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Redesigning an online information literacy tutorial for first-year undergraduate instruction

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ABSTRACT

Between spring 2018 and fall 2019 four librarians in the University Library at California State University, Los Angeles developed and launched an interactive online information literacy tutorial for first-year undergraduate students. The *Library Research Tutorial for First-year Introduction to Higher Education Courses* updates the functionality and content of the University Library's previous 2015 tutorial. Backward design and predictable understandings and misunderstandings were the conceptual frameworks for developing the tutorial. This article describes the development and implementation of the tutorial, which included obtaining grant funding from the University Library, selecting authoring software, scriptwriting, and conducting usability testing. Fall 2019 student performance data for the tutorial are also presented. The authors offer recommendations to future creators for embarking upon a tutorial project.

Introduction

California State University, Los Angeles (Cal State LA) is a comprehensive, public Hispanic-Serving Institution (HSI) with a 2018 headcount of just under 28,000 students. For fall 2019, there were an estimated 3287 first-time first-year undergraduates, accounting for around 70% of the total enrollment of first-year undergraduates (California State University, Los Angeles, Office of Institutional Effectiveness, 2019).

In spring 2018, four teaching librarians (Social Sciences Librarian [tutorial project lead], Education Librarian, Science Librarian, and Engineering, Computer Science, and Technology Librarian) in the University Library at Cal State LA began to redesign and update the library's existing online information literacy (IL) tutorial which was created in 2015 to support the university's undergraduate Introduction to Higher Education (IHE) course. In this article we describe the impetus and process for developing the new *Library Research Tutorial for First-year Introduction to Higher Education Courses*. We also provide preliminary data on students' performance on the tutorial modules, discuss lessons learned in the process, and offer recommendations to other tutorial creators.

As a part of its undergraduate general education requirements, Cal State LA requires first-year undergraduates to take an IHE course in their first semester. In each college of the university, first-year undergraduates enroll in this course which is designed to facilitate their transition from high school to college by introducing them to academic experiences and university resources such as the library. Completing the course also fulfills the university's lifelong learning and self-development civic learning/community engagement requirements (California State University, Los Angeles, Office of Undergraduate Studies, n.d). Although IHE courses are offered in the individual colleges of the university, they all must meet the same general education student learning outcomes.

The Cal State LA *Faculty Handbook* states that information literacy instruction should take place in IHE courses:

> The process of developing information literacy shall occur progressively. Therefore, instruction in necessary skills shall occur in lower-division and introductory courses, including the Introduction to Higher Education course for first time freshmen. (California State University, Los Angeles, Academic Senate, n.d., Chapter IV, Information literacy section)

The *Faculty Handbook* also defines learning outcomes for information literacy:

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> Prior to graduation from California State University, Los Angeles, students must develop the ability to: (1) define a research topic and identify the need for information, (2) access information effectively and efficiently, (3) evaluate information critically for relevance, for quality of sources, and for objectivity, (4) organize, analyze, evaluate, synthesize and communicate that information for a specific purpose, and (5) ethically and legally access and use information. (California State University, Los Angeles, Academic Senate, n.d., Chapter IV, Information literacy section)

To integrate information literacy into undergraduate instruction, librarians at Cal State LA teach classroom-based information literacy instruction sessions in the IHE courses. Instructors of record and teaching librarians collaborate to determine how best to integrate information literacy instruction into each IHE course section. The core library instruction experiences in the courses are an in-person library instruction session taught by a library faculty member and completion of the online library tutorial, usually before the library session.

In the redesign project, we sought to build upon and advance the foundational work of our predecessors who developed the 2015 tutorial. The goals for the new *Library Research Tutorial* were to:

1. Create learning activities that address the learning outcomes stated in the *Faculty Handbook*, and that also take into account the current *Framework for Information Literacy for Higher Education* (Association of College & Research Libraries, 2015).
2. Create relevant assessments for those learning outcomes.
3. Use software that allows for tracking usage and quiz scores.
4. Create a more interactive tutorial that requires students to engage with the content.
5. Ensure the usability of the tutorial by testing it with students.
6. Ensure accessibility for users with disabilities by following best practices such as captioning.
7. Provide a tutorial that instructors of record in IHE courses can easily access, use, and assign in their classes.
8. Promote a flipped classroom model for information literacy learning so that librarians use class time for building upon basic skills learned in the tutorial. Obradovich, Canuel, and Duffy (2015) argued that a flipped classroom model using online tutorials could be effective for teaching information literacy skills.

To achieve these goals, we created the following tutorial modules which are briefly described below:

- *Welcome to the Library*: A brief audiovisual introduction to library services, resources, and spaces.
- *Asking Questions*: Students formulate a research question of an appropriate scope for an assignment.
- *Who Can You Trust*?: Students identify authoritative information sources based on a specific information need.
- *Putting the Search into Research*: Students learn to create a database search with keywords and connector (AND, OR, NOT) terms.
- *#GiveCredit*: Students learn to give credit to the ideas of others through attribution and formal citation conventions.
- *Bringing it all Together*: Students consider their roles as creators, consumers, and disseminators of information in academic, professional, and informal settings.

The modules, learning outcomes developed for the *Library Research Tutorial*, and information literacy frames are aligned as shown in Table 1.

Table 1
Learning outcomes and information literacy frames for each module.

Module	Learning outcome	Frame(s)
Module 1: Welcome to the Library	Identify resources available from the University Library to support learning and information literacy	Research as Inquiry Searching as Strategic Exploration
Module 2: Asking Questions	Formulate a research question of an appropriate scope for an assignment Describe research as an iterative, nonlinear, and interrogative process	Research as Inquiry
Module 3: Who Can You Trust?	Select a source that best meets an information need based on audience, context, and purpose Identify authoritative information sources based on a specific information need	Authority is Constructed and Contextual
Module 4: Putting the Search into Research	Design searches strategically using different types of search language effectively	Searching as Strategic Exploration
Module 5: #GiveCredit	Give credit to the ideas of others through attribution and/or formal citation conventions	Information Has Value
Module 6: Bringing it all Together	Students recognize their roles as creators or critics of information in school research, student journals or presentations, online, or in the future workplace	Information Creation as a Process Scholarship as Conversation

Learning outcomes were adapted from the California State University, Dominguez Hills University Library information literacy program (California State University, Dominguez Hills, University Library, n.d.).

