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Librarians and graduate assistants at R.B. House Undergraduate Library at the University of North Carolina at Chapel Hill teach information literacy instruction sessions to students in the required freshman English courses. One-shot or multi-shot instruction sessions are typically taught but experimenting with instructional methods/techniques is encouraged. Flipped classroom, or inverted classroom, instruction has become increasingly popular at the university. The goal of this study is to explore the effectiveness of traditional versus flipped class instruction to see if one method is more effective for helping students develop information literacy skills. Approximately 50 students participated in the study. Students' unit projects were scored using an information literacy rubric as the tool for assessment. Overall, students' scores in the flipped classes were higher than students' scores in the traditional classes.

Headings:

      Information Literacy Instruction

      Flipped Classrooms

      Student Learning

      Assessment

INFORMATION LITERACY INSTRUCTION: TO FLIP OR NOT TO FLIP THE
CLASSROOM

by
Amanda B. MacDonald

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Approved by

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Barbara B. Moran

Table of Contents

List of Tables

Introduction

The *ACRL Information Literacy Competency Standards for Higher Education* define information literacy as "the set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the information needed" (2000, p. 2). Accordingly, the standards define an information literate individual as being able to "determine the extent of information needed; access the needed information effectively and efficiently; evaluate information and its sources critically; use information effectively to accomplish a specific purpose; and understand the economic, legal, and social issues surrounding the use of information, and access and use of information ethically and legally" (ACRL, 2000, pp. 2-3). Librarians use these standards to define information literacy, develop learning outcomes, plan information literacy instruction sessions, and assess instruction classes/programs.

While the standards help to bring consistency in relation to terminology and understanding to the fields of information and library science, they are not meant to be restrictive, which means librarians can develop information literacy instruction programs that are appropriate for their specific institutions but based on the standards. Information literacy instruction is defined as having a "developing emphasis on information literacy…[and] an increasing focus on the process of learning rather than the process of teaching" (Hinchliffe, 2011, p. 224). Information literacy instruction takes a variety of shapes and forms from one-shot instruction sessions to multiple instruction sessions to for-credit courses. While information literacy instruction sessions can be conducted in a

variety of forms using face-to-face, online, or blended methods, this study focuses on face-to-face instruction sessions.

Traditional one-shot instruction sessions are sessions in which the librarian receives a request from an instructor, reviews the instructor's assignment, develops learning objectives based on the standards and fitting for the assignment, lectures for the first portion of the face-to-face session, and leaves the remainder of the session free for students to begin searching for their own topics based on the lecture and to ask questions when problems or issues arise. A flipped classroom is one in which the work "traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class" (Bergmann & Sams, 2012, p. 13). Flipped classroom instruction "takes many forms including interactive engagement, just-in-time teaching (in which students respond to Web-based questions before class, and the professor uses this feedback to inform his or her teaching), and peer instruction" (Berrett, 2012, p. 1). In a flipped classroom model, the librarian still receives a request from an instructor, reviews the instructor's assignment, and develops learning objectives based on the standards and fitting for the assignment; however, instead of lecturing for a portion of the class, the librarian asks the students to view the lecture at home prior to the session and then plans active learning exercises for the face-to-face instruction session.

While the latter portion of the traditional instruction session could be considered an active learning exercise because the students are "actively" practicing the search process, this study is using a more involved definition of active learning. Here, active learning is

> an educational approach in which teachers ask students to apply classroom
> content during instructional activities and to reflect on the actions they have

taken. Teachers who employ active learning approaches can have students solve problems, work as part of a team, provide feedback to classmates, or peer-teach as ways to put new content to work. Active learning requires students to operate at high cognitive levels, to analyze, synthesize, and evaluate during instructional tasks. (Thomas, 2009, pp. 13-15).

Active learning challenges students to work through the concepts they reviewed prior to the face-to-face instruction sessions. Active learning exercises following this definition go beyond giving a student time to simply search in databases. Instead, students are not only searching but also collaborating, reflecting, peer-to-peer teaching, and questioning the research process on their own, with classmates, with their instructor, and with the librarian. Active learning exercises transform the individual searching done in traditional classroom instruction into a dynamic and collaborative classroom activity.

Whether instructors use the traditional or the flipped classroom method for instruction, assessment is used to show if their instruction sessions effectively helped students learn information literacy skills. By definition, "[a]ssessment is a general term that is used to encompass everything a teacher does to ascertain the level at which students have mastered the subject matter, can perform certain tasks, or exhibit certain behaviors. Assessment includes the collection, analysis, and interpretation of various kinds of information" (Kraska, 2008, p. 61). Common assessment techniques are often used such as the One Minute Paper and the 3-2-1 Assessment. However, evidence based assessment is another viable option for assessing information literacy instruction because it requires "students [to] demonstrate achievement of the desired results" (Wiggins & McTighe, 2003, p. 2). Evidence-based assessment has librarians assessing "authentic performance tasks" such as annotated bibliographies or unit projects that are required for the students' class (Wiggins & McTighe, 2003, p. 2). Examining authentic performance

tasks allows librarians to see if students actually internalized and exercised the information literacy skills covered in the instruction session.

