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Flipped Instruction for Information Literacy: Five Instructional Cases of Academic Librarians

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Abstract

University of California, Berkeley librarians have incorporated the flipped instruction model into information literacy training by focusing on two primary elements: assigning pre-class assignments and increasing active learning techniques. We explore these two elements across five diverse instructional cases, which include one-shot and semester-long classes that were conducted through online or in-person delivery for both graduate and undergraduate students across a range of subject areas (sciences, social sciences, and humanities). We examine the enabling factors and the perceived outcomes of this instructional paradigm. Because students came to class with enhanced library understanding and experience from the pre-class assignment, they were better prepared to engage with the material and articulate additional learning needs. We note students' increased engagement during class and more time available for higher-order learning exercises and discussions. As a result, flipped instruction appears to enable more learning opportunities without increasing classroom time. The challenges of this model are the requisite commitment of time and effort, the need to foster class participation, and the facilitation of active communication within the class. We propose a framework of catalysts, building blocks, and instructional outcomes to help library instructors incorporate flipped instruction elements into their instructional design.

Keywords

Flipped instruction; Information literacy; Library instruction; Instructional design; Academic libraries; Active learning

Introduction

Flipped instruction, also known as the flipped classroom, inverts the traditional classroom pedagogy of content acquisition and application by using class time to clarify questions rather than deliver new material. In this model, “students gain the necessary knowledge before class, and instructors guide students to actively clarify and apply that knowledge during class” (Center for Teaching and Learning — UT Austin, 2015). Proponents of flipped instruction often emphasize the potential for deeper engagement with content during class (Strayer, 2012). Additional benefits of the flipped instruction model may include improved student–teacher interaction, opportunities for real-time feedback, active student participation and engagement, self-paced learning according to students' needs, deeper understanding, and more meaningful assignments and activities (Center for Teaching and Learning - UT Austin, 2015 and Goodwin and Miller, 2013).

In the flipped instruction model, traditional lecture content is delivered through student self-instruction before class. This may take the form of readings, online videos and tutorials, hands-on exercises, and other assignments. Class time is then devoted to engaging in learning exercises, intensive practice opportunities, and learning assessment. This is counter to traditional academic pedagogy where students are first introduced to new concepts in the classroom and are responsible for completing individual homework assignments for practice and application after class.

While flipped instruction is popular and well documented in the literature, it is still considered an emerging approach that has yet to be fully proven effective. Goodwin and Miller (2013), for example, characterize flipped instruction as a growing practice with little research on how well it works. Abeysekera and Dawson (2015) agree that the approach is “under-evaluated, under-theorised, and under-researched in general” (p. 2) with little consistency in definition and practice. However, a handful of studies suggest the efficacy of flipped instruction. Findings show that students may become more open to cooperative learning and innovative teaching methods (Strayer, 2012), and that students believe the flipped classroom provided an engaging learning experience that helped them absorb the content with an increased self-efficacy for independent learning (Enfield, 2013). Additionally, in a quasi-experimental study, Touchton (2015) found statistically significant advantages to the flipped classroom including higher grades, greater student interest in the subject, and student perceptions of learning increasing or “as more relevant” relative to traditional classes. Despite the small empirical base, Abeysekera and Dawson (2015) argue that the case for flipped instruction is supported by evidence in related areas of research on active learning, self-paced learning, and issues related to cognitive load and motivation.

Anecdotally, librarians frequently encounter barriers to implementing flipped instruction. Many do not have the time or authority to assign formal and graded assignments nor do they engage with a class over a semester for intensive learning activities. It can be challenging to motivate faculty and students to engage in this intensive instructional approach for a one-shot library session.

How then might academic librarians realize the opportunities and benefits of flipped instruction within the constraints of limited time and authority? We suggest that librarians focus on two key elements of flipped instruction. The first is providing students with a self-directed assignment to be completed prior to the information literacy class. This contrasts with the usual self-contained structure of a library instruction session, which is bounded by the limits of an hour-long class. The assignment could include readings, online video clips, or self-directed technical exercises and problem sets. With some of the instructional content already learned through a pre-class assignment, librarians are then able to refocus class time for the second element: greater active learning in the classroom. Shifting away from passive lectures and demonstrations, librarians could engage students during class with intensive exercises for problem-solving and skills practice. There is also more time for observing student learning, providing discussion feedback, and tailoring the class to students' learning needs identified in the pre-class assignment.

