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Madeline Cohen
CUNY Lehman College

Jennifer Poggiali
CUNY Lehman College

Alison Lehner-Quam
CUNY Lehman College

Robin Wright
CUNY Lehman College

Rebecca K. West
CUNY Lehman College

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Flipping the classroom in business and education one-shot sessions: a research study

Madeline E. Cohen, Assistant Professor and Head of Reference, Lehman College, New York. Email: madeline.cohen@lehman.cuny.edu. Twitter: [@madelinecoh](https://twitter.com/madelinecoh)

Jennifer Poggiali, Assistant Professor and Instructional Technologies Librarian, Lehman College, New York. Email: jennifer.poggiali@lehman.cuny.edu. Twitter: [@jenpoggiali](https://twitter.com/jenpoggiali)

Alison Lehner-Quam, Assistant Professor and Education Librarian, Lehman College, New York. Email alison.lehnerquam@lehman.cuny.edu.

Robin Wright, Assistant Professor and Health and Human Services Librarian, Lehman College, New York. Email: robin.wright@lehman.cuny.edu.

Rebecca K. West, Senior Clinical Research Coordinator, Icahn School of Medicine. Email: rebecca.west@mssm.edu.

Abstract

In response to the challenge of maximising the effectiveness of one-shot information literacy (IL) sessions, library faculty at Lehman College experimented with the flipped classroom model. This research paper reports the results of a multi-semester quantitative study of the flipped classroom in business management and education one-shot sessions. Researchers explored two research questions: Do students in a flipped session demonstrate greater knowledge before their session than students in a control session? and Do flipped and control students demonstrate significant, positive improvement in knowledge after their session? The researchers used pre- and post-tests to evaluate two crucial aspects of the flipped model: pre-class homework assignments and in-class active learning. A significant finding supports the usefulness of homework assignments in preparing students for these library sessions. Both education and business classes also reported high degrees of satisfaction with the flipped model. The article provides evidence that the flipped classroom, especially those using the pre-class homework assignments, can be effective for student learning in IL one-shot sessions.

Keywords

flipped classroom, flipped learning, inverted classroom, information literacy, one-shot, active learning, higher education, US.

1. Introduction

Each minute of a one-shot information literacy (IL) session is a valuable commodity. To maximise the time available, many librarians have designed lecture/demonstration instructional sessions. While this instructional methodology is effective at imparting large amounts of information, a growing body of library and information science (LIS) literature indicates that students attending instructional sessions with active learning components have a greater rate of engagement and retention of skills and knowledge (Cilli-Turner 2015; Freeman et al. 2014; Prince 2004). The challenge, then, is to find an instructional methodology that makes best use of the limited time available, allows students to acquire basic IL skills, and also engages them in the deeper learning of critical thinking, reflection, and analysis.

To address this challenge, librarians at Lehman College turned to the “flipped classroom” methodology of instruction. Flipped learning is defined as “a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive, learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter” (Flipped Learning Network 2014). The flipped classroom instructional model offers the promise of maximising allotted class time and allowing for deeper learning. To do so, the model moves instruction from the in-class lecture to pre-class assignments, which are delivered via video or other multimedia (Lage et al. 2000).

Library faculty at Lehman College set out to measure the effectiveness of the flipped classroom in the context of disciplinary one-shot IL sessions. They conducted a multi-semester study of flipped library instruction for business management and education courses. The research questions undergirding the present study are:

- Do students in a flipped session demonstrate greater knowledge before their session than the students in a control session?
- Do flipped and control students demonstrate significant, positive improvement in knowledge after their session?

These questions were explored through a quasi-experimental research design that included pre- and post-testing of flipped and control classes in both business management and education.

2. Review of the literature

The past several years have seen a rapid increase in research into the flipped classroom in secondary and higher education (HE), much of it focused on student and teacher satisfaction with the new pedagogical approach (Hamdan et al. 2013; Yarbrow et al. 2014; Uzunboylu and Karagozlu 2015). O’Flaherty and Phillips (2015) performed a review of 28 articles on the flipped classroom from 2002-2014, concluding “...other than in the popular press, there is limited published evidence on student learning outcomes, particularly long term, from flipped learning approaches, particularly in HE.” (p.94). Lage et al. (2014) reported that there had been few quasi-experimental research studies on the flipped classroom in various disciplines of HE and Bishop and Verleger (2013) found similar results in the education literature.

In the library literature, flipped classroom methods and pre-class homework assignments have been employed in a range of instructional settings, including single sessions (Brooks 2014; Datig and Ruswick 2013; Madden and Martinez 2015; Pannabecker et al. 2014; Rodriguez 2016), embedded instruction (Gibes and James 2015) and stand-alone library courses (Rivera 2015). However, as is the case for the broader literature on the flipped classroom, librarians have primarily studied student, librarian, and instructor satisfaction with flipped instructional design as opposed to real impact on student learning (Arnold-Garza 2014; Brooks 2014; Datig and Ruswick 2013; Gibes and James 2015; Goetz and Barber 2015; Madden and Martinez 2015; Pannabecker et al. 2014).

There are exceptions: Brooks (2014) performed a quasi-experimental study using pre- and post-tests, feedback surveys, and content analysis of student bibliographies, to assess the flipped classroom in one-shot IL instruction. Students improved their scores from pre- to post-test to a statistically significant degree in both the experimental and the control group, but the post-test scores of both groups were nearly identical. Although this would suggest that the flipped method had no impact on learning, the bibliographic content analysis revealed interesting differences between the experimental and control group. After studying the citations of 10 randomly selected papers, Brooks observed that students in the flipped class used a total of 32 scholarly sources compared to those in the control group, who used a total of 19. Because the flipped group watched a video on scholarly sources as part of their pre-class assignment, Brooks speculates that “...these

students arrived at the face-to-face instruction session with more clarity on these types of sources, and therefore were able to learn and apply the concept with more depth” (p.232).