The impetus for a new tutorial: rethinking and redesigning the library's 2015 tutorial

Digital learning objects such as online information literacy tutorials are ubiquitous across academic library instruction programs. They provide a self-directed introduction to the information competencies needed for student success. Two librarians and two staff members who selected the content and design developed the University Library's 2015 tutorial. Information literacy outcomes for the tutorial were developed by the University Library and based on the Association of College and Research Libraries' (ACRL) (2000) *Information Literacy Competency Standards for Higher Education*. Although completion of the tutorial was optional for students, it garnered significant usage. In fall 2015, 47.61% (2983) of incoming first-year students completed the tutorial. In fall 2017, 43.8% (2318) of incoming first-year students completed the tutorial.

LibGuides was the platform for the six-module 2015 tutorial and accompanying quiz. After a student completed the modules they were directed to a web page to print a certificate of completion. Each module included videos and text but did not require students to interact with or view the videos and content before moving on to the next module. Thus, a student could easily skip to the end of the tutorial, take the quiz, and print the certificate. Moreover, the certificate did not include the quiz score. A technologically savvy student might even notice that they could share the URL for the certificate with other students who might not have completed the quiz. Thus, the primary goals for redesigning the 2015 tutorial were to increase interactivity, improve functionality so that students could not skip content, and improve the ability to assess and document students' performance on quiz questions.

Literature review

The efficacy of online tutorials depends significantly on the design, content, implementation, and maintenance of the object. Reviewing the literature on best practices in tutorial development and viewing previously published tutorials informed the development of the *Library Research Tutorial* discussed in this paper. It also confirmed that best practices and models are useful guideposts that are adaptable for a local context.

Based on their reviews of published case studies of online tutorials developed at various institutions, Blummer and Kritskaya (2009) and Hartog (2018) identified best practices for creating and delivering these tutorials. Writing primarily about web-based tutorials, Blummer and Kritskaya identified five best practices for tutorial development: (a) identifying objectives and learner needs, (b) using standards as frameworks for defining tutorial content, (c) collaboration between practitioners and experts such as librarians, instructional designers, and media specialists, (d) increasing user engagement by integrating interactivity and ensuring ease of navigation through tutorial modules, and (e) inclusion of an evaluation component such as usability results, user feedback, or quizzes.

Noting the increasing ubiquity of multimedia and the availability of more platforms for hosting and authoring tutorials since the publication of Blummer's and Kritskaya's review, Hartog added the following seven areas of practice for tutorial development: (a) technology updates, (b) maintenance and revision, (c) gaming in learning, (d) cognitive learning and chunking, (e) adult education theory, (f) blended and flipped learning, and (g) ensuring ongoing engagement with the tutorial. Weeks and Putnam Davis (2017) focused on identifying best practices for creating video tutorials based on their own experiences and techniques from previous case studies. They concluded best practices are a sound approach to developing a tutorial, yet they also noted that some established practices were not feasible for their situation. For example, they found it impossible to adhere to previous recommendations in the literature to limit tutorial modules to 1 or 2 min, given their specific need for a longer time length to deliver the learning content effectively. In addition to best practices, topics in the literature about tutorial development include usability and involving students and/or faculty in the design process (Clapp & Ewing, 2013; Held & Gil-Trejo, 2016; Hess & Hristova, 2016; Lantz, Insua, Armstrong, Dror, & Wood, 2017; Yevelson-Shorsher & Bronstein, 2018), hosting platforms (Sherriff, 2017), and integrating learning management systems (LMS) with online tutorials (Georgas, 2014).

In a recent study, Ziegler (2019) described the development of a tutorial embedded in a university's Canvas LMS and designed to use digital badges to document student performance. Digital badging was considered early in the brainstorming stage of the tutorial project presented in this paper. However, we opted to instruct students to provide a print or digital copy of the Canvas grades page to their instructor to receive full credit for completing the tutorial. The page shows proof of completion of the modules and the quiz score.

As previously stated, one of the goals for the tutorial was that students would be able to recognize authoritative information sources. Noting that previous research about tutorials relies on librarians' self-reports of their efforts to teach higher-order thinking skills such as those reflected in Bloom's taxonomy and in the *Framework* (e.g., evaluation of information), Saunders (2018) examined online library tutorials, LibGuides, and instructional videos ($n = 517$) to determine how these digital learning objects (DLOs) address higher-order thinking skills. Results showed that 49.3% of tutorials addressed searching, which Saunders categorized as a lower order skill. Higher-order skills such as defining a topic (4.6%) and evaluation of information (13.2%) were addressed much less frequently. Saunders also found that only 20% of the DLOs incorporated any assessment of learning, and only 13% had explicit learning outcomes. Writing learning outcomes was an early step in developing the tutorial modules discussed in this paper. The process allowed for the scaffolding of lower-order and higher-order skills in the tutorial by starting from a general audiovisual orientation to the library and culminating in a module on students' awareness of their roles as creators, users, and disseminators of knowledge and information.

Project development

Because of the long-term nature of the work, we organized the tutorial project into three phases: planning, implementation, and maintenance (see the project timeline in Appendix A). In addition to reviewing other institutions' tutorials and developing learning outcomes, the planning phase included obtaining funding for authoring software and usability testing, and obtaining Institutional Review Board (IRB) approval for usability testing. The implementation phase centered on creating and testing the digital objects in the software, writing and editing the tutorial modules, coordinating staffing and work processes, and executing a photoshoot for the *Welcome to the Library* module. The maintenance phase entails ongoing upkeep and improvement of the objects. The staffing and photoshoot details and maintenance procedures are discussed in this section. A full explication of the development of the tutorial modules is presented later in the section on developing the tutorial modules.