These two elements match Abeysekera and Dawson's (2015) conceptual review of the flipped classroom approach. Ultimately, it is a "set of pedagogical approaches that (1) move most information-transmission teaching out of class, (2) use class time for learning activities that are active and social, and (3) require students to complete pre- and/or post-class activities to fully benefit from in-class work" (Abeysekera & Dawson, 2015, p. 3).

Library assignments and active learning techniques are not new to information literacy instruction. The value of the flipped instruction model, however, is that it ties these elements closely together and encourages more student self-instruction outside of the classroom balanced with more engaging and intensive learning activities during class. This expands the student's exposure to information literacy instruction; rather than a traditional one-shot library session, with the pre-assignment students receive a "double shot" of information literacy training.

This paper shares the ways that University of California, Berkeley librarians have incorporated these two key flipped instruction elements — a pre-class assignment and greater active learning in the classroom — into instructional practice. We describe our flipped instructional design and qualitatively explore their enabling factors and outcomes.

Background and literature review

This case study was conducted by the Library's Teaching and Learning Expertise Group at UC Berkeley. Expertise groups are our organization's professional learning communities; they are intended to encourage the sharing of questions and approaches across disciplines, to provide a core group for guiding the Library on big issues, to develop individuals' skill sets and increase awareness and expertise of the staff as a whole, to explore innovations in other environments, and to be a springboard for innovative and effective ways to align the Library to the University's mission. Members organize educational events, gather and analyze input from the library and campus, research hot topics, inform policies, and initiate new programs and services. They create opportunities for librarians and library staff to showcase our knowledge in support of the university's research and teaching mission.

During our initial investigation of flipped instruction, the Teaching and Learning Expertise Group reviewed the literature on its application in various library settings. The case studies on flipping in information literacy instruction revealed a pattern of a three-stage approach: (1) pre-session learning assignments to be performed individually by the student; (2) in-class activities; and (3) assessment and feedback. Each stage presents new opportunities and pitfalls over traditional active learning models, whether used in a one-shot library instruction session, in an embedded instruction arrangement, or in a semester-long librarian–instructor scenario.

Pre-session activities aim to introduce students to key issues and techniques through well designed, hands-on activities specific to the course or a class assignment. Integration of the assignment into the course management system, as modeled by librarians at Marquette University who developed a comprehensive digital learning object used in all first-year English classes, allowed instructors and librarians to track the completion of pre-session assignments by students as well as the correlation between the completion of pre-session assignments and success in learning activities and the course overall (Gibes & James, 2015). One of the greatest challenges to one-shot instruction sessions, as noted broadly, is simply getting pre-session materials to the students; developing collaborative relationships between course instructors and librarians for flipped classes may also extend the opportunities for dialog with students (Arnold-Garza, 2014a and Datig and Ruswick, 2013). With faculty buy-in, integrating a combination of learning objects (including video and text-based resources) better accommodates students' varied learning needs and preferences. Because students are not able to get immediate answers to questions as they could in the traditional lecture environment, designing a way to capture students' questions for in-class discussion is important (Datig & Ruswick, 2013).

In the flipped model, the actual in-class session is generally devoted to a variety of group-based activities including guided discussions, student-led demonstrations and evaluation of resources,

timed search competitions, peer-led instruction, and unstructured work time. In all of the above scenarios, librarians have embraced the “guide on the side” model over the traditional “sage on the stage” approach, providing feedback and answering questions during the student-led activities.

Case studies emphasize the value of feedback and assessment, while acknowledging this as a challenging task. Sample sizes in many individual courses are too small to draw meaningful conclusions; also, students' anecdotal feelings of improved performance often do not translate to improved grades (Arnold-Garza, 2014b), and even in studies that claim improved performance tied to flipped instruction, it is difficult to identify causality (McCue, 2014). It would be beneficial to conduct extended assessment over the life of a course. Whether or not the flipped model for information literacy instruction is efficacious may be evident as instructors grade research assignments and papers throughout the course and see the application of concepts and techniques covered in earlier class sessions (Datig & Ruswick, 2013).

In addition to the general literature about flipped instruction, it is illuminating to read case studies addressing the application of flipped instruction techniques in subject-specific information literacy contexts. Articles surveyed included reports of flipped instruction for engineering (Maddison, Beneteau, & Sokoloski, 2014), data management (L. Johnston & Jeffryes, 2014), science laboratories (Gregory, 2013), and legal research courses for international graduate law (LL.M.) students (Lemmer, 2013). Not surprisingly, many of the goals, methods, and outcomes of subject-specific flipped instruction are similar to those found generally: increased student engagement, active learning, technology-mediated delivery of instructional materials for self-study combined with in-class collaborative learning activities emphasizing hands-on application, and positive feedback from participants. An additional benefit of the flipped classroom experience includes strong partnerships with faculty to collaboratively develop the specialized content for classes (Maddison et al., 2014).

