Evidence Based Library and Information Practice

Maintaining Quality While Expanding Our Reach: Using Online Information Literacy Tutorials in the Sciences and Health Sciences

Talitha Matlin et Tricia Lantzy

Volume 12, numéro 3, 2017

URI : https://id.erudit.org/iderudit/1104792ar
DOI : https://doi.org/10.18438/B8ZD3Q

Aller au sommaire du numéro

Éditeur(s)

University of Alberta Library

ISSN

1715-720X (numérique)

Découvrir la revue

Citer cet article

Matlin, T. & Lantzy, T. (2017). Maintaining Quality While Expanding Our Reach: Using Online Information Literacy Tutorials in the Sciences and Health Sciences. *Evidence Based Library and Information Practice*, *12*(3), 95–113. https://doi.org/10.18438/B8ZD3Q

Résumé de l'article

Objective – This article aims to assess student achievement of higher-order information literacy learning outcomes from online tutorials as compared to in-person instruction in science and health science courses.

Methods – Information literacy instruction via online tutorials or an in-person one-shot session was implemented in multiple sections of a biology (n=100) and a kinesiology course (n=54). After instruction, students in both instructional environments completed an identical library assignment to measure the achievement of higher-order learning outcomes and an anonymous student survey to measure the student experience of instruction.

Results – The data collected from library assignments revealed no statistically significant differences between the two instructional groups in total assignment scores or scores on specific questions related to higher-order learning outcomes. Student survey results indicated the student experience is comparable between instruction groups in terms of clarity of instruction, student confidence in completing the course assignment after library instruction, and comfort in asking a librarian for help after instruction.

Conclusions – This study demonstrates that it is possible to replace one-shot information literacy instruction sessions with asynchronous online tutorials with no significant reduction in student learning in undergraduate science and health science courses. Replacing in-person instruction with online tutorials will allow librarians at this university to reach a greater number of students and maintain contact with certain courses that are transitioning to completely online environments. While the creation of online tutorials is initially time-intensive, over time implementing online instruction could free up librarian time to allow for the strategic integration of information literacy instruction into other courses. Additional time savings could be realized by incorporating auto-grading into the online tutorials.

Evidence Based Library and Information Practice

Research Article

Maintaining Quality While Expanding Our Reach: Using Online Information Literacy Tutorials in the Sciences and Health Sciences

Talitha Matlin
STEM Librarian
University Library
California State University San Marcos
San Marcos, California, United States of America
Email: tmatlin@csusm.edu

Tricia Lantzy
Health Sciences & Human Services Librarian
University Library
California State University San Marcos
San Marcos, California, United States of America
Email: plantzy@csusm.edu

Received: 20 Mar. 2017 **Accepted**: 21 July 2017

Abstract

Objective – This article aims to assess student achievement of higher-order information literacy learning outcomes from online tutorials as compared to in-person instruction in science and health science courses.

Methods – Information literacy instruction via online tutorials or an in-person one-shot session was implemented in multiple sections of a biology (n=100) and a kinesiology course (n=54). After instruction, students in both instructional environments completed an identical library assignment to measure the achievement of higher-order learning outcomes and an anonymous student survey to measure the student experience of instruction.

Results – The data collected from library assignments revealed no statistically significant

differences between the two instructional groups in total assignment scores or scores on specific questions related to higher-order learning outcomes. Student survey results indicated the student experience is comparable between instruction groups in terms of clarity of instruction, student confidence in completing the course assignment after library instruction, and comfort in asking a librarian for help after instruction.

Conclusions – This study demonstrates that it is possible to replace one-shot information literacy instruction sessions with asynchronous online tutorials with no significant reduction in student learning in undergraduate science and health science courses. Replacing in-person instruction with online tutorials will allow librarians at this university to reach a greater number of students and maintain contact with certain courses that are transitioning to completely online environments. While the creation of online tutorials is initially time-intensive, over time implementing online instruction could free up librarian time to allow for the strategic integration of information literacy instruction into other courses. Additional time savings could be realized by incorporating auto-grading into the online tutorials.

Introduction

Much of the recent literature on incorporating online teaching methods in information literacy instruction (ILI) has focused on "flipped" and hybrid settings. However, the effectiveness of purely online ILI needs to be examined within the context of higher education, particularly when it is used to replace one-shot IL sessions. At California State University San Marcos (CSUSM), two librarians replaced in-person IL sessions with online tutorials in order to more easily reach a large number of students in critical major courses while still maintaining high levels of student learning. By making the strategic decision to spend less in-person time with students in lower-level courses, the librarians were then able to spend more time on in-person instruction in research-intensive upper-division courses. This study goes beyond examining student perceptions of online versus in-person instruction and focuses on achievement of higher-order student learning outcomes via these two teaching modalities.

CSUSM is a master's-granting institution with approximately 14,000 students (CSUSM, 2015). From 2012-2015, the student population saw a large increase of 32% (CSUSM, 2015). Tenure-track faculty hiring is not increasing at the same rate as the student population, thereby prompting the library to include in its strategic plan a call for the investigation of more scalable methods of instruction. This issue of scalability is not unique to CSUSM (Bracke & Dickstein, 2002; Nichols, Shaffer, & Shockey, 2003; Kraemer, Lombardo, & Lepkowski, 2007; Greer, Hess, & Kraemer, 2016), making the development of online learning objects to replace in-person instruction an important area of research in librarianship.