The flipped classroom has also been successfully implemented in multi-week IL courses. Stonebraker (2015) performed a case study of the flipped method in a for-credit business IL course. The study showed learning growth in key content areas as evidenced on pre- and post-tests. Rivera (2015) implemented the flipped classroom in a seven-week, required but non-credit bearing course on library research. Students in the two flipped sections of the course performed better on the course post-test (both with average scores of 90% out of 100%), than those in the two traditional courses (averages of 84% and 78%). Rivera further observed positive changes in the structure of class sessions, noting that they “...consisted of more hands-on and student-centred activities and less lecture and demonstration. This left time for the instructor to take more questions from the students and more opportunity to assist them while they worked through the assignments in class and lent itself to opportunities for students to assist each other with the assignments” (p.39).

Goetz and Barber’s (2015) quasi-experimental study of homework assignments in IL sessions is not directly concerned with the flipped classroom. Rather, the study examined the value of a pre-class homework assignment for education graduate students attending IL sessions. Students in the experimental group successfully completed their homework assignments and scored higher on the post-test than their peers in the control group. However, the researchers found that these higher scores were due largely to the experimental group’s performance on a single question. These results, coupled with what the researchers described as the “low performance” of students in both groups on the post-test, suggested that improvements in post-test design may be necessary (p.184). The researchers also point out the value of their quasi-experimental research design, noting that: “The use of a control group made it possible for the researchers to evaluate the pre-session homework exercise independently of the impact of classroom instruction, which was identical for both groups” (p.184). Thus, they point to the value of the quasi-experimental, pre/post-test design for evaluating the effectiveness of individual aspects of the flipped classroom: pre-class homework and in-class active learning.

At least two studies of the flipped classroom in IL have used such a research design (Brooks 2014; Rivera 2015), but none to our knowledge have delved into the question of which aspects of the flipped classroom – multimedia homework or classroom work designed for active learning – have the greatest benefit on student learning outcomes. This study will begin to fill this gap in the research.

3. Methods

3.1 Business class design

Students in Introductory Business Management and Advanced Business Management (both undergraduate classes) complete complex, team-based research projects. Each team gathers a range of information on a single company, including legal cases, SWOT analyses, competitor and industry profiles, news articles, CEO biographies, peer-reviewed articles, and financial data.

IL sessions for these courses must cover the essential business databases for finding company information, such as *Lexis-Nexis Company Dossier*, *Business Source Complete*, and *Business Insight Essentials*, as well as corporate websites and SEC filings. Traditionally, the Business Liaison Librarian covered these topics in a single, fast-paced session. The class design, which was maintained for the control sessions of this study, was a lecture/demo in which the librarian presented databases and research resources while students watched or, if possible, followed along on their own computers.

For the present study, the Business Liaison Librarian articulated five learning objectives for these classes:

- Students will be able to conduct searches in Lexis-Nexis Company Dossier to retrieve key information on target companies.
- Students will be able retrieve financial information, market research reports, SWOT analyses, market share, and other information from Business Insights Essentials.
- Students will be able to retrieve articles on companies and industries from Business Source Complete.
- Students will be able to retrieve articles on companies and industries from the *New York Times* and *Wall Street Journal*.
- Students will be able to retrieve 10K annual reports and select information from them relevant to topics in their group project.

The flipped business IL classes transferred the learning objective related to Lexis-Nexis Company Dossier to a homework assignment. The homework required students to view a seven-and-a-half-minute screencast video on Company Dossier. Next, they used a worksheet to complete basic exercises in Lexis-Nexis, such as finding their company's ticker symbol. Thus, the homework assignment had a scaffolded design, starting with an introductory video that students viewed before moving toward practical, hands-on learning with the worksheet.

Library faculty took several steps to ensure completion of the homework assignment. One week before each IL session, two librarians visited the classes and explained the research study, distributed informed consent forms, and assigned the homework. The worksheet was provided in hardcopy, but was also available on a LibGuide that was posted to each course's Blackboard site. In order to incentivise the homework, the business faculty gave students participation credit for completing the assignment.

The following week, a 75-minute class period was devoted to library instruction. During the first 10 minutes of class, students completed a pre-test. Next, the Business Liaison Librarian reviewed the homework assignment to assess student understanding; explained the class structure; and asked students to sit with their project group members. Groups then completed hands-on, structured activities designed to teach techniques for retrieving business data and literature from various databases. These activities were built around worksheets that students completed and took home for practise and review. At the end of the class, students completed a post-test.

3.2 Education class design

The curriculum and focus of the education classes was naturally somewhat different from that of the business classes. The education students, some of whom were graduate-level, were working on an annotated bibliography. The Education Librarian connects research assignments such as this to the inquiry process, both to help students develop their research skills and to provide them with a conceptual framework they can share with their own students.

To that end, the Education Librarian crafted a homework assignment intended to introduce a conceptual framework for inquiry and allow students to use their own research topics to engage with this framework. Students in the experimental group watched a video about the inquiry process and then completed a worksheet. The worksheet asked students to reflect on their research topic; engage in the first four steps of the inquiry process; and conduct searches of the Education Source database for related information. An information sheet on search strategies was attached to their assignment and students were given the option to use it as they searched. During the first semester of this study, these assignments were distributed via email; however, after seeing the success of the in-person distribution method used for the business classes, the Education Librarian began to give out the assignments in person, at the class immediately prior to the library visit.