Flipped library instruction can create logistical challenges for high-enrollment courses because it may be difficult to schedule sufficient instructional sessions with the librarian. Solutions included training teaching assistants to lead some of the hands-on sessions, or organizing a number of hands-on information literacy instruction workshops with the librarian outside of regular class or lab time (Gregory, 2013).

Most of the subject-specific case studies we surveyed described a one-shot information literacy instruction experience, where the pre-delivered materials (readings, prerecorded lectures, etc.) and the in-class hands-on sessions take place once towards the beginning of the term. A notable exception to this was the implementation of a flipped classroom for a legal research course geared to LL.M. students, where a one-credit legal research course is a requirement of

the program, is taught entirely by the librarian, and meets fourteen times during the semester. The author found the flipped classroom model to be ideal for this type of learning environment “as it provides students with the opportunity to work in teams and apply knowledge to challenging research hypotheticals in a directed and guided environment” (Lemmer, 2013, p. 463).

Methods

Case study research design

Our literature review showed the potential to embrace flipped instruction for information literacy training, particularly pre-class assignments and increased active learning techniques. Therefore, our study investigated the question: how do academic librarians apply flipped instruction to information literacy instruction? Our focus was identifying pedagogical tools and methods that facilitate flipped instruction at a large academic library that faces widely varying instructional settings and disciplinary fields.

Our research is a case study with a multi-case design. Case study research is the qualitative “study of a case within a real-life, contemporary context or setting” (Creswell, 2013, p. 97). Yin (2014) has written a comprehensive text on this methodology. He defines a case as a bounded system that may include an individual person, small groups, organizations, communities, events, programs, projects, partnerships, and other units of analysis that are bounded by temporal, spatial, organizational, functional, and other limits. Yin notes how data collection draws on multiple sources of information — including documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts — with triangulation of the collected evidence. Analysis draws on techniques such as pattern matching, explanation building, time-series analysis, logic models, and cross-case synthesis. Outcomes of the analysis include a case description and a report on themes, which provide an in-depth understanding of the issues under study (Creswell, 2013). Case study research has been used in library and information science research (Haglund and Olsson, 2008 and Radford and Kern, 2006), including investigations in information literacy (Johnston and Webber, 2003 and Larkin and Pines, 2005).

Case study methodology is suited to the in-depth understanding of a single case or the comparison of several cases to show different perspectives (Creswell, 2013). Additionally, Yin (2014) emphasizes the “holistic and real-world perspective” (p. 4) of this methodology as well as its distinct advantage for research situations when a “how or why question is being asked about a contemporary set of events” (p. 14). These methodological attributes suited our pragmatic goal of understanding the pedagogical tools and methods that help academic librarians adopt the flipped instruction paradigm. Furthermore, in our exploration of multiple

instructional cases, we aimed to address the range of instructional scenarios faced by academic librarians.

Selection of cases

We studied a variety of instructional cases from UC Berkeley academic librarians who have taught information literacy classes with flipped instruction methods. The cases were selected to be representative of the range of instructional conditions facing academic librarians. Table 1 describes the duration of instruction, audience, subject area, and instructional delivery techniques of our cases.

Table 1. Cases of UC Berkeley librarians' flipped instruction experience.

Case	Duration of Instruction	Audience	Subject Area	Instructional Delivery
1	One-shot	Undergraduate	City Planning and Public Health	Guest lecture
2	One-shot	Graduate	Public Health	Orientation seminar
3	Semester-long	Graduate	East Asian Studies and History	Embedded librarianship
4	Semester-long	Graduate	Library and Information Science	Real-time online course
5	One-shot with optional drop-in sessions	Undergraduate	Biology	Hybrid online and in-person sessions

Data collection and analysis

The first source of evidence was transcripts of in-person, semi-structured interviews of the librarian instructor for each case. The interviews were conducted by the lead researcher and audio-recorded. Questions addressed the context of each instructional scenario, pedagogical needs and challenges, instructional goals and design, conduct of the pre-class assignments and in-class activities, as well as instructional outcomes perceived by the librarian instructor. Another key evidence source was the lead researcher's field notes from the direct observation of the Case 1 instructional session. Finally, available documents including copies of pre-class assignments, instructional plans, course syllabi, as well as course and session evaluations were collected for review.