Using evidence-based assessment, this study aims to comparatively examine the effectiveness of traditional information literacy instruction sessions to flipped classroom information literacy instruction sessions by using treatment and control groups. Students in the control group received traditional information literacy instruction session consisting of a lecture and a discussion surrounding the concepts and skills required to complete their assignment and were given time to research their own topics. Students in the treatment groups watched a video of the information literacy instruction session prior to the class and experienced the flipped classroom method by participating in active learning exercises related to researching their topics during the instruction session. The entire assessment was conducted during the first seven weeks of the semester. The assessment covered only one face-to-face information literacy instruction session per group, and data was collected by evaluating students' final projects using an information literacy rubric. The effectiveness of the instruction sessions was judged by the students' abilities to define topics, select sources, synthesize information, use research to support their points, and cite their research. The goal of this study was to answer two questions. First, did the mode of instruction affect students' learning of information literacy skills? Second, was traditional information literacy instruction more effective, less effective, or equally effective in terms of students learning of information literacy skills?

Institutional Background

Information literacy instruction is an integral part of academic librarianship. R.B. House Undergraduate Library (UL) at the University of North Carolina at Chapel Hill (UNC-CH) is an academic library that focuses on the needs of undergraduates and much of its collection supports the core classes offered at UNC-CH. According to its Mission, the UL "introduces undergraduates to Carolina's rich and complex library system, connects undergraduates and faculty to the information, technology, and other resources essential to supporting undergraduate education, and acts as a testing ground for undergraduate learning and teaching initiatives" (UNC Libraries, 2013). One way the UL librarians carry out this Mission is through the instruction program. While the librarians offer some classes related to technology and teach instruction sessions in a variety of subject areas, the bulk of the instruction sessions taught at the UL are for English 105 classes. The full title of the course is English 105: Rhetoric and Composition. It is a required course for incoming freshmen, as it is part of the core curriculum. The course requires students to analyze, study, and practice "the rhetorical and stylistic conventions that govern professional and academic writing in the natural sciences, social sciences, and humanities" (UNC Department of English and Comparative Literature, n.d.).

During the spring semester of 2014, there were 85 sections of English 105 offered and 21 sections of English 105i. English 105i is intensive and geared towards one particular subject area, such as the humanities. As of March 14, 2014, the UL staff taught 98 information literacy instruction sessions for English 105 and 105i courses.

In order to teach so many instruction sessions, librarians and graduate assistants share the responsibility of teaching the classes. The librarians and the English instructors work together to make the instruction program and sessions successful. All information literacy instruction sessions are taught by request of the instructor. Once the instructor requests a session, the librarian or graduate assistant emails the instructor, reviews the assignment, discusses ideas for the class, plans the session, teaches the session, and then speaks with the instructor to ensure he/she is satisfied with the outcome. There are, of course, some restrictions on what the UL is able to offer based on staff, space, and time. The UL staff tries to be as accommodating as possible to ensure that the instructors and the English department are pleased with the instruction program.

To bring consistency to the UL's instruction program, all of the graduate students who teach attend an instruction boot camp and follow-up training sessions. The goal of this training is to provide graduate students with a pedagogical foundation for teaching. The instruction the UL provides is broken down into three areas: concepts, context, and active learning. Conceptually, all of the information literacy instructors are trying to accomplish the same goal, which is to help students develop information literacy skills. To do this, all instruction sessions are based on the *ACRL Information Literacy Competency Standards for Higher Education*. Contextually, the sessions are tailored to fit teacher requests, assignments, and students' needs. This means the context of each session is unique and specific to each class. The active learning portion usually takes place during the last half of each class when students are asked to research their individual topics. Instead of assessing the instruction program as a whole, the UL

assesses each individual session with the belief that the assessment, like the context, must be tailored to fit each instruction session.

The training in the UL for the graduate assistants is based on Siedfried Engelmann's Direct Instruction theory. Direct Instruction occurs when

> [t]eachers *demonstrate* and *model* expected performance, *lead* and *prompt* students through the performance, and then *release* or test the students' performance. These steps in the process are easily identified during instruction when teachers preface by saying 'My turn' when they demonstrate and model, 'Our turn' when they help the learners to perform accurately, and 'Now your turn' when they check to see whether students can perform without assistance. (Johnson & Street, 2008, p. 241)

When introducing the concepts for a session, the graduate students are trained to "demonstrate and model" the research process. Then, to make the material contextually relevant to students, the graduate students often "lead and prompt" students through the research process either through activities and guided searching. Finally, the active learning portion occurs when students in the class are "released" to practice the search skills they just developed on their own (Johnson & Street, 2008, p. 241).