The experimental group came to their library IL session having completed this pre-class homework assignment. Once they were in the library, the experiences of the experimental and control groups were very similar. The learning objectives were:

- Participants will be able to identify the stages of inquiry and apply the first four elements of the inquiry model to their own research.
- Participants will be able to construct searches using keywords and subject terms.
- Participants will be able to assess search results and determine the most appropriate next steps to limit or expand their results.

After the pre-test was administered, classes began with a discussion about the inquiry process, including consideration of how educators might use it in their teaching. For the experimental group, this discussion was intended to be a quick review to ensure that those who hadn't completed the homework had similar information to those who had. For the control group, students were then asked to think about their own research topic and use the inquiry model to identify areas of research. In the experimental group, the students came to class having already thought about their topics and having done some initial identification of keywords. In both classes, a student's research topic was selected and the Education Librarian led the class in a discussion to brainstorm keywords and identify synonyms. The search strategies exploration in the experimental group classes included an interactive discussion and small group work focused on how strategies can narrow or expand the search results. The control group classes received a brief interactive lecture. After modelling a search based on a student's research topic, the remainder of the class time was spent on independent or small group student research. There was a quick reflection at the end of class about search tools and strategies that were especially effective. All classes concluded with the post-test.

3.3 Pre- and post-tests

To be included in the study, students needed to complete both a pre- and a post-test (Appendices A and B), which were administered at the beginning and end of their library session. Tests were scored for students who had signed permission forms for the research study, and test score were anonymised.

For both business and education classes, the pre-test asked for full time/part time status, semesters of college completed, courses in business or education completed, and whether they had attended a class taught by a librarian. These questions were intended to assess the students' previous experience with research assignments at the college level.

For the business classes, there were 10 multiple-choice questions testing course content; for the education classes, there were seven multiple-choice questions and three narrative questions. Most of the content questions on the business test pertained to specific library databases and what kinds of information might be found within them. This focus grew directly out of the business assignment, which required students to gather many kinds of information on a single company or industry. The test questions for the education classes, on the other hand, addressed students' knowledge of search strategies and their understanding of the inquiry process. The narrative question included on the education test required students to create a sample search.

Multiple choice questions on both tests included questions with one correct answer as well as questions with two or more correct answers. Multiple choice questions were scored as 1 (all correct), .5 (partially correct), or 0 (incorrect). Of the three narrative questions, one was scored. This question was scored using a rubric that measured student use of search strategies, understanding of limiting or expanding a search, and their use of search vocabulary. With this rubric, scores on the narrative question were weighted with the same 0-1 scale as the multiple choice questions; this narrative question was then incorporated into the final score.

Finally, the post-test included two questions intended to gauge students' perceptions of the library sessions. Both of these questions were rated on a five-point Likert scale. One question asked about enjoyment of the class session, another asked how helpful the pre-assignment was (for

those who completed it, i.e. the flipped group). An open-ended comments space also allowed students to make comments about the library session.

While the non-randomised control group pre- and post-test design is widely used in educational research (Ary et al. 2014), these measures have been questioned on grounds of whether learning has occurred as a result of an experimental intervention, or whether the difference in test scores occurred as a result of natural maturation (p.340). In this study, pre- and post-tests were given within one class period. Therefore, there was insufficient time for natural maturation to occur. Most important, the pre-test at the beginning of the class was given within a few days of the experimental group doing the homework assignment, which was the differentiating variable between the two groups.

3.4 Participants

The entire flipped classroom study included 245 undergraduate and graduate students. Of these, 201 were undergraduate students in one of 13 business classes. The business classes were taught by five instructors over the course of three semesters (Spring 2014, Autumn 2014, Spring 2015). 44 of the students in the study were enrolled in one of six education classes; 10 of these students were enrolled at the graduate level, while the remainder were undergraduates. The education classes were taught by three instructors over the course of two semesters (Spring 2014, Spring 2015). Only those students who signed informed consent documents were included in the study. Therefore, 16 (12 business, four education) participants in the flipped condition are not included in the statistical analysis because they either failed to answer a question asking if they had completed the homework assignment, or answered this question in the negative (i.e., they had not completed the homework assignment).

Eight business classes (N=133) were assigned to the flipped condition and five business classes (N=64) were assigned to the control condition. In business, classes were selected from the Introductory Business Management and Advanced Business Management courses taught during each of the semesters of the study. For each course, the Business Liaison Librarian enlisted several business professors teaching the course to participate in this study. The Business Librarian designated some sections of each course as control groups, and others as flipped. Over the course of three semesters, the number of flipped sections was greater than the number of control due to the interest of the Business Liaison Librarian and business professors in experimenting with the flipped method. The entire cohort of flipped business classes (N=133) was approximately double the size of the cohort of control classes (N=64). The sample groups were not randomly assigned, and therefore were not selected to contain an equal number of participants. The main objective was to enlist a sufficient number in each group (flipped and control) to yield significant results.

Three education classes (N=20) were assigned to the flipped condition and three education classes (N=24) were assigned to the control condition. Classes were selected from a graduate research class in the teaching English to speakers of other languages (TESOL) programme as well as two undergraduate education classes: one that focused on childhood education and the other that focused on middle school/high school education. Education professors who had scheduled library visits for two sections of the same course were invited to participate. Since each course had two sections, the Education Librarian assigned one section as control and the other as experimental. The control/experimental assignments were done without consultation with the teaching staff.

