entails, librarians can learn to approach literacy instruction more broadly in science courses.

There are numerous definitions and standards of scientific literacy established by scholars, and by professional and educational organizations.[38] In the book *Empowering Scientific Literacy through Digital Literacy and Multiliteracies*, Wang Ng provides a review of scientific literacy views in the field. These include developing knowledge of general principles of sciences and how scientific theories are generated and can lead to applications for solving problems in society, questioning the integrity of evidence shown and considering whether there are ethical or social concerns, reading and critiquing media reports with the understanding that further research may be needed, and collaborating and communicating with peers, experts, and the general public about science-related issues.[39]

Underlying Ng's consolidation of definitions of scientific literacy is critical thinking. Critical thinking is required to objectively consider how theories are tested, the strengths and limitations of those theories, the integrity of evidence used, and how their applications may work in society. Faculty in the sciences would benefit from librarian assistance with instruction on evaluating sources and elucidating the difference between primary and secondary sources before a research and writing intensive assignment commences.[40]

Scientific information literacy is an appropriate term to describe the fundamental nature of information literacy to scientific literacy.[41] Students must be able to locate and evaluate research in the sciences. Moreover, students should understand the publication process and scholarship as conversation. These aspects of information literacy are often overlooked in undergraduate information literacy instruction, according to a study conducted at Purdue University and University of Illinois at Urbana-Champaign.[42]

> "Metaliteracy promotes critical thinking and collaboration in a digital age, providing a comprehensive framework to effectively participate in social media and online communities."[43]

With information literacy as the foundation, metaliteracy highlights the advantages of integrating the multiple literacies necessary in a world where social technologies prevail. Thomas P. Mackey and Trudi E. Jacobson formulated the encompassing term *metaliteracy* as a response to the need for a greater understanding of what it means to interact with the information communication technologies that afford production and sharing of information in digital environments, and of the value of those affordances to learners.[44]

Metaliteracy learning falls into four learning domains: behavioral (what learners should be able to do after completing an exercise, cognitive (what learners should know after completing an exercise, affective (changes in learners' emotions and attitudes as a

result of completing an exercise, and metacognition (critical thinking and reflection on the learner's own learning).[45] Metacognition is fundamental to metaliteracy; learners must think critically about their own literacy strengths and weaknesses.

The learning goals of metaliteracy emphasize student engagement in critical thinking of their own learning. The learning goals include actively evaluating content while reflecting on one's own biases, engaging with all intellectual property ethically and responsibly, producing and sharing information in collaborative and participatory environments, and developing learning strategies to meet lifelong personal and professional goals.[46]

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In 2020, Trudi Jacobson presented a case for using the ACRL *Framework for Information Literacy for Higher Education* to analyze Wikipedia as an information source, drawing attention to the frames that benefit from a metaliteracy perspective to enhance student learning.[47] Seeing oneself as a producer and consumer in a collaborative environment highlights the role of Wikipedia editors.

Project Background

The Biochemistry Laboratory course (CHEM 378) is part of the undergraduate major and the M.S. program in Biochemistry at Hunter College. In the last thirteen years, the enrollment in the major has increased tremendously (seven biochemistry majors graduated each year before 2003 compared to 460 Biochemistry majors enrolled this year). Enrollment in the lab course was almost 160 students in 2021 (compared to twenty in 2003). The course, offered in the spring and the fall semesters, is taken by students interested in the pharmaceutical industry, medicine, dentistry, veterinary medicine, and physical therapy. A larger number of students enroll in the spring semester (about twice as many as those who enroll in the fall). Students who enroll in the spring semester are following a sequence of courses that put them on track for postgraduate education. The course is accredited by the American Society for Biochemistry and Molecular Biology.[48]

To increase the number of research opportunities in the Biochemistry Lab course, the professor implemented a research lab scheme in the course. This hands-on experience, in which the results can be known only by performing the experiments, helped students better understand biochemistry-based technology. Students also gained a heightened sense of the need to communicate science information and its importance.

Currently, the Biochemistry Lab course consists of ten experiments that are designed based on a lab manual. The lab period is four hours weekly, and it is accompanied by a one-hour weekly lecture on background theory. The lab provides an authentic learning experience and allows the students to experience the scientific method and original research, presenting their data in three written scientific reports that are evaluated and graded by the teaching assistants for each lab section (approximately twelve students per section). The Wikipedia editing assignment augments the lab experience. To provide context for this assignment, class time is scheduled for the librarian to highlight the information literacy abilities required to effectively engage with the assignment and to teach the digital literacy skills required to edit pages in the wiki platform.