The qualitative analysis was conducted through reflective descriptions of the instructional cases with a focus on the pre-class assignments and the in-class activities. Through pattern identification and analysis of cross-case themes, we identified enabling factors, challenges, and class outcomes common to the flipped instruction cases. For validation of the analyses, draft case reports were shared with the librarian instructors of all cases (who are co-authors of this paper) for review and correction.

Case 1: one-shot instruction for large interdisciplinary undergraduate classes

David Eifler, Berkeley's Environmental Design Librarian, teaches information literacy sessions to an introductory City and Regional Planning class and a Public Health class on environmental health and development. Both are large undergraduate classes with more than 100 students. The objective of the library trainings is to help students write a 10–20 page research paper, and classes had previously been conducted as 80-minute one-shot sessions.

From past experience, David saw two instructional challenges. First, in these interdisciplinary courses, the enrolled students come from various disciplines without comparable levels of subject expertise, information resource awareness, or library research experience. Furthermore, the papers span a wide range of topics and research methods including historical research, qualitative and quantitative data analysis, and applied design. Students need to utilize numerous information sources from newspaper and journal articles to data sets and maps.

A second challenge is motivation; students do not always see a clear connection between library services and their research assignment and are often unaware of the role the library can play in supporting their research. Consequently, active participation in the library training class can be limited, so it is important to communicate the efficacy of library training via the course assignment and motivate students' stake in information literacy.

Pre-class assignments addressed both of these challenges. Dubbed a “pre-assignment,” students completed exercise worksheets that mimicked the library research workflow for the term paper. The pre-assignment allowed students to gain experience with question articulation, keyword identification, catalog and database searching, evaluation of results, and off-campus access to electronic resources. The completed worksheets also served as a working guide to help students develop their research papers.

Through this preliminary exercise students explored the context and need for the library training to make the library session seem less abstract. It was hoped that students would recognize the sophistication of resources and the challenges in finding relevant literature, and in discovering gaps in their research skills, they would also come to class prepared with

questions. The pre-assignment was also intended to provide a baseline level of training, especially important for interdisciplinary classes whose students have widely varying levels of research expertise.

Grading the pre-assignment would ensure that students complete the activity. However, librarians and course instructors do not necessarily have the resources to evaluate student responses and provide written feedback on the assignment. As a compromise, the course instructor for the Public Health class assigned a participation grade to motivate library pre-assignment completion. If the library assignment is submitted and complete, students receive participation credit towards their final grade. The City Planning instructor made submission of the library pre-assignment an element of a larger graded assignment to identify a paper topic.

The in-person classes begin with a simple assessment of student learning. The instructor surveyed the class using a show of hands on pre-assignment completion and comprehension. Using the assignment as a guide, David asked the class to volunteer resources and databases they found helpful and valuable, as well as those that were not. This typically begins a discussion about the exercises and serves as a warm-up for a more interactive, participatory session. Discussions focus on what students found easy, difficulties they had, and what types of resources they wanted to learn more about. This served as an informal assessment and helped the librarian tailor the class to students' identified needs.

For the in-class activity, students worked in small teams to complete exercise worksheets evaluating 15 databases including indices, government websites, newspaper indices, and demographic data sources that might be useful in their research. Each team of three to four students was assigned a different database. Afterwards, the teams each gave quick two-minute report-backs to the class summarizing the database explored, the value of its content, and tips for using it. This approach allowed the instructor to emphasize advanced information literacy skills and tools that students may have missed, such as advanced filters, database visualization features, and critical evaluation of content. This activity also helped the class to explore a wide range of resources for their interdisciplinary research and to explore the landscape of disciplinary resources and resource formats. Peer instruction made for a more engaging class and because basic library mechanics were covered in the pre-class assignment, there was more time for questions on research literature organization, time management, and writing skills.

Observations

Faculty support is a critical enabling factor. By formalizing the pre-class assignment in the syllabus and assigning participation credit, faculty can increase student engagement and exercise completion. David won this faculty support by sharing a pre-assignment draft as a proposal. He explained how the exercise could grant more exposure to library training and resources, and hopefully improve students' thoughtful use of the research literature.

From post-class evaluations, students reported satisfaction with the pre-class assignment and the flipped instruction approach. Key benefits cited were the ability to spend as much time as necessary on the pre-assignment and a more active class.