Within the CSUSM Library, the Y Unit undertook a curriculum-mapping project in the 2015-2016 academic year. Curriculum-mapping allowed the librarians to make strategic and informed decisions about which courses needed the most library-related instruction, and which type of instruction would be most appropriate for the identified courses. The STEM Librarian and the Health Sciences & Human Services (HSHS) Librarian took this opportunity to embark on a pilot project comparing the effectiveness of online IL tutorials with in-person instruction in required major courses in biology and kinesiology, the 6th and 7th most popular majors at CSUSM, with over 850 students each (CSUSM, 2015). In fall 2016, there were four sections of Biology 212: Evolution (approximately 140 students total) and two

sections of Kinesiology 306: Exercise Fitness and Health (approximately 65 students total).

Traditionally, it has been difficult for librarians to "take" devoted class time for ILI within the sciences and the health sciences due to the courses' tightly controlled schedules (Gregory, 2013). Additionally, there are an increasing number of online-only and hybrid classes in the sciences and health sciences at CSUSM, requiring alternative methods of library instruction. Despite these challenges, the STEM and HSHS Librarians had previously worked with many classes in these subjects (including the courses being used in this study). However, the curriculum-mapping project identified additional courses in each subject that would benefit from library instruction and with which the librarians had not yet worked. The librarians' working hypothesis was that if they were able to demonstrate that students who received asynchronous online ILI (which wouldn't require disciplinary faculty to give up any lecture time and could easily be incorporated into online-only and hybrid courses) learned as much as those who received in-person ILI, it would be easier to integrate library instruction into additional critical science and health science courses with which they had not worked previously.

Literature Review

Traditional ILI in the sciences and health sciences has been based on the Information Literacy Competency Standards for Higher Education (the "Standards") (Association of College & Research Libraries [ACRL], 2000). After the rollout of the Standards, the Science and Technology Section and the Nursing Section of ACRL adapted them to better suit the needs of their disciplinary populations (Association of College & Research Libraries, 2006; Association of College & Research Libraries, 2013). However, the Standards were recently replaced with the more flexible Framework for Information Literacy for Higher Education (the "Framework") (ACRL, 2016). A good amount of research has been done to evaluate online ILI in the sciences and health sciences (Li, 2011; Schimming, 2008; Tierney & Stefanie, 2013; Weiner, Pelaez, Chang, & Weiner, 2012), but (due to the very recent rescinding of the Standards) none of this research examines online ILI based on the newly adopted Framework. Greer et al. emphasize how well-suited an online format is to providing Framework-based instruction, due to the fact that it can "allow for more exploration and feedback than what may be possible in a more traditional face-to-face instructional setting" (2016, p. 296).

Online instruction, a term that is often used interchangeably with "computer aided/assisted" instruction and "computer aided learning," is instruction that is delivered via the internet (Allen & Seaman, 2013). For this project, the authors decided that asynchronous online tutorials would best meet their students' needs. Asynchronous instruction occurs "…among geographically separated learners, independent of time or place" (Mayadas, 1997, p. 2). In other words, students are able to complete coursework without engaging in a lesson in real-time. In deciding which modality to adopt for this project, the authors consulted the literature on the benefits and drawbacks of different types of online instruction. Some of the reported drawbacks of asynchronous online instruction include the expense and time needed to develop and maintain online learning objects (Joint, 2003; Zhang, Watson, & Banfield, 2007), the lack of personal interaction between students and instructors (Gall, 2014), and the difficulty of incorporating active learning (Li, 2011). However, although difficult, it is possible to include active learning into online learning objects (Dewald, 1999; Nichols et al., 2003; Zhang et al., 2007), which is one of the necessary components of effective ILI in general (Drueke, 1992).

One of the main reported benefits of asynchronous instruction is the scalability, since instructors can design learning objects once and then continue to use these same objects to reach

a (hypothetically) unlimited number of students an unlimited number of times until the content becomes outdated (Grassian & Kaplowitz, 2009; Joint, 2003; Mestre, 2012; Zhang et al., 2007). For students with various learning styles and abilities, asynchronous online tutorials can be more accessible (Bowles-Terry, Hensley, & Hinchliffe, 2010; Webb & Hoover, 2015). Additionally, tutorials can be repeated multiple times (Bowles-Terry et al., 2010) and are self-paced (Mestre, 2012; Schimming, 2008; Zhang et al., 2007). The authors decided that these benefits, in particular the scalability, outweighed the potential drawbacks of asynchronous instruction.

Much research has been done to compare in-person to online library instruction. "Flipped" or hybrid methods can be used effectively to provide interactive instruction (Mestre, 2012; Walton & Hepworth, 2013) and can allow instructors to focus on higher-order skills and concepts in-class since students are responsible for learning the more basic skills and concepts prior to any face-to-face instruction (Gilboy, Heinerichs, & Pazzaglia, 2015). However, although librarians can cover a greater amount of content in a flipped class, they require the same amount of in-person time (plus the additional prep time to create the pre-class instruction/assignments), thereby negating the potential scalability benefits of purely asynchronous online instruction.