As discussed above, the pre-test for all business and education classes included standardised demographic questions intended to help gauge students' previous experience with academic research. These questions revealed that 84.1% of the business students and 71.9% of the education students were enrolled full-time. Among business students, 48.3% had completed at least four business classes, and 66.2% had completed at least four semesters of college; further, 54.2% had taken at least one class session taught by a librarian. Among undergraduate education

students, 52.9% had completed at least four education classes, and 73.5% had completed at least four semesters of college. The education cohort also included 10 graduate students, 80% of whom were in their first three semesters of graduate school. Within the entire education cohort, 65.9% had taken at least one class session taught by a librarian.

Within the business cohort, the flipped and control groups did not differ in distribution of full or part time students, semester and year enrolled in the study, number of semesters completed, or number of business classes completed. There were differences between the groups with regards to distribution of day or evening classes (more flipped participants were enrolled in a daytime course, more control participants were enrolled in an evening course, $X^2 = 49.25$, $p < .001$), and distribution of flipped and control classes among the business professors ($X^2 = 41.70$, $p < .001$).

Within the education cohort, the flipped and control business groups did not differ on the variables of full or part time student, professors who taught class, number of semesters completed, or number of education classes completed.

3.5 Data and analysis

This study posed two research questions and hypotheses:

- Do students in a flipped session demonstrate greater knowledge before their one-shot session than the students in a control session?
- Do flipped and control students demonstrate significant, positive improvement in knowledge after their one-shot session?

For each research question, the analyses were run separately for business and education classes. To test hypothesis 1, independent sample t-tests were run to evaluate the difference in mean pre-test scores between the flipped and control groups. To test hypothesis 2, paired t-tests were run to evaluate the difference from mean pre-test scores to mean post-test scores, for both the flipped and control groups. Further, independent sample t-tests were run to evaluate the difference in mean post-test scores between the flipped and control groups.

3.6 Ethical research

Before starting the research project, Lehman College's Institutional Review Board evaluated the project and gave clearance for it to proceed. Before each library session, the researchers visited classes to distribute the homework assignments and complete the informed consent process. The researchers read an informed consent statement, distributed the agreement on paper, and requested that students sign and return the form if they were willing to have their scores included in the analysis. Students were invited to ask questions in private and were assured that no benefit or harm would result from participation or non-participation in the research. This process was repeated at the start of the library sessions for any student who was absent from the previous class. Since every student completed the pre- and the post-tests, and all the students in a given section experienced the same lesson, there was no harm in terms of learning to those who did not participate in the research project.

4. Results

4.1 Business classes

To evaluate whether there was a difference in performance on the pre-test between flipped and control conditions, an independent sample t-test was run. The flipped group was found to perform significantly better on the pre-test ($M=4.32$, $sd= 1.48$), compared to the control group ($M=3.05$, $sd=1.45$), $t(187)=5.71$, $p < .001$).

To evaluate whether the flipped and control groups improved from pre-test to post-test, two paired sample t-tests were run. The control group demonstrated a significant improvement from pre-test (M=3.05, SD=1.45) to post test (M=4.69, SD=1.66), $t(187)=-6.94$, $p<.001$. The flipped group did not demonstrate a significant improvement from pre-test (M=4.32, SD=1.48) to post test (M=4.29, SD=1.60), $t(120)=.215$, $p=.831$. The two groups did not differ significantly on the post-test (flipped group, M=4.29, SD=1.60; control group, M=4.69, SD=1.66), $t(187)=-1.64$, $p=.108$. All means, standard deviations, and t-test results can be found in Table 1.

Table 1: Business cohort pre- and post-test means and standard deviations, and within and between group t-tests

	Pre-test	Post-test		
	Mean (SD)	Mean (SD)	t (df)	p
Flipped	4.32 (1.48)	4.29 (1.60)	.215 (120)	.831
Control	3.05 (1.45)	4.69 (1.66)	-6.94 (67)	<.001*
t (df)	5.71 (187)	-1.64 (187)		
p	<.001*	.108		

* = $p<.05$

The effect of the IL classes on business students was overwhelmingly positive in both the flipped and control groups, according to their answers to two questions on the post-test (Table 2). In response to whether the students found the class enjoyable, the majority of students in both flipped and control groups “liked a lot” or “liked” the class. The flipped group had more students reporting that they “liked the class a lot”, but overall both groups had a majority of students who enjoyed the class. The comments box on the post-test contained positive comments for both flipped and control classes. However, less than 5% of students wrote comments, and those that did were brief, such as “very helpful” or “could have used more time”. On the question of whether the assignment was helpful, 84% of the flipped class found the assignment “very helpful” or “helpful”.

Table 2: Business cohort results of post-test qualitative questions

Did you enjoy the session?		How helpful was the homework assignment?
Flipped	Control	Flipped only
35.5% liked a lot	22.1% liked a lot	48.8% very helpful
41.3% liked	42.6% liked	35.5% helpful
22.5% neutral	30.9% neutral	14.0% neutral
0.8% disliked	1.5% disliked	0.8% not helpful
0.0% disliked a lot	1.5% disliked a lot	0.8% not helpful at all
.8% no answer	1.5% no answer	0.0% no answer

4.2 Education classes

To evaluate whether there was a difference in performance on the pre-test between flipped and control conditions, an independent sample t-test was run. The flipped group was not found to perform significantly better on the pre-test (M=4.00, SD=1.63) compared to the control group (M=3.33, SD=1.54), $t(38)=1.32$, $p=.195$.