While all graduate students at the UL are trained in the conceptual, contextual, and active learning portions of instruction based on the Direct Instruction, transitioning from the traditional instruction method to the flipped classroom method was an interesting experience. Direction Instruction supports both modes of instruction and is broadly applicable. It allows instructors wishing to flip the classroom to separate the conceptual, contextual, and active learning portions of the session. By removing the conceptual and contextual aspects from the face-to-face sessions, the library instructor can maximize the active learning portions of the session, which is key for flipped classroom instruction. Essentially, the difference between flipped and traditional

classroom instruction is merely a matter of emphasis. In a flipped class, an instructional video can be used to cover the conceptual and contextual aspects of the class, which students are able to view prior to the instruction session. Then, when students arrive to the library session, they are able practice the concepts and context covered in the video during guided classroom exercises. The flipped classroom method for instruction is not a brand new or revolutionary concept; it is a progression of what librarians have already been doing in the classroom.

Literature Review

      Information literacy instruction is the term many librarians are using to refer to the type of instruction that is now offered in libraries. In *Reference and Information Services*, Hinchliffe discusses how the terms for instruction and the types of instruction offered in libraries varied and changed over time. The term library instruction is often interchangeably used for information literacy instruction today, but the terms are not synonyms. By definition "library instruction refers to instruction in the use of libraries, with an emphasis on institution-specific procedures, collections, and policies. The term emphasizes the library as defined by its physical parameters. The focus of library instruction is on in-depth explanation of library materials; it concentrates on tools and mechanics…" (Hinchliffe, 2011, p. 223).

      While Hinchliffe explains the terms related to library and information literacy instruction, her work it is not a study on instruction. However, Anderson and May conducted a study to investigate the best mode of instruction: online, blended, or face-to-face instruction. They chose not to have a control group and had one class of students to test each method. They used a pre-test and post-test to test student learning and concluded that the "method of instruction (online vs. F2F vs. blended) does not influence students' retention of IL skills. All methods of instruction can be equally as effective" (Anderson & May, 2010, p. 498). Like Anderson and May, Silver and Nickel investigate the effectiveness of instructional methods by comparing the assessment of online and

face-to-face library instruction session. For the assessment Silver and Nickel chose a large psychology class consisting of approximately three hundred students. The students were allowed to choose to attend the in-person or the online library instruction session. While their study found that "online instruction is as effective as classroom instruction" (Silver & Nickel, 2007, p. 395), "63.5% preferred learning through an online tutorial" (Silver & Nickel, 2007, p. 393).

Strayer also examines a variety of instruction methods by "compar[ing] the learning environment of an inverted introductory statistics class with a traditional introductory statistics class" (2012, p. 171). Strayer provides some negative feedback in relation to the flipped classroom model and points out that "[m]any students found it very difficult to successfully navigate these in-class expectations. Students were not clear what was expected of them, and eventually they were convinced that most of the students in the class were 'lost' by the end" (Strayer, 2012, p. 189). Even though this was a semester-long course with the activities becoming increasingly more difficult as the semester progressed, Strayer argues "that the feeling of 'being lost' is partially explained by the varied activities in the class" (2012, p. 189). To prevent this from happening to students, he warns "against ill-connected online and face-to-face components in a blending learning environment" (Strayer, 2012, p. 191).

Strayer's article presents concern for librarians who wish to flip the classroom because librarians do not want students to feel anxious or lost after attending an information literacy instruction session. While Strayer addresses the importance of a properly planned and connected course for the inverted model to be successful, Datig and Ruswick also provide suggestions for librarians who wish to flip their classrooms in

"Four quick flips: Activities for the information literacy classroom." Their suggestions follow content usually covered in traditional instructions sessions but with an active learning spin to them: searching databases, keyword searching, web site evaluation, and identifying source types. Near the end of their work they argue that "many different information literacy synchronous sessions are not possible, [so] create effective tutorials instead" (Datig and Ruswick, 2013, pp. 251-252).