Prior research on faculty/student satisfaction with online learning has produced mixed results. Schimming (2008) examined medical students' reactions to online and in-person learning, and found that online students were more satisfied with the instruction, possibly because they were able to control the pacing of the lessons. Other studies have also used post-surveys to determine that students experience high levels of satisfaction with online learning (Nichols et al., 2003; Weiner et al., 2012). However, there are also numerous examples of studies that found lower levels of student satisfaction with online versus in-person instruction (Shaffer, 2011; Summers, Waigandt, & Whittaker, 2005). Johnson, Aragon, and Shaik (2000) found that graduate students had slightly more positive reactions to in-person learning, possibly due to the fact that they developed deeper social ties to their instructor and fellow students, and reported a higher level of instructor support.

In addition to the conflicting evidence of student and faculty satisfaction regarding online versus in-person learning, there is also conflicting or inconclusive evidence regarding student achievement of learning outcomes in these different formats. Gall (2014) compared in-person and online library orientations and found that all student groups improved their research skills, but the study could not determine whether online students learned as much as or more than in-person students. Kraemer et al. (2007) compared in-person, hybrid, and online library instruction and found that "…[Both] groups that had contact with a librarian … scored higher on the final exam than the online group…" (p. 337). The authors concluded that "…contact with a librarian is an important component of student learning" (Kraemer et al., 2007, p. 339).

However, numerous studies have found that students learn as much as or even more through online instruction as they do in person. Silk, Perrault, Ladenson, and Nazione (2015) state that "Whether or not student learning occurs likely has more to do with the quality of the material and teaching rather than the type of modality" (p. 154). Johnson et al. (2000) found that although students tend to prefer face-to-face over online instruction, there was "no difference in the quality of the learning that takes place" (p. 44). This finding was confirmed by other research in this area (Anderson & May, 2010; Beile & Boote, 2004; Greer et al., 2016; Nichols et al., 2003; Zhang et al., 2007). Silk et al. (2015) compared modalities when providing ILI to undergraduate business students and found that students performed the same in-person and online on knowledge and attitudinal measures,

but online students were actually 10% more successful at finding an empirical article. The authors hypothesize that "…because students were instructed to find research articles online for their projects, maybe library instruction works best when the medium by which the instruction is delivered matches the behavior desired…" (Silk et al., 2015, p. 153).

Due to the mixed results of many studies in regards to both student achievement of learning outcomes and student/faculty satisfaction with online and in-person learning, additional research needs to be conducted. Furthermore, there is a gap in the literature regarding assessment of student achievement of higher-order learning outcomes. Joint (2003) notes that it is difficult to teach higher-order IL concepts and skills (such as topic development, advanced database searching, dispositions, and "knowledge practices" that require significant critical thinking) through asynchronous online instruction, especially when the learning modules are not integrated into disciplinary coursework. In their systematic review of the efficacy of in-person and computer assisted library instruction, Zhang et al. (2007) found that both modalities were equally effective in helping students achieve the learning outcomes, but noted that the majority of studies "focused on teaching of basic library skills, such as use of the library catalog and keyword searching of databases, and of knowledge of library services such as interlibrary loan (and placed less emphasis on teaching more advanced skills)" (p. 483).

In order to address this gap, this study aims to assess higher-order student learning outcomes using online tutorials to replace one-shot ILI in the sciences and health sciences. In this instance, the authors used Bloom's "Taxonomy of Educational Objectives" to define "lower-order" learning outcomes as the first three levels in the hierarchy (knowledge, comprehension, application) and "higher-order" learning outcomes as the last three levels (analysis, synthesis, evaluation) (1956). Although student satisfaction data was collected regarding the method of instruction, the main focus of this study was the evaluation of student learning. Rather than using survey data alone, the librarians evaluated students' post-instruction assignments in order to assess student achievement of higher-order learning outcomes, a topic that has typically been addressed in the literature by instructors who are providing online instruction through entire courses (Lalonde, 2011) or in flipped classrooms (Gilboy, Heinerichs, & Pazzaglia, 2015; Walton & Hepworth, 2013).

Methods

Courses

The STEM and HSHS Librarians chose courses with multiple sections in their respective subject areas to compare the efficacy of library instruction delivered in-person and through online tutorials. These courses were selected as a result of a curriculum mapping project that revealed that more scalable library instruction was needed due to either section growth or because the course was transitioning to an online environment. Prior to delivery of instruction using two different teaching modalities and collection of student work, the authors obtained approval from the campus institutional review board to embark on the study.

In fall 2016, the STEM Librarian taught four sections of Biology 212 "Evolution", two of which participated in 50 minutes of in-person library instruction while the other two completed online tutorials focused on the same learning outcomes. Two biology instructors participated and had one section in each instructional group (in-person and online) to control for any differences due to the instructor. The purpose of librarian-led instruction in Biology 212 is to prepare students to conduct research for multiple papers that require them to find, use, and cite both scholarly and popular information. The STEM Librarian has worked

with this course (although with many different professors) for the last four years; this was the first year to incorporate online instruction.

Also in fall 2016, the HSHS Librarian collected similar data in two sections of Kinesiology 306 "Exercise Health and Fitness". As in the biology course, one group participated in 50 minutes of in-person instruction while the other completed online tutorials. Both sections had the same course instructor. In Kinesiology 306, students must find several types of information on a controversial health topic to demonstrate how information from these sources can vary depending on the audience and the purpose. These source types include non-scholarly popular sources (e.g., blog posts, news articles, and message boards), non-scholarly authoritative sources, and peer-reviewed research articles. The HSHS Librarian has worked with the primary instructor for several years and began investigating online methods of instruction when the course first began transitioning into hybrid and totally online sections. Although finding student learning to be comparable between in-person and online synchronous instruction offered through web conferencing (Lantzy, 2016), obstacles to this type of online instruction can be burdensome for course faculty. For these reasons, the HSHS librarian decided asynchronous online instruction might be a better alternative for this course.