To evaluate whether the flipped and control groups improved from pre-test to post-test, two paired sample t-tests were run. The control group did not demonstrate a significant improvement from pre-test (M=3.33, SD=1.54) to post test (M=3.88, SD=1.81), $t(23)=-1.51$, $p=.145$. The flipped group also did not demonstrate a significant improvement from pre-test (M=4.01, SD=1.63) to post test (M=4.58, SD=1.39), $t(15)=-1.25$, $p=.229$. The flipped group did not differ significantly on post-test (M=4.58, SD=1.39) from the control group (M=3.88, SD=1.81), $t(38)=1.31$, $p=.197$. All means, standard deviations, and t-test results can be found in Table 3.

Table 3: Education cohort pre- and post-test means and standard deviations, and within and between group t-tests

	Pre-test	Post-test		
	Mean (SD)	Mean (SD)	t (df)	p
Flipped	4.01 (1.63)	4.58 (1.39)	-1.25 (15)	.229
Control	3.33 (1.54)	3.88 (1.81)	-1.51 (23)	.145
t (df)	1.32 (38)	1.31 (38)		
p	.195	.197		

The effect of the IL classes on education students was positive in both the flipped and control groups, according to their answers to three questions on the post-test (Table 4). Although the cohorts in both flipped and control groups were too small to yield statistically significant results, the answers to qualitative questions revealed results worth noting. 79% of the control group “liked a lot” or “liked” the class, compared to 56% of the flipped group. The homework assignment was thought to be “very helpful” or “helpful” by a majority of students in the flipped group.

Table 4: Education cohort results of post-test qualitative questions

Did you enjoy the session?		How helpful was the homework assignment?
Flipped	Control	Flipped
6.3% liked a lot	45.8% liked a lot	25.0% very helpful
50.0% liked	33.3% liked	43.8% helpful
31.3% neutral	8.3% neutral	18.8% neutral
0.0% disliked	0.0% disliked	0.0% not helpful
0.0% disliked a lot	0.0% disliked a lot	0.0% not helpful at all
12.5% no answer	12.5% no answer	12.5% no answer

4.3 Limitations

Students were not randomly assigned to the group condition. In each semester, all professors teaching Business Management (Introductory and Advanced) were invited to participate in the study. However, classes were not randomly assigned to the flipped or controlled condition. This could mean that class variables (motivation, for example) influenced the impact of group condition on the outcome measures, and it eliminates the ability to make causal inferences.

Further, the low N of the education classes likely impacted our ability to identify significant differences between the flipped and control conditions. The cohort of flipped business classes (N=133) was approximately double the size of the cohort of control classes (N=64). Nevertheless, we believe that our data for the business classes shows significant results.

The education groups consisted of both undergraduate and graduate students. In any study it might be of concern that two different populations, in this case, undergraduate and graduate students, were researched together. To address this concern, the analysis was run with and without graduate students. In both cases nothing changed as to the significance of the results. It may be worth noting that only two of the graduate students had more than three classes completed at the time of the study. On the other hand, most of the undergraduate students indicated that they had taken more than three education classes and had completed more than five semesters of college.

Although we tested for several variables, future research might include testing for additional variables such as age and gender to determine whether these impact the learning outcomes.

5. Discussion

The hypothesis that students in the flipped classes would score significantly higher on the pre-test compared to the control session was upheld by the scores of the business classes. These results were notable for a number of reasons. Most crucially, they indicate that students entered the flipped class with greater mastery of basic concepts than the control group. The homework assignment for the business classes was intended to convey basic information about Lexis-Nexis Company Dossier, as well as core facts about public and private companies and finding and using a company's ticker symbol. These learning objectives, which call on lower-order thinking skills, are precisely what flipped classroom advocates suggest are appropriate for homework assignments (Allen 2014; Galway et al. 2014; Honeycutt and Garrett 2014; Sams and Bergmann 2013; See and Conry 2014). The pre-test scores suggest that a homework assignment of this kind can indeed

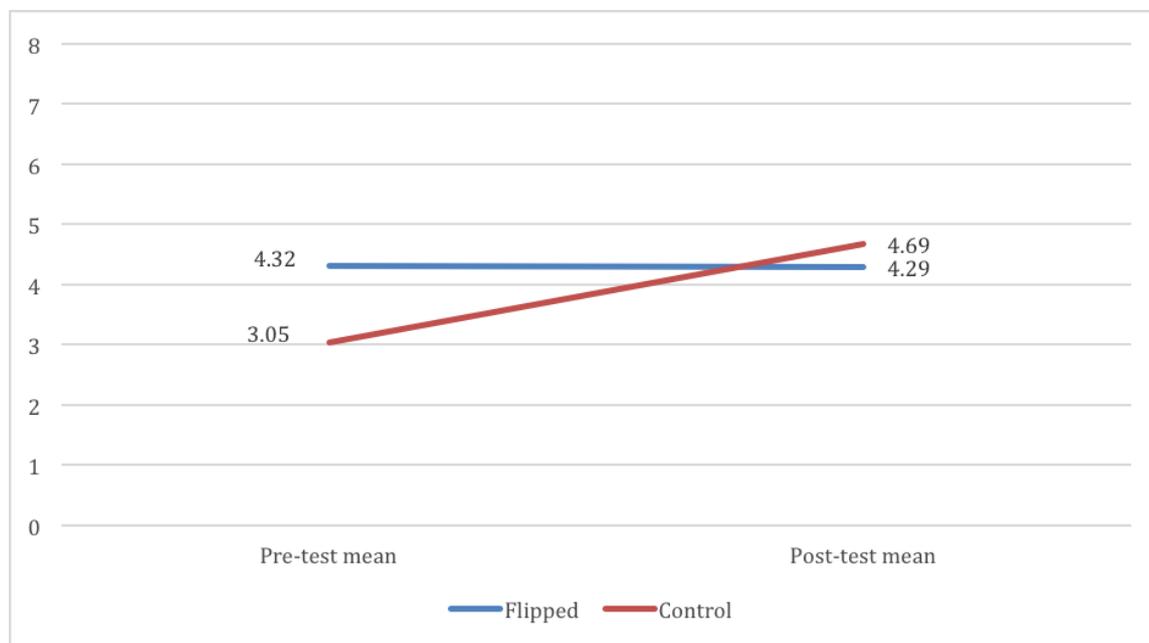
impart basic knowledge, and prepare students to work more effectively on higher-level concepts in the active classroom.