In all of the studies described, in order to determine which types of instruction are more effective, assessment was conducted. In most cases, librarians used pre-test and post-test methods in order to account for skills prior to the instruction session. In "Assessing information literacy skills development in first year students: A multi-year study," Fain's literature review is thorough in discussing the assessment work being conducted by librarians and the variety of tools available. Her study assesses one-shot instruction sessions over the course of five years using a pre-test and post-test method. The method of using pre-tests and post-tests is common in academic library instruction assessment but presents limitations. In "Using rubrics to assess information literacy: An examination of methodology and interrater reliability," Megan Oakleaf notes "the limitations of tests" and "the benefits of rubrics" (2009, p. 969). While rubrics are not common in academic library instruction assessment, Oakleaf argues that rubrics allow "students [to] learn much more effectively" and "to understand the expectations of their instructors" (2009, p. 969). Citing Pausch and Popp, she also notes that "rubrics emphasize 'understanding rather than memorization, 'deep' learning rather than 'surface' learning'" (as cited in Oakleaf, 2009, p. 969).

As can be seen from this literature review, research related to information literacy instruction, like Hinchliffe's chapter, is available. Studies testing and/or comparing the effectiveness of online, blended, and face-to-face information literacy instruction sessions, such as the work of Anderson and May and Silver and Nickel, have been conducted. Articles have also been published, like Fain and Oakleaf's, discussing information literacy instruction assessment. While best practices and/or tips for flipping the classroom, like Datig and Ruswick's piece, are available, there is a need for flipped classroom studies, like this one, to be conducted on information literacy instruction sessions because flipped classroom instruction has become popular in higher education and is missing from library and information science literature.

Methodology

Four sections of English 105 classes participated in this study. While each class varied in size, the maximum number of students per class was 19. A total of 52 students participated. In order to minimize unwanted causal variables, only two English instructors were selected to participate. Both instructors selected taught consecutive sections of English 105. Each instructor used the same syllabi, lectures, and assignments in both of their courses. While all documents adhered to the department's requirements for the course, the syllabi, lectures, and assignments varied from one instructor to the other.

During the first seven weeks of the spring semester, students in all four classes were working on their Unit 1 feeders and final assignments. The first unit in all of the classes is in the natural sciences. By design, the Unit 1 assignment sheets consist of three separate deliverables: Feeder 1, Feeder 2, and the Final Assignment. Feeders are mini-assignments that break-up the information literacy skills required to complete the final assignment. For example, a Feeder 1 assignment might require students to identify their topic in a one page essay using one general source. A Feeder 2 assignment could be an annotated bibliography requiring students to locate general and specific information on their topics. A final assignment might require students to build off of Feeder 1 and 2 by writing an essay, which requires students to have a narrow topic and to synthesize their research. The feeders in all classes build upon one another. In most cases, Feeder 1 focuses on topic selection and background research, Feeder 2 focuses on in-depth

research in subject-specific databases, and the Final Assignment requires students to produce a project utilizing the skills and information required to complete the first two feeders in addition to new requirements.

Students in all four classes were familiar with and already working on their feeder assignments for Unit 1 prior to attending their library instruction sessions. Each instructor had one class acting as a control group and one class acting as a treatment group. Students in the treatment group viewed a video of the library instruction lecture online via Sakai prior to attending the face-to-face library instruction session. The face-to-face library instruction session for these students functioned like a flipped classroom, so the session consisted of active learning activities. Students in the control group attended the library instruction session in person and were given time to search and ask the librarian questions at the end of the session. The library instruction sessions focused on topic selection, developing key terms for searching, and locating background information.

In order to see if students in the flipped classroom library instruction sessions showed more advanced information literacy skills than students who attended the traditional library instruction session, students' final papers in all four classes were evaluated. Their final assignments were selected for the assessment because they serve as an authentic performance task for the students' English class and the library instruction session, which is fitting for evidence-based assessment. The assessment was conducted by scoring the students final papers using a rubric. The criteria for the rubric and the rubric itself was established prior to the start of the study and modeled after the study rubric in Megan Oakleaf's "Using rubrics to assess information literacy: An examination of methodology and interrater reliability." The rubric is based on the *ACRL Information*

Literacy Competency Standards for Higher Education. There are five performance

indicators; one performance indicator for each of the five standards. Each performance

indicator is assigned a learning objective and scored on a three-point scale. The rubric

created for this study is shown in Table 1.