Participants

All participants were undergraduate students enrolled in either Biology 212 or Kinesiology 306. The authors used a quasi-experimental design and assigned students to instructional conditions based on their section enrollment. A total of 100 students across 4 sections of Biology 212 (total enrollment for the 4 biology sections: 120 students) and 54 students across 2 sections of Kinesiology 306 completed the assignments and participated in the study (total enrollment for the 2 kinesiology sections: 64 students).

Instructional Content

Recognizing that instructional materials used for in-person library classes would not be appropriate for online asynchronous tutorials, the authors used the Backwards Instructional Design process described by Wiggins & MacTighe (2006) to develop both the online and in-person sections. After articulating the desired learning outcomes, the authors developed a library assignment to measure the achievement of those learning outcomes. Teaching/learning activities were then created that directly addressed the learning outcomes and prepared students to complete the assignments in ways appropriate to each learning environment.

The authors chose to use Adobe Captivate based on its ability to incorporate active learning components and knowledge checks. The instruction for both the in-person and online classes was developed in alignment with specific course assignments, and therefore reflected the unique IL needs of the course. Blummer and Kristskaya (2009) outlined five best practices for the development of tutorials: identify the objectives of the tutorial, align content with the appropriate guiding standards, collaborate, increase user engagement with active learning, and evaluate. The authors incorporated these along with other accepted practices (such as speaking slowly during recordings and including closed captions) to develop the tutorials.

The Biology 212 tutorials (https://microsites.csusm.edu/wp-content/tutorials/BIOL212-CitingTutorial; https://microsites.csusm.edu/wp-content/tutorials/BIOL212-FindingArticlesTutorial) provided instruction on the peer review process, search strategies for finding peer-reviewed journal articles, and CSE citations. Two tutorials (https://microsites.csusm.edu/wp-content/tutorials/Kine306-Authoritative; https://microsites.csusm.edu/wp-content/tutorials/Kine306-Scholarly) were

developed for Kinesiology 306 and included instruction on evaluating online non-scholarly health information and recognizing and finding peer-reviewed journal articles. Both sections of the kinesiology class also received a handout (physical or electronic) to assist with developing citations for both the library and course assignment.

Tools

All four biology sections completed an identical library assignment (Appendix A). The STEM Librarian graded the assignments together and sorted by section afterwards to eliminate grading bias by instructional group. Both sections of the kinesiology course completed a library assignment (Appendix B) that was graded by the HSHS Librarian before being sorted by instructional group. Both the STEM and HSHS Librarians created grading rubrics to be used in the evaluation of the completed assignments; each assignment had a total possible point value of 10. For the reflection questions, the authors awarded full points if students mentioned particular key words/phrases, and if they provided enough complexity in the response to demonstrate understanding of the concepts being evaluated.

Library assignment data was analyzed using SPSS statistical software. Each assignment measured student learning outcomes related to both basic and higher-order IL skills, although they varied greatly in content. Therefore grades were compared only within each subject area in order to control for potential bias introduced by the differing content. Unpaired sample t-tests were run to determine whether statistically significant differences existed between total library assignment scores in the two instructional groups for each course (see Table 1). However, both assignments asked students to critically reflect on how scholarly sources differ from non-scholarly sources – a higher-order IL skill. To measure differences in the achievement of higher-order learning outcomes, unpaired sample t-tests were run on Question 6A (Appendix A - biology) and Question B5 (Appendix B - kinesiology).

To supplement the assessment of student learning through library assignments, students in all sections completed an anonymous student survey (Appendix C) that measured student attitudes to instruction and provided some indication of their experience. The survey gathered information on the perceived clarity of library instruction, confidence levels after instruction, comfort in asking a librarian for help in the future, and other open-ended feedback.

Table 1
Unpaired Sample T-Tests Results: Comparison of Library Assignment Grades by Instructional Format in Biology 212 & Kinesiology 306

Course	**Library Instruction Format**	***N***	**Mean**	**SD**	***t***	***p***
Biology 212					1.16	0.25
	In-person	55	9.16	0.94		
	Online tutorials	45	9.36	0.65		
Kinesiology 306					0.47	0.64
	In-person	27	8.22	1.09		
	Online tutorials	27	8.07	1.21		

Results

Library Assignments

In Biology 212, a comparison of library assignment scores in the two instructional groups did not show a significant difference between in-person (M=9.16, SD=0.94) and online library instruction (M=9.36, SD=0.64), $t(100)=1.16$, $p=0.25$. However, the mean of the online group was 0.2 points higher than the in-person group. In Kinesiology 306, the in-person average was slightly higher than the online group by 0.15 points. The differences between the in-person (M=8.22, SD=1.09) and online section (M=8.07, SD=1.21) scores were not statistically significant, $t(54)=0.47$, $p=0.64$.