It is also significant to note that a very high percentage of students in the flipped business classes completed the homework assignment (N=133; 92% completed N=122). This result should not be taken for granted, as several studies have grappled with the difficulty of incentivising library homework assignments (Arnold-Garza 2014; Rivera 2015). Moreover, 48.8% of the business flipped participants found the assignment “very helpful”; 35.5% found it “helpful”. These self-reported perceptions support the conclusion that the homework assignment contributed to student learning.

Students in the flipped sections of the education classes earned a mean score on the pre-test that was better than that of the control class, but this difference was not statistically significant. As stated earlier, a larger sample size may have erased or solidified this difference. It is also worth noting that the education homework called on both lower-order as well as higher-order thinking skills. Students were asked to analyse their research topic using a new conceptual framework for inquiry. They were also asked to learn and practise new search strategies. The difficulty of this homework assignment may account for the absence of a significant difference between the flipped and control education groups on the pre-test.

Although students in the flipped business classes came to class with a distinct advantage over the control group, that advantage disappeared by the end of the class sessions. Students in the control group increased their test scores substantially, ending their sessions with post-test scores that were not significantly different from those of the flipped group (Figure 1). To put it another way, the business control group learned enough in their lecture-style class session to close the gap between them and the flipped group. Thus, only students in the control condition demonstrated significant, positive improvement after their one-shot session.

Figure 1: Mean change from pre-test to post- test, business classes

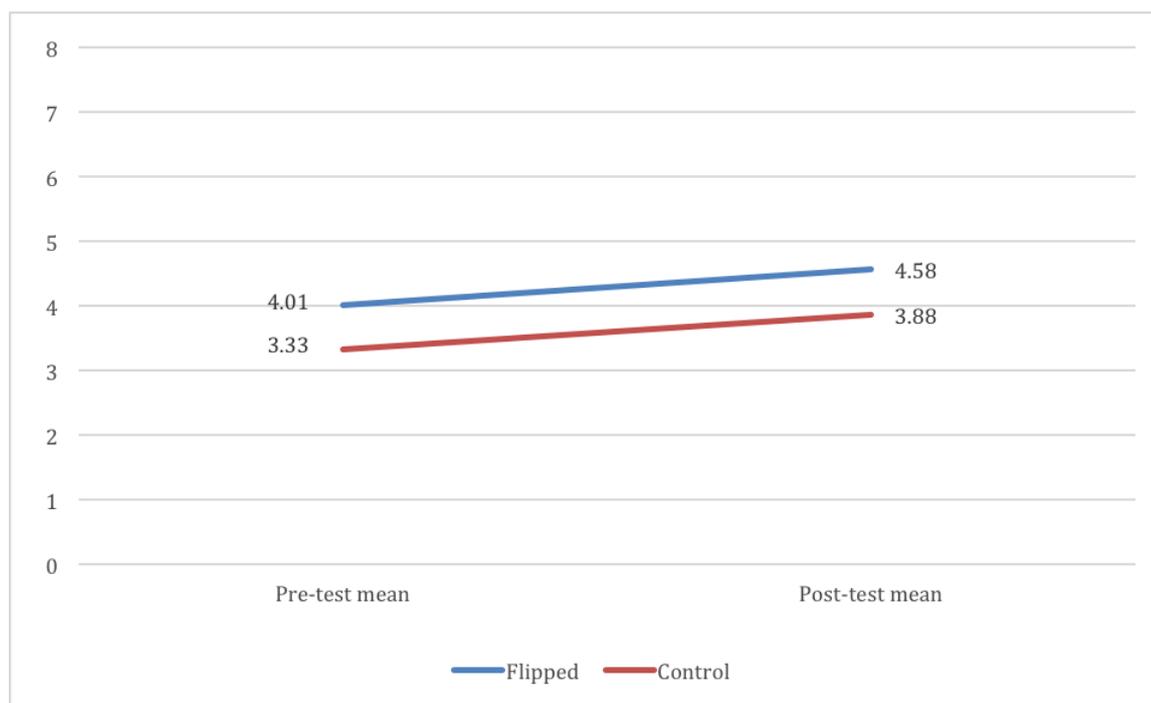


This hypothesis grew from an interest in testing the relative efficacy of active learning versus lecture/demonstration strategies. The results may indicate that a well-executed lecture/demonstration class is just as effective, if not more so, than hands-on group activities. On the other hand, it could be that the class design and post-test failed to draw on the pedagogical value of active learning. Flipped classroom proponents argue that one benefit of the strategy is that it transfers higher-order thinking into the classroom, rather than asking students to perform this

difficult work at home (Allen 2014; Galway et al. 2014; Honeycutt and Garrett 2014; Sams and Bergmann 2013; See and Conry 2014). The business class design in this study taught and tested very similar skills both for the homework and the in-class active learning. Perhaps post-test scores would have been higher in flipped classes had the in-class work called on students to compare and evaluate sources, analyse data and financial records, or develop sophisticated search queries. Those who favour active learning also suggest that its benefit lies in part in retention (Cherney 2008; Prince 2004); perhaps post-test scores would have been higher for the flipped group had the test been administered after several weeks or at the end of the semester.