Planning

Grant proposal

The University Library funded the tutorial project through an internal Library Innovation Grant. The grant is awarded annually to library faculty and staff to implement innovative ideas and programming. The project lead, who had previous experience with tutorial authoring software, began the grant writing process by talking with the librarians and staff who created the 2015 tutorial and researching the University's learning outcomes. All four librarians on the tutorial redesign team worked on refining the grant proposal before submission.

A requirement of the grant is that proposals must align with the University Library Strategic Plan and contribute to student success. Also, projects must be achievable within six months, which meant that the funds for our project had to be spent or encumbered by April 2019 which was within six months of the grant award. Thus, rather than including the full scope of work for the project, the project team wrote the grant as an "implementation grant" to stay within the time parameters. Furthermore, because the grant money had to be spent by the end of spring 2019, student employees' voice-over recordings had to be done before testing the modules. The grant funds were used to pay for the software, hardware, student incentives, and payroll (Table 2).

Institutional Review Board (IRB) and incentives

The tutorial project included usability research with students that we intended to disseminate and therefore required approval by the University's IRB. To begin the IRB process, all project team members completed the online Human Subjects Training required by the University. All materials associated with the project, including informational cover letters for participants, advertisements for recruiting students, and instructions and scripts for the research protocol were vetted by the IRB. With input from the project team members, the project lead created these materials using templates supplied by the IRB and examples from previous studies. The IRB determined that the risk to participants was minimal and approved the usability testing with exempt status.

Although the IRB approved the use of incentives for student participation in the usability study, the project team encountered significant administrative hurdles such as confusing and conflicting information from various university departments about using university funds to pay incentives to students. For example, at one point, we were told that any

Table 2
Budget.

Type	Item	Proposed cost	Actual cost
Software	Articulate storyline 360 one-year subscription (two users)	$1298.00	$1298.00
Hardware	Blue® snowball USB microphone	$69.99	$77.50
Incentives	$20 bookstore gift cards	$200.00	$80.00
Payroll	Student employee pay at $12–$14/h	$552.00	$174.50
Total		$2119.99	$1630.00

amount of money given to a student, even in gift card form, would be automatically reported to the University financial aid office and possibly reduce the total amount of aid a student can receive. Jeopardizing students' financial aid posed a serious ethical conundrum for the team, as even $20 could mean the difference in taking a course or purchasing a textbook. This obstacle was especially concerning given that according to fall 2018 data, 71.5% of undergraduates at Cal State LA are Pell Grant eligible (California State University, Los Angeles, Office of Institutional Effectiveness, 2018).

Fortunately, after working with the University Library's head of fiscal operations to achieve a compromise that met accounting guidelines, protected student data privacy, and did not jeopardize their student aid, we were approved to give gift cards from the university bookstore as incentives. The agreement stipulated that students complete an incentive form, a change that required the project lead to submit an IRB revision with additional considerations for safeguarding participant data. Negotiating the incentives and required forms delayed the usability testing by several months into the summer. Conducting the testing in the summer meant that the pool of students to recruit for usability testing was very limited.

Implementation

Staffing and work processes

As noted previously, the core project team consisted of four liaison librarians: the Social Sciences Librarian, Education Librarian, Science Librarian, and Engineering, Computer Science, and Technology Librarian. As project lead, the Social Sciences Librarian developed the concept for the tutorial and conducted background research about tutorials before putting out a call to library faculty to assemble a project team. Together, the team planned and developed the *Library Research Tutorial*. Table 3 shows the members of the Cal State LA community who were involved in the tutorial project and their roles.

Cal State LA is a highly student-centered institution, and it was important to include images of our students in the tutorial. The team also wanted to value students' time and contribution by paying them rather than asking for volunteers. Due to state law requiring that anyone working for the university, even for a day, be hired and subject to a background check, we decided to hire students from the University Library's student employee staff to participate in the photoshoot and narrate tutorial modules. The project lead worked with library personnel who supervise students to inform students of the opportunity and to ensure that the project did not interfere with their regular work.

Table 3
Cal State LA involvement in the tutorial project.

Contributors	Role
Project Team: Social Sciences Librarian (project lead), Education Librarian, Science Librarian, and Engineering, Computer Science, and Technology Librarian	Planning and development of the *Library Research Tutorial*
Center for Effective Teaching and Learning	Consultation for accessibility and instructional content
Institutional Review Board	Approval of usability testing
First- and second-year undergraduates	Participants in usability testing
Instructors of record	Assign the *Library Research Tutorial* in IHE courses
IT department	Voluntary Product Accessibility Template (VPAT) and software acquisition
University Library Communications and Events Coordinator	Production for *Welcome to the Library* video
University Library faculty and staff	Consultation on the 2015 tutorial and promotion and implementation of the new *Library Research Tutorial*
University and Library fiscal services	Disbursement of Library Innovation Grant funds
University Library Administration	Library Innovation Grant proposals
University Library student employees	Participants in photoshoot; tutorial narrators
University Library supervisors of student employees	Staffing for photoshoot and tutorial narration
University Photographer	Photoshoot

Library photoshoot

We originally planned a full live-action video for the introductory module but the cost and time limitations made that option unachievable. Instead, we opted for a video filmed by the University Library's Communications and Events Coordinator that consisted of photographs taken by a university photographer, short video clips with narration, and a music track. We hired four students to participate in the photoshoot; two also agreed to do voice narration. For the photoshoot the project team created a shot list from the tutorial script and gathered props such as backpacks, books, laptops, drinks, and snacks. The props helped create realistic scenes and conveyed the welcoming and comfortable environment of the library. We also gathered blankets and Xbox controllers for a scene that depicted students studying at home.