Case 2: one-shot graduate orientation seminar

Michael Sholinbeck, Instruction and Outreach Librarian at the Public Health Library, provides library orientation seminars for incoming Doctor of Public Health (DrPH) students. These are 60- to 90-minute sessions with approximately twelve students. Because most students have past graduate experience, Michael often finds that they are experienced library researchers. An advanced audience provides an opportunity for more sophisticated instructional content and to move beyond “point-and-click” demonstrations of the mechanics of catalog and database searches. By discussing advanced information literacy issues, librarians showcase our role in helping scholars evaluate, synthesize, and contextualize research information — complex tasks that move beyond simple information retrieval. However, it is important to test the assumption of doctoral students' library research skills before conducting an advanced information literacy seminar.

A pre-class assignment with tutorial worksheets on keyword identification, Boolean logic, search filters, and controlled vocabulary searching in PubMed gauged the doctoral students' skills. Written with stepwise directions and tested by library student assistants for clarity, these worksheets were designed in such a way that they could be completed by students with little database searching experience. At the beginning of the in-person seminar, Michael assessed the students' learning through a question-and-answer period to uncover any difficulties and challenges encountered in the exercise.

This beginning of the class review helped Michael assess baseline knowledge and skill level. If students voiced challenges and difficulties with the assignment, Michael could tailor the seminar on-the-fly to meet students' needs, perhaps shifting focus to core library skills rather than advanced information literacy topics. If students experienced few challenges with the exercise, Michael could feel confident to move on to higher-order instruction.

Observations

With much of the library mechanics covered in the pre-class assignment, the seminar could be discussion-driven and centered on higher order issues. Typically, this seminar explores critical evaluation of the literature, publication bias and ethics, the peer-review process, advanced disciplinary resources, different disciplinary perspectives, citation impact analysis, controlled vocabulary, as well as the organization of research papers. Discussion of these advanced topics demonstrates librarians' expertise in research support and contributes to relationship-building for future consultations. Furthermore, during the seminar, Michael gave students more

worksheets for additional library databases to encourage further self-instruction and engagement with library sources.

There were a number of positive instructional outcomes. By the librarian's evaluation, the reduction in lectures and demonstrations contributed to a more leisurely and flexible pace in class. Rather than rushing through instructional content, there was more time for open-ended dialog and opportunities to ask students to share their thoughts. Michael found this a more enjoyable teaching experience primarily because he no longer feared being “derailed by questions.” And this flexible atmosphere may communicate a more approachable persona of the librarian — happy to assist and open to discussion. This could improve the affective experience of students with information literacy instruction (Thacker, 2012 and Vidmar, 1998). From the students' perspective, they responded positively to the pre-class assignment, reporting that the exercise served as a working protocol for future database searching.

Case 3: an embedded librarian for a graduate research seminar

For two semesters, Jianye He, the Librarian for Chinese Collections, served as an embedded librarian for a graduate research seminar taught collaboratively by faculty through the East Asian Studies and History departments. Approximately 20 graduate students met weekly for three-hour seminars at the library. The course surveyed research sources for Chinese literary studies and advanced research methods in Chinese history and literature.

As an embedded librarian, Jianye contributed to assignment design and instruction with assistance from Bruce Williams, the Reference Services Coordinator at the East Asian Library. She prepared bibliographies for the weekly reading list and selected key resources to review in class. Additionally, she participated in seminar discussions to facilitate information literacy learning at an advanced graduate level. A challenge for the librarian in an embedded setting is preparing and contributing to the seminar discussions, particularly as graduate students may have sophisticated questions about niche and advanced research topics in Chinese bibliography and Sinology.

To prepare for the seminar discussions, students completed intensive pre-class assignments. They conducted research tasks or solved research problems using an information source or tool. For instance, students ran comprehensive searches for literature on a particular topic and evaluated bibliographies and sources for their value. The pre-class assignments included a reflective and evaluative component. Students wrote 3–5 page reflective reports that were then posted to the online course management system. They also detailed their search procedures and results, noting any challenges encountered as well as their resolution, and identified resources that were not in the course reading list. This exercise captured students'

learning experiences, needs, and goals. All instructors and fellow students reviewed these reports before the start of class.

By reading these reports before class, instructors obtained an in-depth understanding of students' learning needs and could prepare for targeted discussion in response to each student's articulated needs. This also created an opportunity for students to express interest in more advanced issues, prompting the librarian to revise the bibliography or add learning content. Such opportunities to understand and prepare for student learning needs are critical for the librarian's active participation in an advanced graduate research seminar.