Higher-Order Student Learning Outcomes

Both library assignments asked students to articulate the differences between non-scholarly and scholarly sources. This task aligns with two Framework frames: "Authority is Constructed and Contextual," and "Information Creation as a Process." The goal of this question was for students to consider how authority is defined in the academic community and how the peer-review process sets these types of information resources apart from non-scholarly sources. This learning outcome was addressed in question 6a of the biology assignment and question b5 of the kinesiology assignment. A comparison of scores for question 6a in the biology sections showed no statistically significant differences between the in-person class (M=0.96, SD=0.15) and the online class (M=0.98, SD=0.10), $t(100)=0.90$, $p=0.37$. The kinesiology scores also showed no statistically significant differences for question b5 between the in-person (M=1.56, SD=0.64) and the online class (M=1.74, SD=0.59), $t(54)=1.10$, $p=0.28$. Although no significant differences were found between scores on this question, it is interesting to note that the online groups in both courses outperformed the in-person groups on

Table 2
Weighted Average Responses (Scale 1-4)

Course	Library Instruction Format	*N*	The subject matter of the library instruction was clear and understandable.	I feel confident completing the assignment for my class as a result of this library instruction.	I feel more comfortable asking for help from a librarian as a result of this library instruction.
Biology 212					
	In-person	74*	3.68	3.51	3.60
	Online tutorials	43	3.58	3.40	3.53
Kinesiology 306					
	In-person	27	3.78	3.63	3.70
	Online tutorials	16	3.75	3.50	3.63

this higher-order critical thinking question (by 2% in the biology course and 9% in the kinesiology course).

Student Surveys

The quantitative results from the student surveys demonstrated a comparable experience in terms of the clarity of instruction, student confidence in completing the course assignment, and comfort in asking for help from a librarian after instruction (see Table 2). In each category, the weighted average responses were marginally higher in the in-person environment than the online environment. The largest difference between the two instructional groups was seen in student confidence levels in the kinesiology sections (0.13 higher for the in-person section).

The two open-ended questions on the student surveys asked "What did you find most helpful about the library instruction?" and "What is still confusing for you after the library instruction?" Responses to these questions revealed a different set of themes between instructional groups.

Positive student comments from the in-person groups were heavily content-oriented. Several students in the in-person kinesiology section commented on the helpfulness of learning how to differentiate between the three categories of information resources. Many in-person biology students reported the clarity of instruction and the ability to ask questions of the librarian was particularly helpful. One biology student noted, "The information was directly connected to our assignment making it reliant [sic] and any questions that came up were easily answered."

Responses to the question "What is still confusing?" in the in-person groups reflected concepts that are generally difficult for students or concepts that were given less in-class time during the session. Students in both courses mentioned citing in APA/CSE as confusing, and a few biology students cited differentiating between scholarly and non-scholarly articles as challenging. One kinesiology student also mentioned feeling rushed during the session, writing "[t]his was a lot of information that was introduced in a really short period of time. I would feel more confident if it wasn't such a rush to get everything done in 50 minutes."

Students in the online groups who completed the tutorials often mentioned the structure, clarity, and active learning activities as the most helpful parts of the tutorials. For example, one kinesiology student stated that the most helpful aspect was "[t]he simple breakdown of topics and the knowledge check in certain areas to make sure I was understanding the material that was being taught." Positive responses from the online biology students highlighted the clarity, interactivity, and pace of the tutorials. One student described the biology tutorials as "…very clear and concise. They tried to answer all of your potential questions before there was time to let you get confused about searching for a topic or how to properly site in CSE format." Another biology student found it helpful that they were able to go at their own pace and rewatch the tutorials to ensure they understood the content.

There were some technical glitches in the biology tutorials that survey responses helped to uncover. For example, one student reported "The little hot spot buttons didn't always work and it wouldn't let me move on in some sections because even though I was clicking on what it was asking for (i.e. editor names) it wouldn't let me continue." Another student mentioned the navigation as problematic: "I could not navigate back to a page after completing it, so I found it very difficult to use the instruction for the assignment afterward." Lastly, one student brought up the fact that there was no librarian immediately available to answer questions. The student explained, "Throughout the lecture, if I had a question, I was unable to ask anyone so I would just google [sic] it and try to find the answer that way."

Discussion

The online tutorials developed by librarians in this study proved to be as effective as in-person instruction in supporting student learning. While previous studies have shown that online library instruction through tutorials can lead to the same learning outcomes as in-person instruction (Anderson & May, 2010; Beile & Boote, 2004; Greer et al., 2016; Johnson et al., 2000; Nichols et al., 2003; Silk et al., 2015; Zhang et al., 2007), none of these studies focused specifically on undergraduate-level science and health sciences courses. It is difficult to generalize from non-science-based library instruction because IL in the sciences tends to focus on discipline-specific learning goals that can depart from basic library instruction goals. In the kinesiology course, for example, library instruction centred on evaluating different forms of health information based on authority, purpose, and audience. Library instruction in the biology course explained the peer review process in the sciences, explored unique features of searching scientific databases, and provided guidance on developing CSE citations.