Student narrators

Students narrated four of the six modules, including the video created for module 1. In addition to using student photos throughout the tutorials, we included the student narrators' pictures on each module's credit page along with their major and graduation date. Giving credit to the students not only recognizes their work but also conveys a sense of inclusivity to their peers who complete the tutorial.

Maintenance

After going live, maintenance activities for the tutorial have included monitoring help requests from students, regular downloads of usage reports from the Canvas LMS, and continuous assessment of student learning by reviewing quiz scores. Users can submit a help ticket from the tutorial launch page on the library website. Every member of the team receives a ticket email alert to ensure that the ticket is answered promptly. Additional usability testing with students to optimize the design and functionality of the tutorial and to further refine the teaching and learning content are also part of the maintenance plan.

Technology considerations and accessibility

The majority (79%) of the grant monies were spent on software and hardware. We selected the subscription version of *Articulate Storyline 360* because of its robust interactivity and integration with the Canvas LMS. The subscription version includes access to templates, images, and automatic software updates. To ensure that the audio was of high quality, we purchased the Blue® Snowball, an affordable but reliable microphone, to record audio in *Camtasia*. This software is available through the University's institutional license. The project lead, with input from team members, uploaded the audio files to *Articulate Storyline 360* and edited them to the appropriate length and volume level. Achievement of optimal volume levels was a challenge and required numerous adjustments so that the audio would be loud enough to hear on computer speakers.

Accessibility

Accessibility was a critical component of the software selection process, tutorial design, and functionality. The University's information technology department evaluated the software's accessibility using a Voluntary Product Accessibility Template (VPAT) which was available on the *Articulate Storyline 360* website. Selecting accessible software was only the first step in ensuring the tutorial's accessibility. Consulting best practices for implementing the software in an accessible way was equally important. The Association of College and Research Libraries

Instruction Section's (n.d.) *Peer-Reviewed Instructional Materials Online* (*PRIMO*) *Selection Criteria* page includes a list that clarifies the requirements for implementing web accessibility. These requirements served as best practices for the University Library's tutorial design. Thus, all images in the tutorial include alt-text and each module has closed captioning. In addition to following best practices for accessibility we consulted with the university's Center for Effective Teaching and Learning for additional guidance. The Center cautioned that drag-and-drop modalities in the tutorial could not be fully accessible (see Fig. 1); therefore, we created multiple-choice questions as alternative activities for the two drag-and-drop slides (see Fig. 2). To do so, we placed a link at the top of drag-and-drop slides to divert students to a screen-reader accessible version. After completing the exercise the student is automatically led back into the standard flow of the tutorial.

Collaborative authoring in Articulate Storyline 360

Members of the team had varying levels of knowledge and skill in using the *Articulate* software; therefore, learning to use it was a key aspect of the tutorial development process. Also, using the templates available in *Articulate* and a color palette based on the University Library's Strategic Plan design was the best way to create a uniform design for all of the modules.

Developing the tutorial modules

Development of the modules for the *Library Research Tutorial* began with brainstorming sessions that included (a) reviewing other published tutorials that reflected our goals and intentions for the project, (b) identifying the learning outcomes, and (c) drafting preliminary outlines of each module. The team obtained permission from librarian colleagues at California State University, Dominguez Hills to use outcomes from CSUDH's information literacy program for the Cal State LA project (California State University, Dominguez Hills, University Library, n.d.). The final set of outcomes developed for the Cal State LA tutorial are shown in Table 1 in the introduction section of this paper.

Conceptual frameworks: backward design and understandings

We employed backward design (Wiggins & McTighe, 2005) to develop each module, starting first with articulating the learning outcomes. We then designed the instructional content such as definitions and explanations of concepts and activities such as matching, drag-and-drop sorting, fill-in-the-blank, and quiz questions that would produce evidence of achieving the outcomes.

We also used a predictable understandings and misunderstandings framework to develop the instructional content (Wiggins & McTighe, 2005). This approach was useful in considering concepts that students might interpret correctly or incorrectly and allowed us to write content with better clarity and anticipate areas where students might have success or difficulty.

Examples of predictable understandings which were developed based on the tutorial learning outcomes included:

- Understanding an assignment.
- The best research topics are those that engage the researcher's curiosity.
- The difference between a topic and a research question.
- Research questions should be of a manageable scope (e.g., not too broad, not too narrow).
- Understanding when a question requires original research or a literature review.
- Breaking a complex question into researchable elements.

Examples of predictable misunderstandings included:

- Not understanding the assignment.
- Difficulty thinking of narrow or broader questions.
- Not knowing enough about a topic to develop a narrower question.
- Adding too many subtopics to a research question.
- The knowledge or skills that students will have at the end of the tutorial.
- The ability to look for specifics in an assignment prompt, such as length, purpose, sources needed, and style required.
- The ability to translate assignment specifications into a research question.
- The ability to recognize, adapt, and articulate interests as they relate to the assignment.
- The ability to narrow or broaden a research topic.

Unfortunately, limitations on the ability to view student answers to quiz questions in *Articulate* tutorials hosted in Canvas were an obstacle to observing students' understanding of concepts in the modules. This constraint will be discussed more fully in the assessment section below.

Fig. 1. Drag-and-drop workflow.