During the weekly seminar, class began with a discussion of the pre-class assignment. For a full hour, students discussed what they learned from the exercise, focusing on challenges experienced and their solutions. Jianye valued the opportunity to hear about their information literacy experiences as well as their creative solutions and insightful discoveries. If students reported a lot of difficulty or interest in a topic in their reflective essays, Jianye could respond in the first hour through a short presentation on the subject.

Observations

Course evaluations revealed that the majority of students enjoyed the class format because of their deep engagement with library sources and the student-driven learning. According to Jianye, the pre-class assignment fostered closer class engagement because of the thorough understanding of students' learning needs. Jianye also observed that her participation and preparation for the seminar made her an ally to students outside of the classroom as they felt comfortable asking her questions and meeting for reference consultations. Furthermore, as students discussed their experiences with research sources, Jianye better understood their library research behavior which led to enhanced collection development and library service.

Case 4: real-time online graduate course

Liladhar Pendse teaches the graduate Information Organization and Access course in the Department of Library and Information Studies at the University of North Carolina at Greensboro. It covers the organization of information, including cataloging and metadata. The class is delivered online for 2 hours per session in real time using the Blackboard Collaborate course management system. Approximately 25 students enroll in this online course when it is offered.

The study of cataloging and metadata entails the mastery of a detail-oriented and technical skill set, which can be challenging for students in light of the rapidly evolving landscape of information organization practice. Lectures focusing on the procedural steps for cataloging and metadata might not be ideal whereas learning through practice to resolve information organization problems is more effective. Problem-solving skill development also enables

students to adapt to professional changes in their future careers. Consequently, Liladhar focused class time on collaborative problem-solving exercises which offers greater student–instructor interaction and allows for guided exploration of information organization problems.

The pre-class assignment and class activity centered on problem sets and students submitted their assignments before class for instructor review. An example problem set is transliterating foreign language titles for MARC catalog records. During the class, which was run as a web conference, Liladhar began by reviewing the answers to the problem sets, sometimes asking volunteers to explain their solution which provides an opportunity for him to field student questions and give detailed explanations or technical demonstrations in response to student interests.

This review was followed by a collaborative problem-solving session in which Liladhar posed real-world information organization problems, similar to the questions in their pre-class assignment. The class then worked together to solve the problem, taking turns, under the facilitation of the instructor, to find a solution. In this manner, it brought the lively discussion and tutorial-style of office hours to the classroom. Additionally, the collaborative sessions helped the instructor observe student practice and evaluate their problem solving process more directly.

Observations

Liladhar noted that the pre-class assignment and the online problem-solving sessions provided more opportunities to assess student learning. Reviewing the assignments helped him evaluate student progress before class, and student preparation for these assignments facilitated the collaborative problem-solving sessions. Additionally, the flipped approach infused the online learning community with greater dialog. Online course environments present barriers for student questions, and it is difficult for the instructor to observe classroom confusion and then respond. During the collaborative problem-solving sessions, challenges and issues would arise to encourage and prompt questions. Because students are expected to work collaboratively and ask for help during class, this reduces barriers for finding instructor assistance. Overall, priming students with a pre-class assignment and then conducting collaborative problem-solving exercises improved class engagement for a real-time online course.

Case 5: hybrid online and in-person instruction for a large undergraduate class

Elliott Smith, the Emerging Technologies and Biosciences Librarian, regularly provides information literacy instruction for a large introductory biology class, Biology 1B. The library training, developed in coordination with the course faculty and staff, gives students practical

library research experience in order to scaffold an annotated bibliography and presentation assignment.

In the past, librarians gave 50-minute orientations to each lab section. Afterwards, students completed a library assignment to practice finding research literature sources. This paper exercise was then graded by teaching assistants for the course. This instructional model presented several challenges. The library assignments could take several weeks to be graded. They were occasionally returned to students after the annotated bibliography assignment's due date, thus defeating the primary purpose of the library assignment. Due to curriculum changes, the course schedule could no longer devote 50 minutes of a lab session to a library orientation; however, faculty wanted students to learn the same information literacy content as before. It became clear that in-person library training sessions and paper assignments were no longer a sustainable model.

The solution was to provide information literacy instruction online, outside of class time. Elliott developed an assignment in which students completed six online learning modules consisting of instructional videos embedded into the LibGuides content management system. Each video was 35 minutes long and was accompanied by text summaries and helpful links. Students could watch the videos, read the guide, or do both, to accommodate their learning preference.