This study also aimed to assess student achievement of higher-order learning outcomes in online and in-person settings by assessing student work on specific library assignment questions that required critical thinking and a deep understanding of information processes and authority. Much of the current library research comparing student learning from one-shot in-person and online asynchronous environments focuses on basic library skills such as general catalog use and requesting library materials (Zhang et al., 2007) rather than higher-order IL skills that involve critical thinking. To address this gap in the literature, the authors identified a common question between the library assignments for the biology and kinesiology courses that measured a higher-order concept that aligns with the Framework for Information Literacy for Higher Education (ACRL, 2016). While the authors found no significant differences in analyzing these answers, it is interesting to note that in both courses, students who took the online tutorials performed slightly better than the in-person group on these higher-order questions. It is possible that this slight advantage is the result of students being able to rewatch tutorials as they work on the assignments. The differences may also be a result of the more rigidly structured nature of tutorials. When explaining peer review (a concept that can be difficult for many students to understand) the organization of the material explaining the process (and how this process changes the way the final information "product" is perceived) may have been more beneficial for students than the more conversational nature of in-person classes.

At the start of this project, the authors decided it was important to require a library assignment for assessment purposes. Unfortunately, providing this individualized feedback was extremely time consuming. The authors will likely modify the assignments to be at least partially auto-graded online. In addition to reducing the workload for the librarian, this change will allow for future growth and will reduce the turnaround time for students receiving feedback. Developing and assessing these tutorials was labour intensive as well. The librarians had to learn the software and spent eight to twelve hours creating each tutorial. Fortunately, any updates or minor changes to the tutorials can be made relatively quickly moving forward. For librarians interested in undertaking a similar project, the authors recommend ensuring administrative support of the project and putting aside an appropriate amount of time for its completion.

Overall, the student surveys showed that the student experience in both instructional environments was positive. Survey responses also brought technical issues to the attention of the librarians quickly, making this type of feedback a useful indicator of potential problems with the online instruction. The average weighted responses for the first three survey questions demonstrated a very slight but

consistently higher average for students in the in-person sections. The open-ended survey results allowed the authors some room to speculate about the causes of this difference in the weighted averages. While it would be imprudent to overstate the importance of non-statistically significant differences, these small distinctions may reflect the impact of in-person librarian-student interaction or the importance of receiving immediate answers to questions that arise when students are learning higher-order IL concepts. Future research exploring the reasons behind these differences should aim to uncover ways to improve the student experience of online tutorials.

The positive feedback received from the online groups supports the continued use of tutorials in these courses. These students were able to revisit important concepts as they completed their library assignment, leading to a slight advantage in averages for questions measuring higher-order learning outcomes. Many students appreciated the structure and clarity of the tutorials, a feature that may be hard to duplicate in the classroom. Finally, many students described the active learning components as being valuable. In large classroom environments, students may disengage from group discussions and other active learning activities if they are uncomfortable sharing or worried about offering an incorrect answer. All students participate in the activities on their own terms when completing online tutorials, making the experience more consistent.

The findings of this assessment affirm that it is possible to replace an in-person one-shot library instruction session with asynchronous online tutorials without any significant detriment to student learning in science and health science courses. In the long-term, this could result in a significant savings of instructional hours and the ability to effectively reach a greater number of students in these disciplines. The authors are now redirecting time generally spent in these classes to other upper-level courses in need of in-person instruction and to developing online instructional materials for other courses. Pairing this assessment of library instruction with curriculum maps to identify classes that require librarian intervention has made instruction in these programs more strategic and thoughtful.

Although the authors controlled for librarian and course instructor, there exist some limitations to this study based on the population and university setting. The results of this study cannot be directly applied to non-university settings, although the findings may be of interest to public or special librarians planning on developing tutorials for instruction or outreach purposes. Also, as a result of this article's focus on student learning and the student experience, various other factors (such as the preferences of course instructors and students) that should be involved in determining which instructional format is best suited for a particular course have not been included. Additionally, although the subject areas of biology and kinesiology can be generalized to a certain extent across the science and health sciences disciplines, future studies that measure student learning from online tutorials in different subjects and courses within those disciplinary groups would expand the generalizability of these results. Lastly, although the authors determined in this study that it is possible to achieve similar levels of learning through both online and in-person delivery of instruction, these findings do not necessitate that this would always be the case. Indeed, this result depends upon the development of high-quality online tutorials – any instructor hoping to achieve a similar result would need to invest time and energy into developing a level of expertise in learning theory and online tutorial development. Additional studies comparing achievement of student learning across instructional modalities would add to the generalizability of this finding.

References

Allen, I. E., & Seaman, J. (2013). *Changing course: Ten years of tracking online education in the United States*. Sloan Consortium. Retrieved from http://eric.ed.gov/?id=ED541571

Anderson, K., & May, F. A. (2010). Does the method of instruction matter? An experimental examination of information literacy instruction in the online, blended, and face-to-face classrooms. *The Journal of Academic Librarianship*, *36*(6), 495-500. https://doi.org/10.1016/j.acalib.2010.08.005

Association of College & Research Libraries. (2000). *Information literacy competency standards for higher education*. Retrieved from http://www.ala.org/acrl/standards/informationliteracycompetency

Association of College & Research Libraries. (2006). *Information literacy standards for science and engineering/technology*. Retrieved from http://www.ala.org/acrl/standards/infolitscitech

Association of College & Research Libraries (2013). *Information literacy competency standards for nursing*. Retrieved from http://www.ala.org/acrl/standards/nursing

Association of College & Research Libraries. (2016). *Framework for information literacy for higher education*. Retrieved from http://www.ala.org/acrl/standards/ilframework

Beile, P. M., & Boote, D. N. (2004). Does the medium matter? A comparison of a Web-based tutorial with face-to-face library instruction on education students' self-efficacy levels and learning outcomes. *Research Strategies*, *20*(1), 57-68.