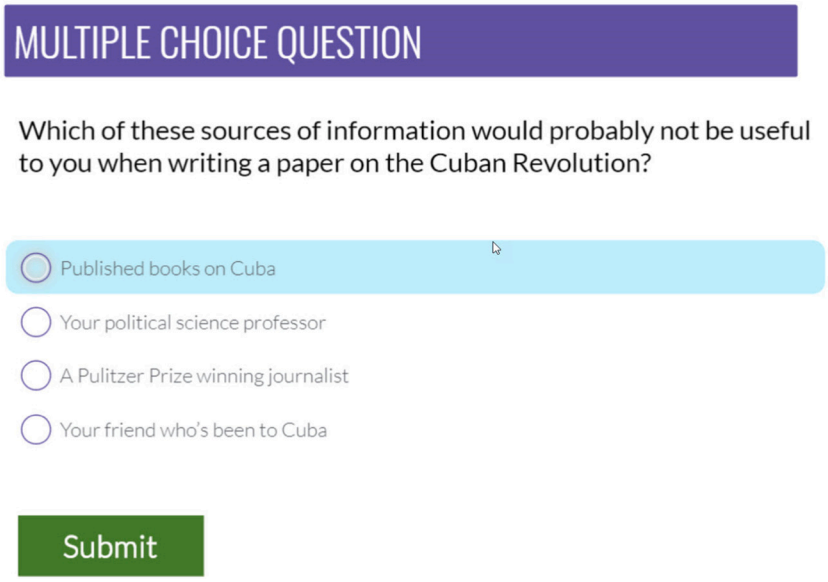

Fig. 2. Alternative multiple-choice workflow.

Writing the modules

Writing and developing each module was an iterative process. The team wrote, revised, and reviewed each module several times before deciding on final drafts. To outline each frame/slide, narration, on-screen action, and accompanying visuals, we used a scriptwriting process that the Education Librarian learned in an American Library Association online tutorial e-course (American Library Association, 2017; see also Rempel & Slebodnik, 2015). Monthly writing and discussion meetings of the project team kept the project on track to achieve the goal of going live in fall 2019.

All members of the project team contributed content for module 1, *Welcome to the Library* while working closely with the University Library's Communications and Events Coordinator who provided drafts of audio (including music) and video options. The main goal of module 1 was to engage the user visually and intellectually. We divided the writing for the remaining five modules among the team based on interests and expertise. The modules were written so that instructors can assign the entire tutorial or just the modules of interest. Based on best practice recommendations in the literature about tutorial design, each module is 10 min or less. A 10-item quiz created in the Canvas LMS is presented after module 6. Each module is briefly described below with images of selected scenes in Figs. 3 through 7.

- Module 1: *Welcome to the Library*: A student-narrated video to introduce students to the library. Scenes set to a music track show students studying alone and in groups in the library and interacting with library services such as checking out books and receiving research help from librarians (California State University, Los Angeles, University Library, 2019).
- Module 2: *Asking Questions*: In this module, students learn how to decide on a research topic, how to develop a research question based on a topic, and how to refine a question by identifying whether it is too broad, too narrow, or just right.
- Module 3: *Who Can You Trust*?: This module guides students in identifying the kinds of information needed to answer a research question, such as where the information might be found and how to evaluate the trustworthiness and relevance of information.
- Module 4: *Putting the Search into Research*: Students learn how to select and search a database such as Google or the library's discovery system based on an information need. They also practice developing appropriate search terms and combining them with AND, OR, and NOT connectors.
- Module 5: *#GiveCredit*: Students learn to recognize the intellectual property of creators; how, why, and when to cite and give

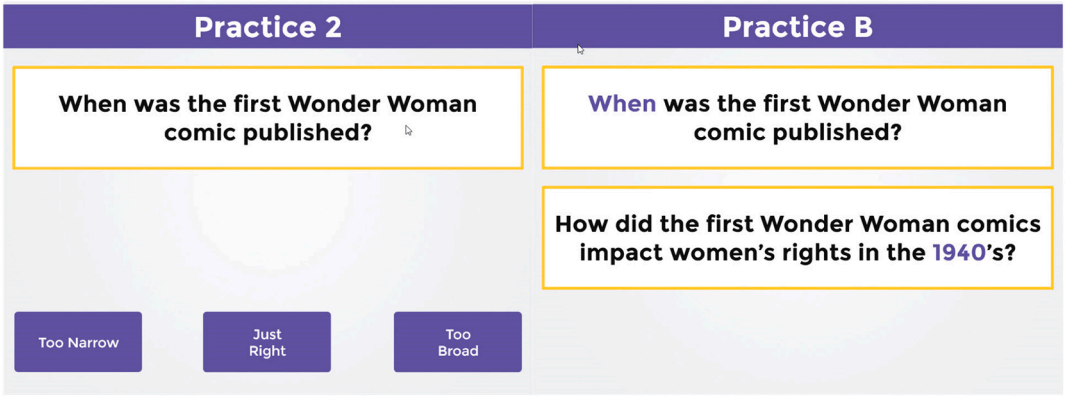

Fig. 3. Exercise on narrowing and broadening a research question (module 2).