Performance Indicator	Learning Objective	Beginning	Proficient	Advanced
I. The information literate student defines and articulates the need for information.	Student's topic is clearly developed in a thesis statement and points to be covered in the paper.	0 - Thesis has not been developed or is underdeveloped.	1 - Thesis shows signs of some development but lacks clarity and/or scope.	2 - Thesis shows signs of significant development, clarity, and scope.
II. The information literate student retrieves information online or in person using a variety of methods.	Uses various search systems to retrieve information in a variety of formats	0 - Does not contain requisite number of sources and does not show variety in source selection.	1 - Requisite number of sources are used but limited variety in source selection.	2 - Requisite number of sources or more are used, and appropriate variety in source selection.
III. The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.	The information literate student synthesizes main ideas to construct new concepts.	0 - No sources are used in conjunction with one another.	1 - Limited use of sources in conjunction with one another.	2 - Significant use of sources in conjuction with one another.
IV. The information literate student uses information effectively to accomplish a specific purpose.	The information literate student applies new and prior information to the planning and creation of a particular product or performance.	0 - Sources are used to support few or none of his/her points.	1 - Sources are used to support some of his/her sources.	2 - Student uses information directly related to his/her topic to support all or nearly all of their points.
V. The information literate student acknowledges the use of information sources in communicating the product or performance.	Selects an appropriate documentation style and uses it consistently to cite sources	0 - Not all information is cited; or none of the information is correctly cited or formatted.	1 - All information is cited, but some errors are present in citation or format.	2 - All information is cited, and format is correct.

Table 1: Information Literacy Rubric for Assessment (ACRL, 2000, pp. 8-14)

Limitations

This study was narrow in scope and scale. It examined only four face-to-face instruction sessions: one instruction session for both of the control groups and one online instruction video and one face-to-face instruction session for both treatment groups. The duration of this study was limited to approximately seven weeks; it traced students' progress through the first of three units required in the course. This study used students' final projects and a rubric as the assessment tool instead of using a pre-test/post-test method, so student knowledge and skill level prior to the instruction session is unknown.

Results

A total of fifty-two students' final papers were scored using the Information

Literacy Rubric located on pages 17-18. While more students attended the classes, some

students did not place their final projects online in Sakai; therefore, those student papers

were not included in the results. Student papers were scored on a three point scale, as

shown in the rubric; accordingly, the lowest score a student could receive was a 0 and the

highest score was a 2 for each performance indicator.

Performance Indicator 1: Developing a Topic was based on the students' ability to

define and articulate their information needs. This could be seen in the students' thesis

statements, which were scored for clarity and development. The table below shows the

mean scores for each class.

Performance Indicator 1: Developing a Topic			
Class	***n***	**Mean**	**SD**
Flipped Class 1	12	1.5	0.522
Traditional Class 1	10	1.1	0.568
Flipped Class 2	17	1.71	0.47
Traditional Class 2	13	1.231	0.5991

Table 2: Mean Scores for Performance Indicator 1

According to Table 2, the mean score for both flipped classrooms was 0.879 higher than

the mean score for the traditional classroom.

While the mean score was higher for the flipped classes, frequency tables were

also calculated. Table 3 shows a breakdown of students/scores earned for each class for

Performance Indicator 1.

Performance Indicator 1: Developing a Topic			
Class	Score	Number of Students	Percent
Flipped Class 1	1	6	50.0%
	2	6	50.0%
	Total	12	100.0%
Traditional Class 1	0	1	10.0%
	1	7	70.0%
	2	2	20.0%
	Total	10	100.0%
Flipped Class 2	1	5	29.4%
	2	12	70.6%
	Total	17	100.0%
Traditional Class 2	0	1	7.7%
	1	8	61.5%
	2	4	30.8%
	Total	13	100.0%

Table 3: Breakdown of Scores for Performance Indicator 1

According to Performance Indicator 1: Developing a Topic, none of the students in either of the flipped classes earned a score of 0. This means that all students in the flipped classroom had a thesis statement that at least showed signs of clarity and development; however, one student in each of the traditional classes earned a score of 0 for this indicator, which showed that two students' thesis statements were underdeveloped in the traditional classes. In Flipped Class 1, 50% of the students scored a 2, the highest possible score, on this performance indicator, while only 20% of the students in Traditional Class 1 scored a 2. An increase in scores was also visible for Flipped Class 2. 70.6% of students in Flipped Class 2 scored a 2 for this indicator, while only 30.8% of students in Traditional Class 2 scored a 2. Overall, students in the flipped classes scored an average of 34.9% higher for this performance indicator.

Performance Indicator 2: Selecting Varied Sources was based on the students'

ability to retrieve information online or in person using a variety of methods. This could

be seen in the students' ability to use at least the required number of sources, which was

determined by the instructors' assignment sheets, with a variety in their selection of

sources. A variety in source selection means that students did not use all websites but

instead used a combination of sources from library databases, books, newspapers, and

websites in their papers. The table below shows the mean scores for each class.

Performance Indicator 2: Selecting Varied Sources			
Class	n	Mean	SD
Flipped Class 1	12	1.83	0.389
Traditional Class 1	10	1.4	0.516
Flipped Class 2	17	1.53	0.717
Traditional Class 2	13	1.385	0.6054

Table 4: Mean Scores for Performance Indicator 2

According to Table 4, the mean score for both flipped classes was 0.575 higher than the

mean score for the traditional classes.