Bloom, B. S. (Ed.). (1956). *Taxonomy of educational objectives*. New York: David McKay.

Blummer, B. A., & Kritskaya, O. (2009). Best practices for creating an online tutorial: A literature review. *Journal of Web Librarianship*, *3*(3), 199-216. https://doi.org/10.1080/19322900903050799

Bowles-Terry, M., Hensley, M. K., & Hinchliffe, L. J. (2010). Best practices for online video tutorials: A study of student preferences and understanding. *Communications in Information Literacy*, *4*(1), 17-28. Retrieved from http://repository.uwyo.edu/cgi/viewcontent.cgi?article=1008&context=libraries_facpub

Bracke, P. J., & Dickstein, R. (2002). Web tutorials and scalable instruction: Testing the waters. *Reference Services Review*, *30*(4), 330-337. https://doi.org/10.1108/00907320210451321

CSUSM. (2013). *Campus master plan*. Retrieved from https://www.csusm.edu/pdc/campus-master-plan/index.html

CSUSM. (2015). *Fast facts*. Retrieved from http://news.csusm.edu/fast-facts/

Dewald, N. H. (1999). Transporting good library instruction practices into the web environment: An analysis of online tutorials. *The Journal of Academic Librarianship*, *25*(1), 26-31. https://doi.org/10.1016/S0099-1333(99)80172-4

Drueke, J. (1992). Active learning in the university library instruction classroom. *Research Strategies*, *10*(2), 77-83.

Gall, D. (2014). Facing off: Comparing an in-person library orientation lecture with an asynchronous online library orientation. *Journal of Library & Information Services in Distance Learning*, *8*(3-4), 275-287. https://doi.org/10.1080/1533290X.2014.945873

Gilboy, M. B., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior*, *47*(1), 109-114. https://doi.org/10.1016/j.jneb.2014.08.008

Grassian, E. S., & Kaplowitz, J. R. (2009). *Information literacy instruction: Theory and practice* (2nd ed.). New York: Neal-Schuman Publishers.

Greer, K., Hess, A. N., & Kraemer, E. W. (2016). The librarian leading the machine: A reassessment of library instruction methods. *College & Research Libraries*, *77*(3), 286-301. https://doi.org/10.5860/crl.77.3.286

Gregory, K. (2013). Laboratory logistics: Strategies for integrating information literacy instruction into science laboratory classes. *Issues in Science and Technology Librarianship*, *74*. https://doi.org/10.5062/F49G5JSJ

Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research*, *11*(1), 29-49.

Joint, N. (2003). Information literacy evaluation: Moving towards virtual learning environments. *The Electronic Library*, *21*(4), 322-334. https://doi.org/10.1108/02640470310491559

Kraemer, E. W., Lombardo, S. V., & Lepkowski, F. J. (2007). The librarian, the machine, or a little of both: A comparative study of three information literacy pedagogies at Oakland University. *College & Research Libraries*, *68*(4), 330-342. https://doi.org/10.5860/crl.68.4.330

Lantzy, T. (2016). Health literacy education: The impact of synchronous instruction. *Reference Services Review*, *44*(2), 100-121. https://doi.org/10.1108/RSR-02-2016-0007

Lalonde, C. (2011). Courses that deliver: Reflecting on constructivist critical pedagogical approaches to teaching online and on-site foundations courses. *International Journal of Teaching and Learning in Higher Education*, *23*(3), 408-423. Retrieved from http://www.isetl.org/ijtlhe/pdf/IJTLHE1070.pdf

Li, P. (2011). Science information literacy tutorials and pedagogy. *Evidence Based Library and Information Practice*, *6*(2), 5-18. https://doi.org/10.18438/B81K8Z

Mayadas, F. (1997). Asynchronous learning networks: A Sloan Foundation perspective. *Journal of Asynchronous Learning Networks*, *1*(1), 1-16.

Mestre, L. (2012). *Designing effective library tutorials: A guide for accommodating multiple learning styles*. Oxford: Chandos Publishing.

Nichols, J., Shaffer, B., & Shockey, K. (2003). Changing the face of instruction: Is online or in-class more effective? *College & Research Libraries*, *64*(5), 378-388. https://doi.org/10.5860/crl.64.5.378

Schimming, L. M. (2008). Measuring medical student preference: A comparison of classroom versus online instruction for teaching PubMed. *Journal of the Medical Library Association*, *96*(3), 217-222. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2479068/

Shaffer, B. A. (2011). Graduate student library research skills: Is online instruction effective? *Journal of Library & Information Services in Distance Learning*, *5*(1-2), 35-55. https://doi.org/10.1080/1533290X.2011.570546

Silk, K. J., Perrault, E. K., Ladenson, S., & Nazione, S. A. (2015). The effectiveness of online versus in-person library instruction on finding empirical communication research. *The Journal of Academic Librarianship*, *41*(2), 149-154. https://doi.org/10.1016/j.acalib.2014.12.007

Summers, J. J., Waigandt, A., & Whittaker, T. A. (2005). A comparison of student achievement and satisfaction in an online versus a traditional face-to-face statistics class. *Innovative Higher Education*, *29*(3), 233-250. https://doi.org/10.1007/s10755-005-1938-x