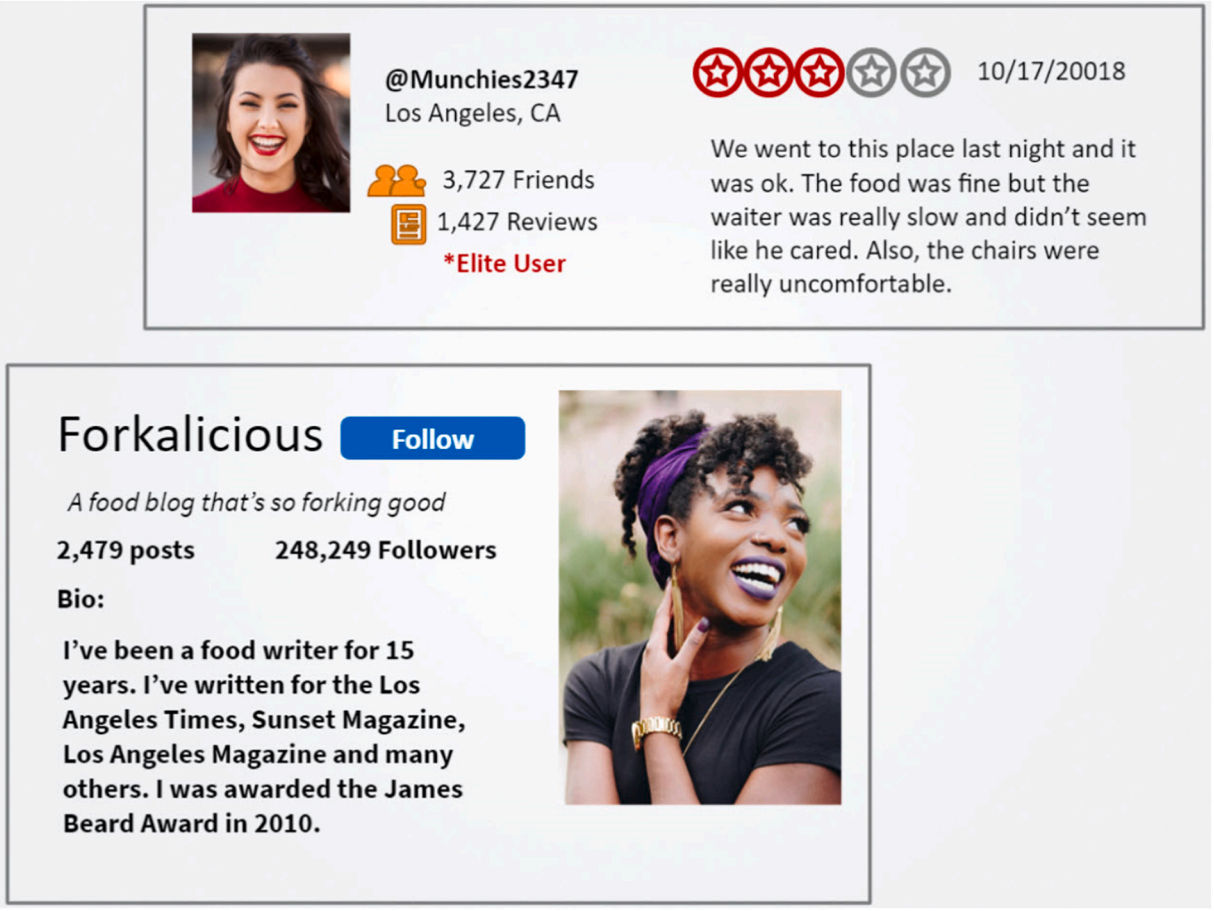

Fig. 4. Hypothetical examples of a social media food review and professional food writing site (module 3).

Fig. 5. Exploration of the use of the Boolean 'OR' operator (module 4).

attribution; and identify the parts of a citation. They also learn that citation styles vary by discipline.

- Module 6: *Bringing it All Together*: Students learn about their roles as creators, users, and disseminators of information and knowledge. They are introduced to scholarly communication as a process that begins in their courses and can extend beyond the classroom into venues such as conferences or scholarly publications.

Usability testing: recruitment, participation, and data

After completing the first draft of the six tutorial modules in spring 2019, we began recruiting first- and second-year undergraduates to participate in usability testing in summer 2019. Flyers were placed in high-traffic areas on campus to invite students to join in 60 min of usability testing for a $20 gift card to the campus bookstore. The initial goal was to conduct usability testing with ten students. However, because of administrative delays in the project timeline only four students could be recruited to participate during the summer and early fall

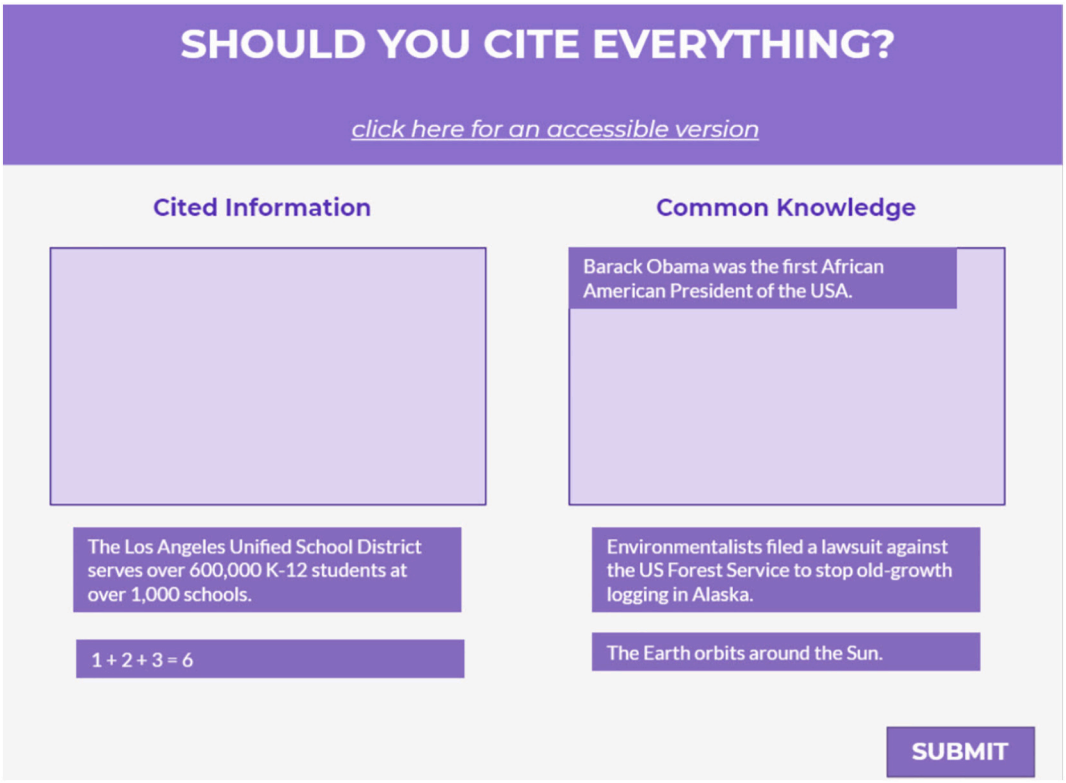

Fig. 6. Sorting information according to whether it needs to be cited (module 5).