The mean post-test score of the flipped education sessions was higher than that of the control sessions. Although the results are not statistically significant, some intriguing possibilities emerge from this small sample. Both the flipped and the control classes increased their mean scores from pre- to post-test by about the same amount: .57 and .55 respectively. This may reflect the very similar format of the flipped and control sessions. As mentioned earlier, the Education Librarian routinely uses active learning in her classes, and her control sessions made use of active learning techniques such as large group discussion, individual reflection, and hand-on activities. In this circumstance, the only variable in the education class was the pre-class assignment. This likely explains why control and flipped scores from pre- to post-test increase along a virtually parallel line, as shown in Figure 2: the flipped and control groups came to the class session at different levels, then experienced essentially the same class design, which increased their scores at essentially the same rate.

Figure 2: Mean change from pre-test to post- test, education classes



The qualitative results in both business and education provide support for the flipped model at least as much as the traditional class in terms of student satisfaction. Student attitudes are critical for successful IL one-shot classes where there is only a very short time to engage students and establish productive communication. The majority of students in business and education reported positive enjoyment of the class, both flipped and control. Most significant to the results of this study are the attitudinal results indicating that 84% of students in business flipped classes, and over 50% of students in education classes, found the assignment “very helpful” or “helpful”. This finding, along with the statistically-significant result of the value of the assignment in the flipped business class, provides impetus for further research to identify ways to structure effective assignments for flipped IL classes.

6. Implications and conclusions

The results from this study indicate that pre-class homework assignments prepare students for one-shot IL sessions. Given how inconvenient and time-intensive it is to create and assign homework to a one-shot session, it is helpful to know there will be a pay-off. Further, while others have struggled to incentivise homework assignments (Bruff 2015; Center for Innovative Teaching and Learning, University of Indiana 2015; Center for Research on Teaching and Learning, University of Michigan 2016; Honeycutt 2016), this study saw a remarkably high level of completion: 92% in business; 80% in education. This may be due to the tight integration of the IL session with the course assignments, and to the support of the teaching staff – factors that Rodriguez (2016) also notes were helpful in her implementation of flipped instruction for one-shot sessions. Those interested in using the flipped model might also consider visiting the classes before the one-shot sessions to introduce themselves and explain the rationale behind the homework. Assignments that are directly related to class content or research papers, and that are endorsed by teaching staff, will likely be completed by more students and be treated with greater seriousness.

The success of the homework assignment, along with the post-test results of the business class, suggests another best practise for flipped one-shot IL sessions: increasing the difficulty level of in-class assignments to focus on developing higher-order thinking skills. Students in the flipped business sessions came to class substantially better-prepared than their peers in the control sessions – an advantage that might have been capitalised on by scaffolding more complex learning objectives for the in-class group activities. This study was begun before the final release of the Association of College and Research Libraries (ACRL) *Framework for Information Literacy for Higher Education*, which posits that core abstract concepts, called “threshold concepts,” should be the foundation for planning of library instructions (ACRL 2015; Hofer et al. 2013). A follow-up study might use these threshold concepts to develop classroom activities that build on higher-order thinking skills, as is advocated in more orthodox implementations of the flipped classroom (Allen 2014; Brame 2013; Galway et al. 2014; Honeycutt and Garrett 2014; Sams and Bergmann 2013; See and Conry 2014).

Ultimately, this study provides more evidence that the flipped classroom model, especially using multimedia homework assignments, can be effective for one-shot library IL classes.

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Appendix A: Pre-/post-test, business classes

Pre-Test includes Part 1 and Part 2. Post-Test includes Part 2 and Part 3.

Part 1

1. Are you a...
 - Full-time student (12 credits or more)
 - Part-time student (fewer than 12 credits)
2. How many semesters of college have you completed (here or at any college)?
 - [freshman]
 - 2-3 [sophomore]
 - 4-5 [junior]
 - More than 5 [senior]
3. How many business courses have you completed?
 - 0-3 [novice]
 - 4-6 [intermediate]
 - More than 6 [advanced]
4. How confident are you that you can complete the research needed for your papers and group project?
 - 1 Not confident at all
 - 2
 - 3 Neutral/Not sure
 - 4
 - 5 Very confident
5. Have you ever had a class session taught by a librarian (here or at any other college)?
 - Yes
 - No
 - Maybe (I don't remember!)

Part 2

Please answer **ALL** questions below:

1. Public Companies are

Check **ALL** that are correct

- Owned by individuals who purchase shares
- Traded on stock exchanges
- Owned by the government
- Required to file reports to the Securities and Exchange Commission

2. Which is the best source to find the status of a company's recent legal cases?

Check **ONE** box below

- Wall Street Journal
- Lexis-Nexis Company Dossier
- Google Scholar
- Business Encyclopedia

3. To find [or calculate] the Market Share of a company, I can use

Check **ALL** that are correct

- Company Revenue
- Company's press releases
- Interview with CEO (Chief Executive Officer)
- Industry Revenue

4. Good sources for a company's competitors and brands are

Check **ALL** that are correct

- Wikipedia
- Lexis-Nexis Company Dossier
- Business Insights Essentials
- Hoover's on Lexis Nexis Academic

5. What is a 10-K report?

Check **ALL** that are correct

- Report filed by a company every year to the Securities and Exchange Commission
- Report by company lawyers on lawsuits
- Report included in glossy Annual Report
- A corporate tax form filed with the Internal Revenue Service

6. Which section or sections of a 10-K report will help most with an environmental analysis?

Check **ALL** that are correct

- Financial Data
- Compensation
- Business description
- Risk Factors

7. To find articles about an industry, it is best to search using

Check **ALL** that are correct

- NAICS / Industry Code
- Locations of companies
- Names of Company Executives
- Subject term for industry

8. Article searches on a company will be more relevant if I

Check **ALL** that are correct

- Enter the proper name of the company in the search box
- Select the Company field to search on company name
- Search on the company Ticker Symbol

9. To find articles from academic business journals, the best source below would be

Check **ONE** box below

- Google
- Business Source Complete
- Huffington Post
- Wall Street Journal

10. One way to find articles on a company's ethical dilemmas is to search using a Subject term related to ethics and the company's proper Company Name.