While the mean score was higher for the flipped classes, frequency tables were

also calculated. Table 5 shows a breakdown of students/scores earned for each class for

Performance Indicator 2.

Performance Indicator 2: Selecting Varied Sources			
Class	**Score**	**Number of Students**	**Percent**
Flipped Class 1	1	2	16.7%
	2	10	83.3%
	Total	12	100.0%
Traditional Class 1	1	6	60.0%
	2	4	40.0%
	Total	10	100.0%
Flipped Class 2	0	2	11.8%
	1	4	23.5%
	2	11	64.7%
	Total	17	100.0%
Traditional Class 2	0	1	7.7%
	1	6	46.2%
	2	6	46.2%
	Total	13	100.0%

Table 5: Breakdown of Scores for Performance Indicator 2

According to Performance Indicator 2: Selecting Varied Sources, 83.3% of the students

in Flipped Class 1 scored a 2 on this performance indicator, while only 40% of the

students in Traditional Class 1 scored a 2. An increase in scores was also visible for

Flipped Class 2. 64.7% of students in Flipped Class 2 scored a 2 for this indicator, while

only 46.2% of students in Traditional Class 2 scored a 2. Overall, students in the flipped

classes scored an average of 30.9% higher for this performance indicator, which indicates

that students in the flipped classes selected and included more varied sources than

students who attended the traditional classes.

Performance Indicator 3: Synthesizing Information was based on the students'

ability to synthesize information and construct new ideas from that information. This

could be seen when students used sources in conjunction with one another and in support

of their own arguments. The table below shows the mean scores for each class for this

performance indicator.

Performance Indicator 3: Synthesizing Information			
Class	*n*	Mean	SD
Flipped Class 1	12	1.58	0.669
Traditional Class 1	10	1.8	0.422
Flipped Class 2	17	1.53	0.514
Traditional Class 2	13	1.154	0.8987

Table 6: Mean Scores for Performance Indicator 3

According to Table 6, the mean score for both flipped classrooms was 0.156 higher than

the mean score for the traditional classroom.

While the mean score was higher for the flipped classes, frequencies and

percentages were also calculated. Table 7 shows a breakdown of students/scores earned

for each class for Performance Indicator 3.

Performance Indicator 3: Synthesizing Information			
Class	Score	Number of Students	Percent
Flipped Class 1	0	1	8.3%
	1	3	25.0%
	2	8	66.7%
	Total	12	100.0%
Traditional Class 1	1	2	20.0%
	2	8	80.0%
	Total	10	100.0%
Flipped Class 2	1	8	47.1%
	2	9	52.9%
	Total	17	100.0%
Traditional Class 2	0	4	30.8%
	1	3	23.1%
	2	6	46.2%
	Total	13	100.0%

Table 7: Breakdown of Scores for Performance Indicator 3

According to Performance Indicator 3: Synthesizing Information, one student in the

flipped class model earned a score of 0, while four students earned a score of 0 in the

traditional class model. Students who earned a 0 for this performance indicator did not

use any sources in conjunction with another source. In Flipped Class 1, only 66.7% of the students scored a 2 on this performance indicator, while 80% of the students in Traditional Class 1 scored a 2. Conversely, in Flipped Class 2 52.9% of students scored a 2 for this indicator, while only 46.2% of students in Traditional Class 2 scored a 2. Overall, the results of this performance indicator were mixed with students scoring higher in Traditional Class 1 than students in Flipped Class 1 but with students scoring higher in Flipped Class 2 than in Traditional Class 2.

Performance Indicator 4: Using Information was based on the students' ability to use information effectively to accomplish a specific purpose. This could be seen when students' used information directly related to their topics to support all or nearly all of their points, which were often, but not always, included in their thesis statements. The table below shows the mean scores for each class for this performance indicator.

Performance Indicator 4: Using Information			
Class	n	Mean	SD
Flipped Class 1	12	2	0
Traditional Class 1	10	1.8	0.422
Flipped Class 2	17	2	0
Traditional Class 2	13	2	0

Table 8: Mean Scores for Performance Indicator 4

According to Table 8, the mean score was higher for Flipped Class 1 than Traditional Class 1 by .2, but the mean scores were even for Flipped Class 2 and Traditional Class 2.

While the mean score was higher for the flipped classes, frequencies and percentages were also calculated. Table 9 shows a breakdown of students/scores earned for each class for Performance Indicator 4.