Fig. 7. Activities that involve students as creators of information (module 6).

months.

Two librarians, the project lead and the Science Librarian, conducted the usability testing. One took notes and the other asked guiding questions while the student navigated the tutorial. Each testing session was recorded with *Camtasia*. At the beginning of each testing session, instructions were read to the student and they were asked to log in to Canvas via a self-enroll link. The first student quickly recognized that the self-enroll link did not work. We discovered that this was a problem related to Chrome browsers; therefore, we added an instruction on the tutorial launch page to use Firefox. All student testers identified technology-related issues such as broken links, bad audio, or incorrect playback timelines. Also, students noted several style inconsistencies between modules such as the types of *next* and *back* navigation buttons, the ability to adjust the timeline, and the location of the menu.

Subjective opinions related to the content were also uncovered during usability testing. For example, in module 2, *Asking Questions*, a picture of a science march protester is included in an example of how to create a research question from a topic of interest. One participant noted that they did not understand the picture, and another said they liked the example. Students also occasionally gave somewhat contradictory responses. For example, Participant 2 frequently commented that they were learning new information in the tutorial, but also stated that some information might be too difficult for first-year students. Given that all student testers were first- or second-year undergraduates, it is interesting that they found the information helpful but were concerned it was too much for first-year students.

Screen recordings, audio, and written feedback from the tests were used by all team members to make revisions to the modules where needed. Technological issues were typically corrected immediately after each usability test. Content issues were usually updated following the first three tests. No changes were made after the fourth test because it was conducted after the tutorial was published in Canvas.

Putting the tutorial into practice

The *Library Research Tutorial* was developed with the approval of the librarians who developed the 2015 tutorial. However, questions remained about its adoption by faculty and the transition from old to new. Thus, all library faculty were invited to view the *Library Research Tutorial* and attend a meeting to discuss the transition. After discussing the potential impacts of the redesign on instructors of record and library faculty, the library faculty agreed to maintain access to the old tutorial for the first semester and phase it out afterward. This strategy allowed instructors of record and library faculty time to adjust their teaching plans if needed. It also served as a backup in case unforeseen issues arose with using the new *Library Research Tutorial*. The Education Librarian drafted a boilerplate email about the new tutorial for all teaching

librarians to edit as desired and send to the IHE instructors with whom they would be working. The email also included a one-page flyer created by the project lead describing the reasons for the tutorial redesign and an overview of the tutorial learning outcomes.

Overall, roughly 3123 students enrolled in IHE classes in fall 2019. Just over 53% (1821) of them enrolled in the *Library Research Tutorial* and 52% (1626) completed the final quiz. Based on courses with a high degree of enrollment in the tutorial, we determined that instructors assigned the tutorial in 63 of the 109 course sections. Adoption rates were minimally impacted by the continued use of the 2015 tutorial given that only 203 students completed that version. Courses in the liaison areas of the tutorial project team members and in health sciences IHE courses had the highest adoption rates. Lower use of the tutorial in other courses might be attributed to the instructional preferences and practices of library faculty or instructors of record. Our data on tutorial adoption indicates a need for greater collaboration among library faculty to increase the use of the *Library Research Tutorial*.

Assessment and student learning

Currently, it is not possible to view students' responses to individual quiz questions or activities in *Articulate Storyline 360* tutorials housed in Canvas. For example, in module 2, *Asking Questions*, students create a research question and revise the question if they identify it as too broad or too narrow. In *Articulate*, it is not possible to view the original or revised question. Unfortunately, this means that it is not possible to assess how students understand concepts within a module. This limitation seems to be due to a recent change in *Articulate Storyline 360* because previous SCORM 2004 and Tin Can API publishing options allowed users to see a multitude of data points within modules (Articulate, 2017).

Despite this limitation, overall module scores for all graded activities and quizzes can be passed from *Articulate* into Canvas as a number (8/10), percentage (20%), or complete/incomplete score. While the numbers and percentage show slightly more information, it would be difficult to assess what students are learning without knowing how they perform on individual questions. For example, it would not be possible to determine whether there were questions that all participants answered wrong. For the above reasons, we chose to use complete/incomplete scoring to determine students' performance. The option shows whether students completed the module, but it does not penalize them if they didn't understand something on the first attempt.

Given the limitations in collecting data from the tutorial modules in *Articulate*, we created a final ten-question quiz using the Canvas quiz tool to assess student learning. We created two questions each for modules 2 through 6 to address each module's learning outcomes. For example, a learning outcome for module 3, *Who Can You Trust*? is that students will identify authoritative information sources based on a specific information need. Thus, one of the questions included in the final quiz was, "Which of these is NOT an indication of expertise?"

Overall, students performed well on the final quiz, with an average score of 8.26 out of 10 across the 1626 students who completed the quiz during the fall 2019 semester. Students were not as successful (56.59% answered incorrectly) on a Boolean operators question in module 4 about expanding a search. The question will be revised for future semesters and the project team will review module 4 to improve students' understanding of Boolean searching. Notably, most students correctly answered the questions "What does NOT need to be cited" and "Examples of sources that Cal State LA student scholars can use to find information about a research topic include…" and they scored at 97.16% and 97.10% respectively.

Recommendations to tutorial creators

Throughout the tutorial creation process the project team gained valuable insights that might assist other creators with their work. Most notable are the following:

Allow extra time

Nearly every step of the project took longer than expected, and delays impacted our ability to proceed to the next steps. Working within institutional protocols, learning new software, and troubleshooting required extra time. A little padding in the timeline is advisable. It is particularly beneficial for scheduling student usability testing. Also, when developing a tutorial for the new school year or term, creators should plan to complete the work by the end of the previous year or term.