To include a more intellectually motivating format and allow the students to connect the real world, the Wikipedia assignment is intended to improve students' ability to communicate scientific information to a nonscientific audience.[49] While Wikipedia does not allow original research to be added to articles, the students are able to develop articles related to areas of student's interest in the fields of biochemistry, medicine, biology, and chemistry with research from secondary sources. As scientific information is often difficult for students to grasp because they perceive it more abstractly, most of the students may not see the connection between the assignment and their future careers as doctors, researchers, and so forth. This information and scientific literacy assignment helps students to see how what they are learning relates to their everyday life as most if not all the students use Wikipedia. It also helps them to be conscious of their learning practices, particularly after adding a reflection portion to the assignment.

The Wikipedia assignment, first introduced in the Biochemistry Lab course in spring 2017, has been included in the course syllabus since then. The original learning objectives were to critically evaluate information and sources, and to distill and communicate scientific information from scholarly sources for a broad general audience. These learning objectives have been expanded as a result of the current study to include a number of metaliteracy learning objectives assessed through reflections that illustrate students' ability to understand their own biases in the selection and evaluation of information, their responsibility as information producers in a participatory online environment, and their recognition of learning as an ongoing process.

The WikiEdu Dashboard is used to organize and track student work in Wikipedia. The Dashboard has been instrumental in facilitating the oversight of student work in a large class and providing the training modules that include evaluating Wikipedia articles and sources, the repercussions of plagiarism, and technical information on how to contribute to an article. The authors use the timeline blocks on the Dashboard to scaffold the assignment. In the first few weeks students complete a series of training modules and exercises that provide instruction on the skills needed to be a responsible Wikipedia editor. During this time, students also decide on a stub to edit from the list of stubs in the biochemistry category. When the assignment was first introduced, students had the latitude to select any topic of interest in biochemistry, but were frustrated when their contributions were promptly removed from or edited in well-developed articles. The authors determined that targeting stubs in the biochemistry category would provide a more relevant learning experience where students would make an impact in boosting Wikipedia content.

In the following weeks, students research their topic, locate a minimum of two sources that they will use to support their contribution to a stub, write several sentences, and enter them in their Wikipedia sandbox. Central to students' success with the Wikipedia assignment, the librarian provides key instruction that spans searching, evaluation, and using information ethically. Ultimately, students copy from their sandbox to the stub article in Wikipedia to publicly share their contribution. Students are responsible for ensuring that they have completed assigned training modules and exercises and that their Wikipedia entries are accessible through WikiEduDashboard.

Shortly after the assignment's due date, the authors meet to review and grade each student's assignment. The WikiEdu Dashboard facilitates this process by tracking the progress on tutorials and isolating students' edits. Students are graded on completion of

tutorials, quantity and quality of student writing, and sources used to support contribution. The assignment is worth 10 percent of students' grade for the course.

The Survey

Methodology

The authors designed a qualitative survey in Qualtrics in the fall 2019 semester to learn more about students' engagement with the assignment and assess whether learning objectives were met. The participants' results on the ten questions that comprised the survey were anticipated to reveal information that would guide the authors to improve the assignment design. The questions were centered on Wikipedia use, research skills, and interest in the topic students selected to research. The Blackboard learning management system's Announcement feature was used for outreach to students regarding the survey.

As mentioned previously, the authors submitted the project to their college's IRB in late winter 2020 and waited for approval with the intention of recruiting participants by the end of the spring 2020 course. The link to the survey and reminders to students requesting their participation were posted on Blackboard throughout the summer. The survey was closed at the end of the summer. Fourteen students from the spring 2020 course of ninety-three enrolled students participated. With limited data, the authors opened the survey again and invited students in the smaller fall course (45 students) to participate. To assess the larger spring course as originally intended, the survey was opened a final time for students in the spring 2021 course.

See Appendix A for survey questions.

Results

The initial level of participation from the spring 2020 class, 15 percent, was too low to analyze the results meaningfully. To collect responses from a larger sample, the study was extended to three semesters of the course, therefore involving three cohorts.