Performance Indicator 4: Using Information			
Class	Score	Number of Students	Percent
Flipped Class 1	2	12	100.0%
Traditional Class 1	1	2	20.0%
	2	8	80.0%
	Total	10	100.0%
Flipped Class 2	2	17	100.0%
Traditional Class 2	2	13	100.0%

Table 9: Breakdown of Scores for Performance Indicator 4

According to Performance Indicator 4: Using Information, none of the students in any of

the classes earned the score of a 0, which indicates that all students in the study used

sources to support at least half of the points made in their papers. 100% of the students in

Flipped Class 1, Flipped Class 2, and Traditional Class 2 scored a 2 for this performance

indicator. However, two students, or 20% of the class, scored a 1 in Traditional Class 1.

Overall, the results of this performance indicator were mixed with students scoring higher

in Flipped Class 1 than students in Traditional Class 1 but with students scoring the same

in Flipped Class 2 and Traditional Class 2. For this performance indicator, 50 out of the

52 students in the study scored a 2, which shows that 96.2% of the students used

information to support at least half of the points they made in their papers.

Performance Indicator 5: Citing Information was based on the students' ability to

cite and format their papers in the citation style assigned by the instructors. Students

work was scored based on their in-text citations, full citations, and paper documents in

relation to citation style guides appropriate for each class. The table below shows the

mean scores for each class for this performance indicator.

Performance Indicator 5: Citing Information			
Class	**n**	**Mean**	**SD**
Flipped Class 1	12	1.83	0.389
Traditional Class 1	10	1.5	0.527
Flipped Class 2	17	1.71	0.47
Traditional Class 2	13	1.846	0.3755

Table 10: Mean Scores for Performance Indicator 5

According to Table 10, the mean score for both flipped classrooms was 0.194 higher than

the mean score for the traditional classroom.

While the mean score was higher for the flipped classes, frequencies and

percentages were also calculated. Table 11 shows a breakdown of students/scores earned

for each class for Performance Indicator 5.

Performance Indicator 5: Citing Information			
Class	**Score**	**Number of Students**	**Percent**
Flipped Class 1	1	2	16.7%
	2	10	83.3%
	Total	12	100.0%
Traditional Class 1	1	5	50.0%
	2	5	50.0%
	Total	10	100.0%
Flipped Class 2	1	5	29.4%
	2	12	70.6%
	Total	17	100.0%
Traditional Class 2	1	2	15.4%
	2	11	84.6%
	Total	13	100.0%

Table 11: Breakdown of Scores for Performance Indicator 5

According to Performance Indicator 5: Citing Information, none of the students in any of

the classes earned the score of a 0, which indicates that all students in the study cited the

information they used in their papers though errors in citation or format may have been

present in some of the students' papers. 83.3% of the students in Flipped Class 1 scored a

2 for this performance indicator, while only 50% of the students in Traditional Class 1 scored a 2. However, only 70.6% of students in Flipped Class 2 scored a 2, while 84.6% of students scored a 2 in Traditional Class 2. Overall, the results of this performance indicator were mixed with students scoring higher in Flipped Class 1 than students in Traditional Class 1 but with students scoring lower in Flipped Class 2 than in Traditional Class 2.

In order to determine if the differences in scores were statistically significant, the Wilcoxen Mann-Whitney test, a non-parametric test that does not assume the data is normally distributed, was run. The test was run to compare both flipped classes to both traditional classes. The results are shown in Table 12 below, in which asymptotic significances are displayed with a significance level of .05.

Hypothesis Test Summary			
Null Hypothesis	Test	Sig.	Decision
The distribution of Performance Indicator 1 is the same across categories of Flipped.	Independent-Samples Mann-Whitney U Test	0.006	Reject the null hypothesis.
The distribution of Performance Indicator 1 is the same across categories of Flipped.	Independent-Samples Mann-Whitney U Test	0.062	Retain the null hypothesis.
The distribution of Performance Indicator 1 is the same across categories of Flipped.	Independent-Samples Mann-Whitney U Test	0.8	Retain the null hypothesis.
The distribution of Performance Indicator 1 is the same across categories of Flipped.	Independent-Samples Mann-Whitney U Test	0.109	Retain the null hypothesis.
The distribution of Performance Indicator 1 is the same across categories of Flipped.	Independent-Samples Mann-Whitney U Test	0.615	Retain the null hypothesis.
The distribution of Total is the same across categories of Flipped.		0.007	Reject the null hypothesis.

Table 12: Wilcoxen Mann-Whitney Test

As shown in Table 12, the increase in students' scores in the flipped classes for

Performance Indicator 1: Developing a Topic was statistically significant. When looking

at Performance Indicators 2-5, the difference in students' scores between the flipped

classes and the traditional classes was not statistically significant. However, when

comparing students' total scores for all of the performance indicators between the flipped

and the traditional classes, the increase in students' scores from the flipped classes as

compared to the traditional classes was statistically significant. Ultimately, this indicates

that flipped classroom instruction, in this study, was more effective because students'

scores in the flipped classes were higher than students' scores in the traditional classes.