After studying each online module students were provided questions about its content which addressed identifying primary and secondary scientific articles, developing a search strategy for topics based on faculty research, refining a search to retrieve specific types of results, accessing the full text of articles, writing a citation, and finding print materials using the Library of Congress call number system. Questions were delivered in multiple choice and short answer formats that added a higher-order problem-solving element to the assignment.

Instantaneous autograding of each question enabled efficient assessment and provided students with real-time feedback. The platform selected for assignment delivery and autograding was edX Edge (<https://edge.edx.org/>) which includes programming functionality that enables the assignment designer to accommodate variations and minor errors in student responses, rather than requiring a character-by-character match. Autograding thus became not only an efficient means to consistently grade more than 700 student assignments, but also a sophisticated assessment tool.

Use of the edX Edge platform for assignment delivery and autograding led to several student learning benefits. First was immediate testing on learned content, which has been shown to improve student retention (Roediger & Karpicke, 2006). Second was real-time assessment: as soon as students submitted a response, they learned whether it was correct. And finally, the platform facilitated iterative learning for content mastery. Students had multiple opportunities

to complete an assignment question. If a student's response was incorrect, they could refer to embedded contextual help. After further review, the student could re-submit their response to receive full credit. This iterative process helped students learn from their mistakes and the assignments became tools for developing understanding, rather than (as in the case of the paper assignments) a rigid assessment of content retention. Furthermore, multiple opportunities for success may motivate students and ease anxiety.

Because of course time constraints, librarians presented only 10-minute in-person introductions to the assignment during lab sections and students were encouraged to visit the library's reference desk or email their questions to a librarian. Additionally, drop-in sessions were held at the library's computer lab where students could work on the library assignment with peer or librarian support.

Observations

The transition from in-person information literacy instruction to autograded online modules was beneficial for a large first-year class. The library was able to provide rich instruction, motivate student engagement with library exercises, and scaffold course assignments in a timely and efficient manner. Autograding of assignments permitted individualized feedback and an iterative learning process for students. More than 90% of students surveyed indicated that the assignment had the right difficulty level and between 60 and 90% of the students reported improvement in each of a set of research and library skills. This case demonstrates that it is possible to employ flipped pedagogy without a formal classroom setting. Information literacy instruction can employ a sophisticated online learning system with real-time assessment that reinforces learning. Supplemental reference desk and drop-in student workshops can provide the in-person “classroom” support and engagement that some students desire.

Discussion

In examining flipped instruction conducted by librarians at Berkeley, we saw a focus on two core elements. First, librarians provided students with a self-directed assignment to be completed before class. This assignment replaces the traditional lecture content and relies on student self-instruction for initial exposure to library resources and mechanics. Second, students were given opportunities for more active learning in the classroom and via individual in-person or online librarian interactions. Because much of the content imparted in traditional “point-and-click” library demonstrations was completed through the assignment, class time could be devoted to analysis and synthesis, problem-solving activities, technical practice, and other active learning exercises.

In studying instructional cases at Berkeley, we see how the two flipped instruction elements can be applied to various library instructional settings, modes, and audiences. In Case 1, a one-

shot instructional session for a large interdisciplinary undergraduate course, as well as in Case 2, a one-shot graduate orientation seminar, the pre-class assignment helped instructors establish a baseline level of library knowledge which created time in class for discussions and higher-order learning activities. In Case 3, an embedded librarian in a graduate research seminar used library exercises and reflective papers to better understand learning needs and focus classroom instruction. In Case 4, a real-time online graduate course, pre-class assignments enabled subsequent collaborative problem-solving sessions driven by student activity and questions. Finally, in Case 5, a hybrid online and in-person instructional program was scaled to the large audience of a first-year undergraduate biology course. With autograded assignments and drop-in workshops this case demonstrated how flipping a classroom does not require a formal class setting.

Our study explored a variety of instructional audiences, subject areas, and modes that librarians face in order to address a gap in the research literature regarding diverse methods of flipped instruction in academic library settings. Despite differences in the five case studies, common benefits were observed. Students were better prepared to engage with the material and communicate additional learning needs because they arrived to class with enhanced library understanding based on the pre-class assignment. Librarians were able to customize the class to students' articulated needs and reported that this eased the pressure to cover all the content in lecture. Student questions were welcomed, rather than being made to feel they might derail a lecture. Anecdotally, we also found that students were more motivated and engaged in class, and there were more opportunities for higher-order exercises and discussions. An unexpected benefit of each of these case studies was that the two flipped instruction elements enabled more opportunities for information literacy instruction without increasing classroom time. Countering the typical one-shot instructional experience, where library instruction is self-contained within a single guest lecture, flipped instruction may offer an intensive "double shot" of information literacy.