After three semesters of voluntary participation in the study, 118 out of a total of 241 students, approximately 49 percent, responded to the survey. The majority used Wikipedia before the assignment, with a subset indicating using it while cognizant of its limitations. Most who used it acknowledged its limitations and stated that it was where they started their research looking for background information. Some mentioned using it to look up the sources cited in articles. Most respondents said their opinion of Wikipedia improved after the assignment. Only a small percentage of the respondents (11 percent) had experience editing Wikipedia articles before the assignment. Over 75 percent of respondents said that the assignment helped improve research and writing skills, at least to some degree, and led to students learning something new through research for the assignment. See Appendix B for a breakdown of the results by semester.

The following comments from students reflect their perception of Wikipedia before the assignment.

> "I would start there so it could expose me to sources, but I used it with a grain of salt since I knew how easily it can be edited."
>
> "Not known as a "reputable" source, but still a very good resource for quick information."
>
> "A good source to get a summary of information and get relevant peer reviewed sources from the reference section of the topics."
>
> "Wikipedia is a good source of initial information to give you a brief overview but you must verify the information."
>
> "Good place to scour for sources by looking at the references."
>
> "I did not think Wikipedia was a reliable source due to the fact that ALL of my instructors told me to never utilize it as a citation source."
>
> "I did not think it was [a] reliable source of information, due to previous professors saying it is not because "random" people edit the information."
>
> "I was always told to use Wikipedia as a sort of "summary" but to never fully trust what is written on there, given that anyone can simply add in information."

The results of the survey showed that apprehension regarding the use of Wikipedia most often originates from instructors' comments. Students expressed critical thinking skills in their appraisal of its usefulness.

More than half of survey participants said that the assignment helped improve research and writing skills:

> "It helped me become capable of breaking down complex chemical reactions into simple terms."
>
> "Yes, I can now read an article with a more critical eye and I am more confident in understanding and writing about scientific articles."
>
> "Yes, the assignment helped me learn more about the process of researching from scientific articles, how to interpret those points without drawing connections that have not been explicitly stated, and with how to format writing so that it is easier to read and flows better. I think the ability to write without inserting the personal self is important, and may play a role in developing papers in the future."
>
> "It helped me put scientific information in my own voice. Albeit extremely difficult, it was done."

The librarian's instruction emphasized locating and identifying types of sources in the college libraries' databases.

> "I used journal articles as sources and an ebook."
>
> "Journal articles in a database."
>
> "Mostly journal articles from Science Direct."
>
> "Journal articles for proteins."

Reasons students selected the article to edit included interest in topic, relevance to course, prior knowledge, and inclination to improve a limited article.

Through the Wikipedia assignment, the students were able to connect scientific articles with knowledge acquired in the course and experiments performed in the lab. Once completed, most of the students were able to connect the assignment and their course work and future careers as doctors, researchers, or other professions in the sciences. The assignment helped students see that what they are learning in class, which is often considered abstract with no connections with everyday life, is of interest to the scientific and non-scientific community, including their own family and friends. Therefore, the Wikipedia assignment helped them see that what they are learning is valuable outside of the classroom.

Through the Wikipedia assignment, the students were able to connect scientific articles with knowledge acquired in the course and experiments performed in the lab.

Conclusion

There are limitations of the current study to be considered in future studies of the perceptions and effectiveness of a Wikipedia editing assignment. One of the survey questions provided a guided answer, potentially leading students to respond that they used the institution's databases and resources instead of revealing that sources were located elsewhere. (Survey Q.7: Were you able to find sources for the Wikipedia page you contributed to through Hunter College Libraries? See Appendix A for all survey questions.) The survey was voluntary and anonymous: the results included only students who voluntarily elected to participate, and the anonymous survey did not provide a way to include a pre-assignment assessment that would allow for matching results to a participant's post assignment assessment.

Acknowledging the limitations, the survey responses served to inspire the authors to think more broadly about the critical-thinking aspect of the assignment. The responses represented evidence of the importance of reflecting on what is accomplished as an outcome of the assignment. A metaliteracy approach addressed the intent for a pedagogical shift that would holistically advance multiple literacies while students reflect on the learning process of acquiring information sources and communicating information for a broad audience in an online participatory environment.