Discussion

When comparing students' scores in the flipped classrooms to the traditional classrooms, students in the flipped classrooms scored higher in the first two performance indicators with statistically significant higher scores for Performance Indicator 1: Developing a Topic. This indicates that students who watched the video and attended the flipped classroom information literacy instruction session wrote thesis statements with signs of significant development, clarity, and scope and included the requisite number of sources that showed appropriate variety in source selection. However, this is not terribly surprising based on the lecture portion of the sessions. The video lecture for the flipped classroom and the in-person lecture for the traditional classroom were based on three learning objectives: at the end of session students will be able to select and narrow a topic, develop key terms, and locate background information. These three learning objectives support the first two performance indicators but not the last three.

The results for the remaining three performance indicators were mixed. This means that students' ability to synthesize main ideas to construct new concepts, to apply new and prior information to the planning and creation of a particular product or performance, and to select an appropriate documentation style and use it consistently to cite were not consistently better or worse in the flipped or in the traditional classroom. The latter three performance indicators were mentioned in both types of class discussions but were not the focus of either session. In the traditional classroom sessions, students were given time to practice the searches covered in the lecture using their own topics;

however, in the flipped classroom sessions, students were guided through a variety of active learning activities.

In the flipped classes students practiced two of the final three performance indicators in an activity, which related to students' ability to synthesize the information and to relate the information to the main points in their final papers. The activity asked students to skim/review all of the information they have located so far, write down what they know based on the information the located about their topics, and write down what they want to know about their topics. This activity requires students to think about the information they have, how they will use it in their final projects, and what holes are still located in their research.

Conclusion

The goal of this study was to answer two questions related to information literacy instruction. The first question was to learn if the mode of instruction used affected students' development of information literacy skills. The mode of instruction does appear to affect student learning, as the flipped classroom model yielded higher student scores in two of the five performance indicators and in total scores than the traditional classroom model. The second question was to discover if the traditional method for instruction was more effective, equally effective, or less effective than the flipped classroom method. The results of this study show that the flipped classroom method was more effective. While this study shows that flipped classroom instruction can improve student scores, there are lessons to be learned from this experience.

First, rubrics, like instruction sessions, need to be tailored. The rubric used in this study was purposefully vague, so it could be applied to two different instructors'

assignments. However, in the future, librarians should create rubrics to fit the instructors'

specific assignments and the learning objectives for the information literacy instruction

session, so librarians will be able to make specific connections between the learning

objectives for the session, students' work, and the rubric. Including performance

indicators that relate to the information literacy standards but not directly to the lecture

bring the results into question for those specific performance indicators because it is hard

to know whether the students who scored high in those areas learned the skills in the

information literacy instruction session, in the instructor's class, or already had the skills

prior to the session.

Secondly, evaluating students' papers or projects, the authentic performance task,

as part of evidence-based assessment makes sense; however, it makes sense to do the

assessment with an assignment due shortly after the information literacy instruction

 session. In this study, the assessment was conducted a few weeks after the instruction

sessions. While an improvement was noticed in the scores for the flipped classes, it does

call into question whether the students' skills were honed in the library session or in the

instructor's classroom. Conducting the assessment shortly after the session would help to

answer this question.

Thirdly, librarians should be prepared for an increase in preparation time when

initially preparing for flipped classroom instruction. For this project, lectures were

recorded and placed online. This means that lesson plans had to be created and videos

had to be recorded, edited, and placed online. While the same lesson plan was used in the

traditional classroom as was used in creating the videos, additional lesson plans had to be

created for the flipped classroom sessions. Planning the active learning sessions can be

challenging at first but should be quicker and easier over time because active learning exercises based on information literacy skills can be adapted to fit future classes.

Suggestions for Further Study

While this study showed improvement in student scores, it is merely a preliminary study. A larger scale study needs to be conducted to confirm that flipped classroom instruction benefits students' and leads to higher scores in assessment. To do this, librarians should include more participating students, consider creating reusable/broadly applicable videos for the lecture portions to save preparation time, tailor only the in-person instruction sessions to fit the assignments, and increase the duration of the study because one instruction session per class per semester is not enough to see long-term benefits, if they exist, of flipped classroom instruction. Librarians should also consider experimenting with the number of sessions they teach and assess for individual classes. The reason for this is that while improvement was shown in students attending the flipped classroom sessions, it was difficult to prove that the reason students' scores improved in those sessions was due to the active learning exercises or to the fact that students viewed the lecture prior to class and then attended a session reviewing/practicing the same skills. A more in-depth study could reveal whether it was the increased exposure or the active learning exercises that led to higher scores.

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