Tierney, L., & Stefanie, W. (2013). Health sciences information literacy in CMS environments: Learning from our peers. *The Electronic Library*, *31*(6), 770–780. https://doi.org/10.1108/EL-06-2012-0063

Walton, G., & Hepworth, M. (2013). Using assignment data to analyse a blended information literacy intervention: A quantitative approach. *Journal of Librarianship and Information Science*, *45*(1), 53-63. https://doi.org/10.1177/0961000611434999

Webb, K. K., & Hoover, J. (2015). Universal Design for Learning (UDL) in the academic library: A methodology for mapping multiple means of representation in library tutorials. *College & Research Libraries*, *76*(4), 537-553. https://doi.org/10.5860/crl.76.4.537

Weiner, S. A., Pelaez, N., Chang, K., & Weiner, J. M. (2012). Biology and nursing students' perceptions of a web-based information literacy tutorial. *Communications in Information Literacy*. Retrieved from http://docs.lib.purdue.edu/lib_fsdocs/4

Wiggins, G. P., & McTighe, J. (2006). *Understanding by design* (2nd ed.). Upper Saddle River, N.J: Pearson Prentice Hall International.

Zhang, L., Watson, E. M., & Banfield, L. (2007). The efficacy of computer-assisted instruction versus face-to-face instruction in academic libraries: A systematic review. *The Journal of Academic Librarianship*, *33*(4), 478-484. https://doi.org/10.1016/j.acalib.2007.03.006

Appendix A
Library Assignment Biology 212

Biology 212 – Library Assignment
For this assignment, you will find two sources for your BIOL 212 writing assignments on the topic of CLIMATE CHANGE.

1. Write one or two sentences describing your topic and what you'll be searching for:

2. Now, break this up into KEYWORDS that you can use to search the databases and online. Combine different concepts with AND.

AND

3. Find one scholarly article on your topic using one of the recommended databases for this class.

   Author(s):_____

   Article Title:_____

   _____

   Journal Title Abbreviation:_____

   Year: _____ Volume: _____ Issue:_____

   Pages:_____ URL:_____

   DOI:_____

4. Find one non-scholarly source on your topic. This could be a webpage, newspaper article, or magazine article.

Author(s) – if any:_____

Article/Webpage Title: _____

_____

Magazine/Newspaper/Website Title:_____

_____

Date of publication: _____

URL:_____

5. Write your citations in CSE format:

    a. Journal article citation:

    b. Popular source citation:

6. Reflection
    a. Compare and contrast scholarly and popular sources. How are they similar and how are they different?
    b. Provide an example of how you, as a student, would use the **scholarly** source you found in Step #3 for this class (or another Biology class). In other words, what is the best way for you to use a scholarly article to support your argument/thesis/hypothesis?
    c. Provide an example of how you, as a student, would use the **popular** source you found in step #4 for this class (or another Biology class). In other words, what is the best way for you to use a popular source to support your argument/thesis/hypothesis?
    d. Who do you think are the intended audiences for scholarly and popular sources? Are

Appendix B
Library Assignment Kinesiology 306

KINE 306 – Library Assignment
Part A: Compare the two **non-scholarly** online health resources provided below by filling out the table.

	Source A http://www.healthcentral.com/cpd/c/215658/167244/cigarettes-cigarettes	**Source B** https://www.drugabuse.gov/publications/drugfacts/electronic-cigarettes-e-cigarettes
1. When was it created/last updated?		
2. Is the information available in languages other than English?		
3. Who created the content? Do they have expertise on this topic?		
4. Who sponsors the site? How is the site funded? (The "About us" section may help.)		
5. Is there advertising? If so, what are they advertising?		
6. What is the goal or purpose of this website? (Ex. Entertain, Inform, Sell, Educate, Convince, etc.)		
7. Would you consider this to be an authoritative health resource for the topic? Why or why not? (Think about what you learned in responding to each of the previous questions.) At least 3 sentences.		
8. Write an APA citation for ONE of these two sources. (Use the APA handout for help.)		

Part B: Find a **scholarly** article on your topic

1. Write one or two sentences describing your controversial health topic:

2. List at least 5 keywords to help you in your search. They could be synonyms, related terms, or broader terms than your main topic:

3. Find one scholarly article on your topic using one of the recommended databases for this class. Fill in the table below with the article information.

Author(s)	
Article Title	
Journal Title	
Year	
Volume	
Issue (if applicable)	
Page Range	
URL	
DOI	
Database used	

4. Write the citation for your scholarly article in APA format:

5. What makes this source different from the non-scholarly sources you evaluated in **Part A** of this assignment? At least 3 sentences.

Appendix C
Student Survey used for Biology 212 & Kinesiology 306

1. What course are you enrolled in?

2. Did you attend an in-person class or complete an online tutorial?

3. The subject matter of the library instruction (library instruction = either the in-person class with the librarian or the online tutorial created by the librarian) was clear and understandable.

Strongly agree	Agree	Disagree	Strongly disagree
○	○	○	○

4. I feel confident completing the assignment for my class as a result of this library instruction.

Strongly agree	Agree	Disagree	Strongly disagree
○	○	○	○

5. I feel more comfortable asking for help from a librarian as a result of this library instruction.

Strongly agree	Agree	Disagree	Strongly disagree
○	○	○	○

6. What did you find the most helpful about the library instruction?

7. What is still confusing for you after the library instruction?

Done

Powered by SurveyMonkey

See how easy it is to create a survey.