Librarians can support faculty focused on imparting subject-specific information by fostering aspects of information and digital literacy that may not otherwise be covered.

Academic librarians can complement the pedagogy of educators in lab-based science classes using a Wikipedia editing assignment. For the assignment, students engage in independent research, searching for and relying on subscription-based and open access materials to underpin their contributions to Wikipedia articles in their discipline. Librarians also guide students in reflecting on what it means to consume information in open access resources as well as on the privileges and restrictions inherent in subscription-based resources. Students consider the content of the material, how to

effectively communicate that information, the importance of citing their sources, and how easily their contribution will be removed if sources are omitted. These outcomes are not limited to classes in the sciences. Librarians can support faculty focused on imparting subject-specific information by fostering aspects of information and digital literacy that may not otherwise be covered. Further research is recommended to assess the extent to which librarian support with a Wikipedia editing assignment improves student outcomes versus in classes where there is no librarian support with the assignment.

The results of the current study are consistent with results of prior studies that investigated perceptions and the pedagogical value of Wikipedia editing assignments conducted in different disciplines at universities and colleges of varying sizes throughout the world, whether or not there was librarian support.[50] The positive results provide support for recommending the inclusion of a Wikipedia editing assignment in higher and post-graduate education in a variety of disciplines. In addition to covering multiple learning goals as students master subject content, an editing assignment serves as a social good through the sharing of information with a broad audience of knowledge seekers. The awareness that communication with others is encouraged through the Talk pages in Wikipedia allows students to be confident in defending their contributions should they be questioned. Conversely, students can question and edit contributions by others when appropriate. Librarians and educators interested in exploring the range of Wikipedia editing assignments can view active courses that use the Wiki Edu Dashboard to manage assignments.[51]

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Appendix A

Survey Questions

1. Do you use Wikipedia to look for information?

2. What did you think of Wikipedia as a source of information before the assignment?

3. Did your opinion of Wikipedia change after completing the assignment?

4. Have you edited a Wikipedia article before completing the assignment for CHEM 378?

5. Will you use your skills to edit Wikipedia pages in the future?

6. Why did you choose the article you selected to edit?

7. Were you able to find sources for the Wikipedia page you contributed to through Hunter College Libraries?

8.What types? (*ebooks, journal articles in a database, book chapter online, etc?)

9. Do you think the Wikipedia assignment helped you with your research and writing skills? How?

10. Did you learn about a new topic through the assignment that you want to research further?

Appendix B

Spring 2020

All ninety-three students enrolled in the biochemistry course in spring 2020 completed at least part of the Wikipedia editing assignment during this challenging time, contributing to 103 articles.

- 14 students out of 93 students enrolled in the course responded to the survey = 15%
- 12 respondents used Wikipedia before the assignment = 86%
- 7 respondents said their opinion of Wikipedia improved after the editing assignment = 50%
- 1 respondent edited Wikipedia prior to the assignment = 7%
- 10 respondents said that the assignment helped improve their research and writing skills = 71%
- 11 students who responded to the survey learned about a new topic through research for their contribution =78%

Fall 2020

Forty-eight students completed at least part of the assignment, contributing to forty-nine articles.

- 32 out of 49 students responded to the survey = 65%
- 27 respondents used Wikipedia before the assignment = 84%
- 20 respondents said their opinion of Wikipedia improved after the assignment = 62%
- None of the survey respondents edited Wikipedia before the assignment = 0%
- 25 respondents said that the assignment helped improve their research and writing skills, at least to some degree = 78%
- 27 students who responded to the survey learned about a new topic through research for their contribution = 84%

Spring 2021

Ninety-six out of ninety-eight students enrolled in the class contributed to 103 Wikipedia articles.

- 72 out of 99 students responded to the survey = 72%
- 66 respondents used Wikipedia before the assignment = 91%
- 40 respondents said their opinion of Wikipedia improved after the assignment = 55%
- 12 respondents edited Wikipedia before the assignment = 16%
- 54 respondents said that the assignment helped improve their research and writing skills, at least to some degree = 75 %
- 52 students who responded to the survey learned about a new topic through research for their contribution = 72%

Notes

1. Thomas P. Mackey and Trudi E. Jacobson, "Reframing Information Literacy as a Metaliteracy," *College & Research Libraries* 72, 1 (2011): 62–78, https://doi.org/10.5860/crl-76r1.
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