Understand technology constraints

Articulate Storyline 360 provides the ability to create professional-level tutorials and to integrate them into an LMS. Yet, there were challenges and constraints that we did not fully anticipate or understand before starting the project. Moreover, although *Articulate* integrates into Canvas, it only reports an overall quiz score. It does not report the specific questions that students answered correctly or incorrectly or any text they input.

Audio, display, and LMS limitations are also important to mention. For example, it was difficult to achieve optimal volume levels during tutorial production. A good microphone can go a long way toward solving this problem. It is possible to view the *Library Research Tutorial* on a smartphone, but in some browsers the audio is disabled when the tutorial is viewed on a smartphone.

We chose to store the tutorial in the Canvas LMS due to its ability to host *Articulate Storyline 360* SCORM files and its data tracking capabilities. However, hosting in an LMS means that the tutorial cannot be easily shared with others outside of the Cal State LA community. In addition, although an unlimited number of students can be enrolled in a course in Canvas, the built-in data visualizations are unavailable for quizzes with more than 100 questions or more than 1000 attempts (Canvas, n.d.). Fortunately, data can be exported from Canvas into Microsoft Excel to create visualizations. Lastly, updates to the tutorial should not be performed until after the end of the academic term or the desired period of tutorial administration. Updating the modules after the beginning of an academic term could reset quiz grades and alter the modules' locking mechanisms.

Know the rules and regulations of your institution

As previously discussed, it was a challenge to pay student usability testers and student workers at a state university. Allowing time to learn about institutional policies for financial incentives and to build relationships with the campus community is critical for planning procedures that involve students.

It is also important to understand photography policies in order to advise students accordingly. Cal State LA's photo waiver contains a statement noting that images can be used in any manner without notification. However, it was not clear to the project team that images would be used outside of the stated project and made available via a university file system for easy use by the campus community. Because this was not clear to the project team and thus not explained when recruiting student workers, students were concerned when they saw their photos used in other ways. The misunderstanding was resolved by requesting that the photographer limit the use of the images to library purposes only. This experience confirmed the importance of awareness of institutional practices related to using images so that students are properly informed.

Conclusion

Applying the predictable understandings and misunderstandings framework (Wiggins & McTighe, 2005) made it possible to write content

based on how we might expect students to respond to the concepts presented in the modules. However, given the previously noted limitation of viewing question responses in *Articulate* modules, for future updates to the tutorial, we will re-evaluate how well the functionality of the software supports this framework.

As stated previously, one of the goals for the 2019 *Library Research Tutorial* was to promote a flipped classroom model of instruction for the IHE courses. During the fall 2019 semester, approximately 50% of the IHE courses completed the tutorials. At the mid-semester mark, the completion rate for the fall 2020 semester appears to be similar. We were hopeful that there would be an increase in the completion rate in fall 2020 but it is unclear at this time why it remains stagnant. We intend to review multiple factors such as marketing, integration with the overall IL program, and the transition to online teaching modalities precipitated by the COVID-19 pandemic. At the time of the tutorial launch in 2019, there were no specific University Library guidelines for content that librarians should include in face-to-face IL instruction sessions. However, with the arrival of a new instructional services coordinator to the University Library in 2020, the library faculty are developing a more cohesive and defined asynchronous and synchronous IHE curriculum informed by the ACRL *Framework*.

Given the time constraints that impacted the recruitment of student participants in the usability testing, we were unable to receive feedback from more than just a few students. Nevertheless, the feedback was invaluable for editing the design and content of the modules. This underscores the critical role of usability testing in tutorial development and that this step should not be skipped if at all possible. In addition, it is essential to consider equity, diversity, and inclusion in the design of digital learning objects to account for the diversity in students' learning experiences. For example, although the University's Center for Teaching and Learning provided helpful guidance regarding accessibility, future usability testing should also include the voices of students with disabilities. Future testing should also include the voices of students who are impacted by the digital divide. To be sure, the COVID-19 crisis has further illuminated disparities that impact student learning in online environments (Auxier & Anderson, 2020; Lederman, 2020). Future revisions to the current *Library Research Tutorial* or the design of new DLOs in the University Library will explore other conceptual frameworks that more specifically address equity in teaching and learning.

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CRediT authorship contribution statement

Kimberly Y. Franklin: Project administration, Methodology, Investigation, Writing – original draft, Writing – review & editing. **Kendall Faulkner:** Conceptualization, Project administration, Funding acquisition, Methodology, Investigation, Writing – original draft, Writing – review & editing. **Tiffanie Ford-Baxter:** Methodology, Investigation, Writing – original draft, Writing – review & editing. **Sheree Fu:** Methodology, Investigation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

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Appendix A. Tutorial development timeline

Planning	
Spring 2018	Pre-research
	• Define the purpose and need for tutorial • Talk with stakeholders to understand their needs and implementation • Define learning outcomes (LOs) • Choose format and delivery methods
Summer 2018	• Call for project team members • Write and submit internal University Library Innovation Grant
Fall 2018	• Review learning outcomes and develop outlines for each module • Write scripts; meet to review and revise drafts
Implementation	
Spring 2019	• Purchase software and hardware • Submit plans to the IRB for usability testing • Delays related to student incentives and acting/modeling wages • Re-submit IRB documents with updated forms for student payment • Develop modules in *Articulate Storyline*, meet with team to review and refine • Work with communications and events coordinator to develop video • Photoshoot with University photographer and student models • Record audio with student workers • Funding expenditure deadline: end of April
Summer 2019	• Usability testing with students • Revise modules based on feedback • Develop tutorial shell in Canvas and troubleshoot issues • Develop and post instructions for enrolling in and using the tutorial • Meet with library faculty to discuss the transition and marketing
Maintenance	
Fall 2019	• *Library Research Tutorial* goes live • Monitor help requests • Regularly download reports and statistics of usage • Continue usability testing

(*continued on next page*)

(*continued*)

Ongoing	• Assess learning outcomes • Make adjustments over semester break periods • Monitor help requests • Regularly download reports and statistics

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