We observed three challenges to flipped instruction implementation in library settings. First is the greater investment of time to prepare and deliver this type of instruction. There is a long lead time for designing the pre-class assignment, coordinating with the course instructor, responding to student questions, and then evaluating assignments. When faculty request instruction on short notice, it will be challenging to use flipped instruction. Therefore, this model is suited to a recurring class for the investment in time to be justified. Otherwise, librarians could reframe their outreach to academic departments and make the case for developing the course support earlier and more collaboratively than in the traditional model.

A second challenge is encouraging adoption and engagement with the model. Even with good working relationships with course instructors, the time commitment of flipped instruction may

require persuasion. Furthermore, there is risk that if students don't complete the pre-class assignment they may subsequently lack the preparation for higher-order classroom activities. In this case, flipped instruction could become less useful than traditional approaches. Integrating or scaffolding the pre-class assignment into an overall course project may encourage assignment completion. However, this could cede control of library instruction to the needs of a particular class project, resulting in greater emphasis on the dictates of the course assignment tasks at the expense of information literacy concepts. Another participation issue is the reliance on students to seek help when they encounter difficulties. And if the pre-class assignment is overly challenging, students could feel discouraged when arriving to class. To address these engagement challenges, library instructors could carefully design a pre-class assignment for feasibility, integrate it within a larger course project for relevance to the students, and reserve class time for careful review of the exercise.

The third and final challenge centers on communication between the librarian and students. In some cases, students were not vocal during class; it is possible they were embarrassed to admit difficulty with the exercises. It can be challenging for the librarian to pinpoint these communication barriers and remedy them during class. And, in online settings, the lack of in-person interactions makes it even more difficult to monitor for student questions, learning confusion, and activity progress. Furthermore, when online library assignments are delivered separately from an existing course management system, students must learn to navigate an unfamiliar interface, which can present difficulties. This was the experience for Case 5's autograded assignment where students logged into the separate edX Edge system to complete their exercise. To address these barriers, librarians could provide more class time for student reflection, allow questions to be asked anonymously, and integrate online information literacy instruction within existing class management systems.

Fig. 1 maps the understanding and experience with flipped instruction of Berkeley librarians. It outlines the diverse catalysts that motivated the adoption of flipped instruction, the different building blocks for designing flipped instruction, and the perceived outcomes and benefits of embracing this paradigm in library settings. Together these components serve as a framework for library instructors to incorporate flipped instruction elements into their instructional design. The elements are modular and the instructor may select and incorporate them to varying degrees in order to meet students' learning needs as well as the constraints of the instructional setting. Key to all elements is the pre-class assignment, which sets the context of information literacy instruction and allows for expanded classroom time for active learning. This is the transformative element of flipped instruction and differentiates it from the benefits attributed to active learning techniques alone.

Fig. 1. Catalysts, building blocks, and perceived outcomes of flipped instruction by UC Berkeley librarians.



Future work might explore how flipped instruction could be applied to additional pedagogical settings and subject areas beyond our case studies, how pre-class assignments could support course projects beyond research papers and presentations, and how this time- and effort-intensive model could be employed for short and intermittent classes, such as library orientations and drop-in sessions. Additionally, studies may incorporate interviews with students as a key data source on learning outcomes.

Conclusion

UC Berkeley librarians have incorporated the flipped instruction model into information literacy instruction by focusing on two primary elements: assigning a pre-class assignment and increasing classroom active learning. Our five cases show how these elements could be applied to a variety of instructional settings facing academic librarians: one-shot and semester-long classes, online and in-person delivery, and a wide range of subject areas for graduate and undergraduate students. The observed benefits of flipped instruction center on its role in setting the context for learning, increasing opportunities to engage with students, and situating the learning and instruction in practice and assessment. The most transformative benefit of flipped instruction is that it allows more opportunities for information literacy instruction without increasing classroom time. The challenges of this model are the requisite commitment of time and effort, the need to foster class participation, and the facilitation of active communication within the class. We hope our framework of catalysts, building blocks, and instructional outcomes will help academic library instructors incorporate flipped instruction elements into their instructional design as well as respond to any challenges.

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