How would I find the right Subject term and Company Name to use?

Check **ONE** box below

- Look in a dictionary
- Use a legal encyclopedia
- Use a database's thesaurus or "look-up" lists
- Read journal articles on the company

Part 3

1. How confident are you that you can complete the research needed for your final assignment?

- 1 - Not very confident at all
- 2 - Not confident
- 3 - Neutral/Not sure
- 4 - Sort of confident
- 5 - Very confident

2. Did you enjoy today's library session?

- 1 - Disliked it a lot
- 2 - Disliked it
- 3 - Neutral
- 4 - Liked it
- 5 - Liked it a lot

3. If you completed the pre-class assignment, how helpful was it?

- 1 - Not helpful at all
- 2 - Not helpful
- 3 - Neutral
- 4 - Helpful
- 5 - Very helpful
- I did not complete a pre-class assignment

4. Comments:

Appendix B: Pre-/post-test, education classes

Pre-Test includes Part 1 and Part 2. Post-Test includes Part 2 and Part 3.

Part 1

1. Are you a...
 - Full-time student (12 credits or more)
 - Part-time student (fewer than 12 credits)
2. How many semesters of college have you completed (here or at any college)?
 - 0-1
 - 2-3
 - 4-5
 - More than 5
3. How many education courses have you completed?
 - 0-1
 - 2-3
 - More than 3
4. How confident are you that you can complete the research needed for your research assignment?
 - 1 - Not very confident at all
 - 2 - Not confident
 - 3 - Neutral/Not sure
 - 4 - Sort of confident
 - 5 - Very confident
5. Have you ever had a class session taught by a librarian (here or at any other college)?
 - Yes
 - No
 - Maybe (I don't remember!)

Part 2

6. Inquiry as a life-long activity is driven by:
(select one)
 - Resources and information
 - Questioning and critical thinking
 - Libraries
 - Professors and assignments

7. How do you analyze a topic?

(select as many as apply)

- Identify words related to the topic
- Think deeply about a topic
- Break the topic into components or essential features
- All of the above

8. When searching to get the best results for your topic, in a scholarly database like Education Source, is it best to:

(select one)

- Search by using the most detailed and specific words for a topic
- Develop a question related to your topic and input it into the search box
- Use a single word or brief phrase related to your topic in a search box to start, assess the results, and then limit or expand as appropriate
- None of the above

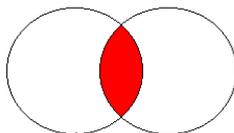
9. Peer-reviewed articles are helpful for scholarly research because:

(select as many as apply)

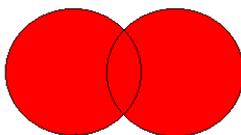
- They have been evaluated by a panel of experts
- They present scholarly opinions on books by other scholars
- They carry more authority than an article in a trade publication like *Education Week*
- They often present new or original research carried out by educators or education researchers

10. Draw a line to match the appropriate diagram with AND, OR, & NOT

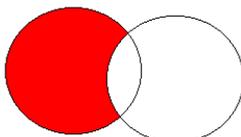
OR



NOT



AND



11. What would happen if you searched for school* in Education Source (i.e., if you added an asterisk to the end of the word)?

(select as many as apply)

- Your search results include articles with school in the subject, abstract, or title but no other forms of the word

- Nothing. This isn't an effective way to search
- Your search results include articles with the words school, schooling, and schools in the subject, abstract, or title
- Your search results are expanded or increased
- Your search results are narrowed or reduced

12. What would happen if you searched for "inclusive education" in Education Source (i.e., if you put the two words in quotes)?

(select one)

- Your search results include only the articles with the phrase inclusive education
- Your search results include all articles with either the word inclusive or education
- Your search results include all articles with the phrase inclusive education and with either the word inclusive or the word education
- Your search results include only the articles with the phrase inclusive education and articles with similar concepts

13. You are writing a paper on the second language acquisition of middle school children who recently immigrated to the United States. You searched for Second Language Acquisition and found 9,200 articles. At a quick glance the first few articles in the search results are way off your topic. What would you do now? List three things you could do. Be specific about search words and the steps (strategies) you would take:

14. What do you know about searching databases like Education Source?

15. What do you wonder about searching databases like Education Source?

Part 3

16. How confident are you that you can complete the research needed for your assignment?

- 1 - Not very confident at all
- 2 - Not confident
- 3 - Neutral/Not sure
- 4 - Sort of confident
- 5 - Very confident

17. Did you enjoy today's library session?

- 1 - Disliked it a lot
- 2 - Disliked it
- 3 - Neutral
- 4 - Liked it
- 5 - Liked it a lot

18. If you completed the pre-class assignment, how helpful was it?

- 1 - Not helpful at all
- 2 - Not helpful
- 3 - Neutral
- 4 - Helpful
- 5 - Very helpful
- I did not complete a pre-class assignment

19. Comments: