Exploring the Learning Outcomes of a Flipped Learning Methodology for
Post-Secondary Information Literacy Students: A Mixed Methods Approach

by

Richard McCue
Bachelor of Commerce, University of Victoria, 1995

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Abstract

The concept of flipped learning has received significant attention in recent years. In a flipped learning methodology, students view instructional videos and complete related assignments before class, so that face-to-face time with the instructor can be spent applying the knowledge and skills they were introduced to in the pre-class assignments. This study aims to determine the effectiveness of a flipped learning method for teaching information literacy (IL) skills to undergraduate students compared to a traditional teaching method where the majority of face-to-face time is spent instructing. To evaluate this, a mixed methods research design was used, where results from qualitative interviews helped explain findings from test data, assignment completion data, and major paper rubric data. The IL tests resulted in a small but insignificant test score improvement for flipped participants. Interviewed flipped participants reported mainly positive feelings toward flipped learning, whereas all flipped ESL interviewees related strong positive feedback towards flipped learning.

Keywords: flipped learning, active learning, blended learning, information literacy

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Dedication

I dedicate this to my partner Heather, for her lifelong support, and for motivating me when I needed it most.

Chapter One: Introduction

Background

Flipped learning methods are garnering significant interest among educators in post-secondary institutions (O'Flaherty & Phillips, 2015, p. 85), as educators explore more engaging pedagogies and look for possible solutions to campus space crunches (Graham, Woodfield, & Harrison, 2013, p. 345). In a flipped learning environment, students typically complete instructional classwork at home, using videos and exercises to learn new concepts and skills. Face-to-face (F2F) class time is then devoted primarily to active group exercises to build on the knowledge and skills from their pre-class "home work." The teacher is then available to assist and guide students who need help with the exercise during class time. This contrasts with some traditional teaching methods where students primarily listen to the lectures in class and then complete assigned homework on their own outside of class, without teacher assistance (Rivera, 2015, p. 34). Student expectations for the use of technology in their coursework are also changing as the ownership of digital communication devices and use of web-based collaborative tools become more pervasive (Gabriel et al., 2012, p. 8; McCue, 2016).

Statement of the Problem

Post-secondary instructors are implementing flipped learning methodologies for information literacy (IL) instruction without fully understanding how effective the teaching method is, and what student attitudes are towards the new pedagogy. Larger quantitative sample sizes are needed to determine if a flipped learning methodology for IL instruction produces higher summative test scores than a traditional teaching method. More substantial sample sizes are also needed for qualitative measures so that attitudes of student sub-groups can be more accurately represented. For example, research studies similar to Rivera (2015) have been

conducted to evaluate the impact of flipped learning methodologies on IL students (Hotle & Garrow, 2016; Trail & Hadley, 2010; Walton & Hepworth, 2013; Wilson, 2010); however, the author of this paper did not find any studies to date that had a large enough sample size to detect the effect size typical of moving to a flipped methodology in other disciplines.

Purpose of the Study

The purpose of this study was to determine whether or not a well-designed flipped learning methodology leads to higher summative assessment scores for IL instruction than a traditional instruction method. This study will also explore learner attitudes towards flipped learning and lecture-based IL instruction. To evaluate the flipped learning approach to IL instruction, a mixed methods, multi-phase sequential explanatory research design was used in order quantify, triangulate, and more deeply explore the impact of this pedagogy on IL learners. This included collecting quantitative data using an IL pre-test from control and treatment groups, collecting data on pre-class work completion from the treatment group, and then post-test data from both groups. This was followed up with interviews of a sample members from both groups to help explain the results with in-depth qualitative data and analysis. Finally, data was collected on IL performance on a major paper assignment to measure long-term skill retention (Creswell et al., 2011, p. 212). All data collected was analyzed to correlate and triangulate answers to the study's research questions.

Research Questions

Research question 1. How does a flipped learning methodology differ from a traditional teaching method in terms of undergraduate student achievement on IL and research skills test scores for students at the University of Victoria?

Research question 2. What is the relationship between completion of pre-class work (pre-training) and IL post-test scores for flipped learning participants?

Research question 3. What effect does a flipped learning methodology have on learner perception on IL instruction compared to a traditional approach?

Research question 4. What results emerge from comparing the quantitative test data of student achievement using different teaching methods with the qualitative interview data, exploring potential factors leading to differences in test scores?

Research question 5. What is the relationship between flipped learning pre-class work completed and achievement on the major paper assignment?

Definitions of Terms

Active learning - an alternative to lectures where students typically engage in activities like group discussions, pairing and sharing with one or two classmates, group problem solving, and learning by teaching.

Blended learning - a combination of F2F and online instruction. Currently, one of the major obstacles to evaluating blended learning research studies is the wide range of operational definitions for blended learning. Those definitions range from a traditional F2F class with some add-on online quizzes and supplemental materials offered through a learning management systems (LMS) like Moodle, to classes conducted almost completely online with limited F2F interaction (Graham et al., 2013, p. 333).

Face-to-face (F2F) instruction - any teaching that takes place with both the instructor and students located in the same physical space.

Flipped learning - when instruction for the most part moves out of F2F class time and

into short online videos and exercises that are completed as homework outside of the class. Class time is usually spent working on active learning, constructivist, project-based group learning activities.

Information literacy (IL) - is a set of knowledge and skills that enable individuals to recognize when additional information is needed and have the ability to find, evaluate, integrate, and use the new information.

Just-in-time learning - when new stills are taught or information is provided just as they are needed by learners to perform other tasks. This contrasts with just-in-case learning where skills are taught in-case they are needed without an immediate practical application.

Learning management system (LMS) - a web-based software platform that allows educational institutions to put their educational materials and resources on the Internet for their students. The materials are typically organized on a class-by-class basis with students only able to access the class websites they are registered in. Examples of LMS's are: Moodle, Blackboard, and Canvas.

Mixed methods research - a pragmatic approach to research that combines both qualitative and quantitative methods in various ways.

Online learning (or instruction) - usually refers to some form of distance education that uses a digital medium, like the Internet, to teach students.

Pedagogy - a term used to describe teaching methods.

Personal learning network (PLN) - an informal network of colleagues with which the learner interacts and learns from. Typically many of the interactions take place on the Internet via various social media websites and web applications.

Pragmatic worldview - a research context is a viewpoint that ascribes more value to research that generates practical uses and outcomes rather than representative accuracy.

Project-based learning (PBL) - an alternative to lectures and paper based exercises, is an approach where students engage a topic through problem solving. It is a form of active learning.

Qualitative research - a method of inquiry where researchers build a detailed understanding of human behaviour using tools such as interviewing, group discussions, and observations.

Quantitative research - a method that uses statistical, data driven techniques to measure a phenomenon or behaviour. Some tools used in quantitative research include surveys, public or private data sets, and social media data.

Retention - in an educational setting, is the degree to which students are able to remember and use the information or tools they learned in the past.

Delimitations

Two delimitations related to this research project were identified. First, the literature review focuses primarily on flipped and blended learning literature for IL instruction. The scope of the literature review was not broadened to all flipped and blended learning literature because a thorough search of all the literature was not possible given the large number of articles and papers on the subject.

Second, the population being studied consists of first-year university students taking part in IL instruction. Most IL instruction delivered by the University of Victoria Department of English and Library takes place in first-year classes. In addition, by focusing only on first-year students, this population has approximately the same level of experience with college-level

research, including IL.

Limitations

In order to protect sessional instructors, who are more vulnerable in university systems, the unit leadership decided to allow only full-time professors to participate in this study. This limited the sample size to three sections of the research and writing course, which were taught by two professors, with a total of just over 100 potential participants.

All but one of the quantitative pre-class quizzes were of custom design and therefore their validity and reliability have not yet been established. This was done in order to integrate in a seamless fashion with the curriculum of the course that is being partnered with for the study. In the end, the non-validated quantitative instruments were used as measures of effort based on whether the participants attempted them or not, rather than performance based evaluations.

As is often the case with data generated by qualitative interviews, while useful in obtaining detailed information about a phenomenon, generalizable findings cannot be made from the data. The marking of major papers for information literacy skills poses a significant reliability challenge to manage and mitigate. In order to help bring the marking of the two senior instructors involved in the research project into line, a common rubric to be used to mark the papers was created with the input of both instructors.

As is sometimes the case with new technologies, there may be a novelty effect with the flipped learning pedagogy that could have inspired the flipped treatment group to put more time and effort into the course than the traditional lecture group (Forsey, Low, & Glance, 2013, p. 94). While maybe a risk with truly new technologies, the LMS employed by the study is the same system used by most other courses on campus for a number of years, and the streaming video

technology being used in this study is similar to what is commonly used by students for entertainment purposes, lowering the risk of a confounding effect (YouTube Statistics, n.d.).

A surprising moderator in studies of large, multi-section courses is the tendency for the sections with lower numbers (e.g., section A01) to have consistently higher grades than sections with higher numbers (e.g., section A26). This is often an issue at institutions that allow students with higher grade point averages to register before other students (Richard Pickard, personal communication, June 2015).

Lastly, when trying to determine if a technology contributes to the effectiveness of instruction, the issue of "no difference expected," made famous by the Clark-Kozma (1994) debate, should be addressed. Clark (1994) argued that "media are mere vehicles that deliver instruction" and that "student achievement [is not influenced by a new delivery technology like video] any more than the truck that delivers our groceries causes changes in our nutrition" (p. 22). Kozma (1994) countered that while Clark's argument is often correct, "if media are going to influence learning, media must be designed to give us powerful new methods, and our methods must take appropriate advantage of a medium's capabilities" (p. 16).

Summary

This chapter presented a background on flipped learning for IL instruction, and identified a significant gap in the literature in the form of a lack of studies with large enough sample sizes to detect the small effect sizes round in flipped learning in other disciplines. In addition, this chapter discussed the purpose of the study, presented research questions, definition of key terms used throughout, discussed delimitations, and limitations.

The rest of this thesis is structured as follows: Chapter Two reviews the literature related to flipped learning in general and then focuses on flipped learning for IL instruction. Chapter Three presents the methodology and procedures used to obtain the quantitative and qualitative data for this study, including population, instrumentation and mixed methods analysis. Chapter Four presents the results of the study, including IL test results, pre-class assignment completion, major paper results, student interviews, correlational results, and ends reviewing each research question answered. Chapter Five discusses interpretation of the results, educational implications, limitations, and recommendations for future research.

Chapter Two: Theoretical Framework and Review of the Literature

Introduction

The structure of this chapter is as follows: First, the theoretical principles that frame this study on flipped learning for IL instruction are reviewed. Second, the methods employed in the literature review are presented. Third, a history of flipped learning and definitions of learning are discussed. Fourth, research involving flipped learning is explored both in the area of IL and more generally in higher education. Fifth, resources required to implement a flipped learning teaching method are reviewed along with specific considerations for embedding library-based IL instruction in research and writing classes. Lastly, quantitative measurement considerations will be discussed.

Theoretical Perspective

The two theoretical foundations for this study are cognitive load theory and constructivist learning theory. These theories directly relate to two key tools often employed in flipped learning methodologies, which are pre-work in the form of videos and exercises completed in preparation for class, and active, meaningful learning exercises in class.

Cognitive load theory (CLT). CLT describes learning in terms of the amount of information that must be processed in order for learning to take place. Short-term working memory is finite so if it becomes overwhelmed by too many simultaneous information processing inputs - possibly no more than two or three - learning suffers (Musallam, 2010). As Pass, Renkl, and Sweller (2004) pointed out, "long-term memory can greatly expand a learner's processing ability" (p. 2); however, moving information into long-term memory takes time, effort, and practice, or strategies.

Pre-training is one strategy to reduce the cognitive load on learners to manageable levels. Musallam (2010) found "a significant relationship between mental effort and pre-training for students, indicating that students needed to use fewer cognitive resources to learn new material when they received pre-training" (p. 92). The use of video and exercises is a common form of pre-training used to differentiate instruction for students at different levels of preparation and ability, and reduced cognitive load during class time in flipped learning curriculums. If the flipped learning curriculum used in this study reduces in-class cognitive loads for students, this could potentially have an impact on the retention of IL skills practiced during in-class exercises. IL skills retention could manifest itself in a change in student scores on IL tests which would address research questions one and two. A change in grades on participants' major paper assignments would help answer research question five, which relates to the relationship between pre-class work completed and achievement on the major paper assignment.

Constructivist learning theory. Constructivist learning theory is a philosophical perspective that describes how we learn. New knowledge is built on the learner's experiences and background and is often problem-based. For example, the instructor's role when using a constructivist pedagogy is to guide the learner and facilitate their problem solving, encouraging them to question, challenge, and arrive at their own conclusions (Gomboc-Turyan, 2012, p. 18). Some of the earliest practitioners of constructivist pedagogies include John Dewey, Maria Montessori, and David Kolb (Ultanir, 2012, p.196).

In 1994, David Jonassen suggested eight characteristics that contribute to constructivist learning environments:

1. Constructivist learning environments provide multiple representations of reality.

2. Multiple representations avoid oversimplification and represent the complexity of the real world.

3. Constructivist learning environments emphasize knowledge construction instead of knowledge reproduction.

4. Constructivist learning environments emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.

5. Constructivist learning environments provide learning environments such as real world settings or case-based learning instead of predetermined sequences of instruction.

6. Constructivist learning environments encourage thoughtful reflection on experience.

7. Constructivist learning environments allow for knowledge construction by context and content.

8. Constructivist learning environments support construction of knowledge through collaboration, not competition (p. 35).

Active, meaningful, problem-based learning exercises are often used in conjunction with flipped learning curriculums. If carefully prepared and paired with appropriate pre-class "scaffolding" work, these exercises can help students become more fully engaged in their active group work in-class. A difference in in-class engagement levels may lead to different learner perceptions of their in-class experience which would address research question three which relates to learner perception of IL instruction.

Review Methods

The majority of the articles included in this literature review came from the University of Victoria Library's Summon search engine, Google Scholar, and the Education Resources

Information Centre (ERIC) database. Twenty different search formulations were iterated through between 2013-10-08 and 2013-11-02, and the following search phrase was used for both Summon and Google Scholar: *("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills") NOT ("virtual reference" OR "distance learning" OR "technology literacy")*. In addition, the following delimiters were used: *Journal Articles, Peer Review, Not Book Review, Between Jan 2002 and October 2013*. This Summon query yielded 133 articles. The same search in Google Scholar produced 1770 articles. The exact same query in ERIC returned no results so the following search query with no limiters was used instead: *("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills")*. This search produced 21 results.

A second round of searching using the following search string was used between 2014-04-08 and 2014-04-14: ("*flipped classroom*" OR "*flipped class*" OR "*flipped learning*") AND "*information literacy*". In addition the following delimiters were used: *Peer Review, Not Book Review*. This yielded 66 results in Summon and 1958 results in Google Scholar.

In a third round of searching, four different search formulations were iterated through between 2014-04-08 and 2014-04-14, and the following two search phrases were used for both Summon and Google Scholar: A. (*"constructivist learning theory" AND "education"*). B. ("cognitive Load theory" AND "education"). In addition the following delimiters were used: *Peer Review, Not Book Review*. Search "A" Summon query yielded 1903 articles. The same search in Google Scholar produced 8100 articles. Search "B" Summon query yielded 1930 articles. The same search in Google Scholar produced 8730 articles.

The author also put out a call to his personal learning network on Twitter and via email,

asking colleagues to suggest favourite articles on flipped and blended learning. In the end, three colleagues suggested five pertinent articles for consideration. The author's graduate advisor suggested three articles related to technology and pedagogy that were helpful. The Zotero.org citation library was also searched for citations tagged with *"flipped learning"* and *"blended learning"*. Lastly, as the author read the journal articles selected, notes were made of references to other articles, which were added to a list for evaluation.

The criteria used to select articles from the Summon, Google Scholar, and ERIC searches were:

A. Is there relevant flipped or blended learning coverage in the article?

B. Is there some IL coverage in the article?

C. Is there an attempt to compare learning outcomes of flipped or blended learning with other pedagogies?

D. Is the article peer reviewed?

E. Is the article from a quality journal, reputable institution, or reputable scholar?

In the first round of searching, after reading 133 abstracts from the Summon search and applying the criteria above, 26 articles were selected to read. From the Google Scholar search of 1770 articles, all the Google Scholar article summaries were read and five articles selected. It should be noted that most of the Summon articles selected were among the Google Scholar articles reviewed. Of the 21 articles from the ERIC search, one was selected based on the criteria above. As with the Google search, most of the 21 articles had already been selected from the other search tools.

After the second round of searching, all 66 abstracts were read from the Summon search results and three articles were selected to read. The first 1000 summaries from the Google Scholar search were reviewed and two articles were read.

In a third round of searching, after reading the abstracts of the first 40 Summon search articles and applying the criteria above, the author selected five articles. From the Google Scholar search, the author read the abstracts of the first 40 articles and selected two to read.

The evaluation criteria employed for the articles suggested by the author's personal learning network, graduate advisor, Zotero.org search, and selected bibliography reviews were somewhat different. Instead of insisting on some discussion of IL in the articles, the articles selected had the strongest evidence-based research on flipped or blended learning regardless of whether or not IL was discussed. Using this criterion, all the articles from the personal learning network and graduate advisor were included. In order to assist future researchers, the author has made available a data set with all the search information, see Appendix A.

The History of Flipped Learning

Blended learning. Before the term "flipped learning" was coined, there was another related precursor trend in education called "blended learning" or "hybrid learning." Unlike flipped learning, what constitutes blended learning is not well defined. At its most basic level, blended learning is when a portion of learning takes place F2F and a portion takes place online (Bonk & Graham, 2006, p. 181). As Graham et al. (2013) points out, "much of the current research" around blended learning "has focused on attempting to describe and chart its boundaries" (p. 333). It should be noted that the blending of F2F classes with instruction delivered by technology outside the classroom has taken place for more than 20 years ("A

Wonderful Visual Timeline of The History of Classroom Technology," 2014). The adoption of

internet and web-based technologies, along with low-cost laptops and tablets, has made

interactive multimedia tools for learner instruction affordable and available in a way that was

only possible in the realm of sci-fi novelists two decades ago (Dziuban et al., 2004).

Some blended learning researchers and practitioners are advocating for a pedagogical

rather than delivery mode based definition for blended learning in order to make the definition

meaningful for comparison purposes (Dziuban, Hartman, & Moskal, 2004). More radically,

others argue that a new blended learning definition should only include transformational blends

that use technology to radically transform pedagogy (Guidry, 2010). Two examples of

transformational blends are the flipped active learning teaching method and "buffet blends,"

where students can pick and choose the mix of lecture, online, individual projects, and group

activities that best meet their needs (Graham et al., 2013, p. 338).

History of flipped learning. The term flipped learning or flipped classroom is often

credited to the Woodland Park High School chemistry teachers Jonathan Bergman and Aaron

Sams, although they are not the originators of the term (2012). Seven years previous, at the 11th

International Conference on College Teaching and Learning, a paper was presented titled, "The

'Classroom Flip': Using Web Course Management Tools to Become the Guide by the Side"

(Baker, 2000). In this conference paper, Baker advocates for the use of LMS's in order to allow

instructors to become "guides on the side." This "guide on the side" terminology was

appropriated from a 1993 article by King titled, "From Sage on the Stage To Guide on the Side."

King argued in his article that class time should be used to construct meaning rather than

transmit information. It should be noted the teaching methods that strongly resemble flipped

learning, often implemented without the assistance of digital technologies, have been around for many years. One could argue that a traditional graduate seminar, where learners read a common text and then arrive in class ready to discuss and debate, could be accurately described as a flipped learning method (Svinicki, 2013).

Flipped Learning in an Information Literacy Context

"Flipping" is one method of freeing up F2F class time for more active learning exercises (Zhang, Dang, & Amer, 2016, p. 2). "Rather than the teacher providing synchronous in-class group instruction, students are expected to use the video resources provided, along with other materials, to learn concepts and complete tasks on their own at their own pace and at a location convenient to the student" (Davies et al., 2013, p. 3). The pre-class work allows learners to pre-train, thus reducing their cognitive load in class and allowing them to more easily learn and retain in-class information (Musallam, 2010, p. 92). Class time is then mainly free for constructivist, active learning activities to build on what they have learned on their own, while encouraging critical thinking and problem solving. If any students are struggling, the instructor is available and has more time to provide individual help during class while other classmates are working on their problem based learning activity (Davies et al., 2013).

The structure of successful flipped learning classrooms are not monolithic but there are some features that frequently appear, particularly in successful flipped IL classes. According to Fogleman, Niedbala, and Bedell (2013), these features include:

- Active learning, using personal driving questions to motivate with authentic research tasks.

- Public artifacts, or a place to publicly publish finished works to help motivate some reluctant learners to do their best work.

- The instructor should be acting as a mentor and facilitator.

- Blending online and F2F by using discussion boards, blogs, and social media.

- Provide scaffolding for complex cognitive tasks. High quality user guides can provide just-in-time learning for research tasks, showing learners effective strategies and tools.

- Use writing as a learning process. "Writing is a unique way of learning because it relates new knowledge to preview our experience, engaging students in the process of articulating ideas and re-coding knowledge graphically through language" (Fogleman et al., 2013, p. 76).

Flipped, active learning teaching methods appear to have potential as engaging ways to teach IL skills (Campbell, Matthews, & Lempinen-Leedy, 2015, p. 581).

What is information literacy? IL is not just a library-based skillset that assists people in finding the information they are looking for and in "participating ethically in communities of learning" (American Library Association, 2015, p. 3). It also includes cognitive tools and mental frameworks to help them think critically at school and beyond into all aspects of their lives (Walton & Hepworth, 2012). In the context of envisioning a transformative blend or flipped pedagogy for IL instruction, Walton and Hepworth (2012) argue that "for an IL teaching intervention to be successful in engaging learners' higher cognitive states it seems self-evident that current thinking in pedagogical theory should be discussed and best practice incorporated into its design" (p. 56).

Constructivist / active learning. In a constructivist, active learning environment students typically engage in activities like group discussions, pairing and sharing with one or two classmates, group problem solving, or learning by teaching (Campbell, Matthews, & Lempinen-Leedy, 2015, p. 582). One of the main reasons active learning assignments are desirable for most academic instruction, is that 50- to 80-minute face-to-face class blocks do not allow a typical student to "reflect and retain the information" (Chen, Lin, & Chang, 2011, p. 520) they are presented with. If active learning assignments are well designed, they present learners with "real-life, open-ended, and multifaceted problems for students to discuss, analyse and solve," (Chen et al., 2011, p. 520) which can increase student engagement (Carroll, Tchangalova, & Harrington, 2016, p. 128). It should also be noted that the amount of time that students spend engaged in active learning projects is less important than "the quality of the learning activities themselves" that leads to student achievement (McNaught, Lam, & Cheng, 2011, p. 284). As Parker et al. (2005) related in the case study of their successful blended learning trial, "high impact on student's results was achieved by integration and contextualization, when the information skills resource was firmly embedded into the course" (p. 6).

Kirschner, Sweller, and Clark (2006) argued that there is little evidence that "instruction using [constructivist-based] minimal guidance" is effective in teaching novice to intermediate learners (p. 83). In response to that assertion, Helmo-Silver, Duncan, and Chinn (2007) countered that Kirschner et al. (2006) "mistakenly conflated" constructivist PBL with discovery learning (p. 99). PBL is not an instance of "minimally guided instruction," (p. 99) particularly when teachers scaffold student learning by "modeling, coaching, and eventually fading some of their support" (p. 101). Further, there is significant empirical evidence showing that scaffolded

PBL can help students increase achievement on standardized tests as well as "foster deep and meaningful learning" (p. 99).

Research Involving Flipped Learning

The majority of studies looking at the effectiveness of flipped and blended learning have found that students in online classes "perform modestly better" (Means et al., 2010, p. xiv) on formative and summative assessments than students in traditional F2F instruction studying the same material, and that students in flipped and blended learning classes "perform better" than F2F (O'Flaherty & Phillips, 2015, p. 85). The Sheridan College study on blended learning in a wide range of classes at their Ontario, Canada based campus concluded that students in their blended learning classes performed on average 1.2% worse on their formal assessments than F2F students (Waldman & Smith, 2013). Waldman and Smith (2013) did not report what pedagogical approaches the classes at their institution used in blending their courses so we are left in the dark as to why their results differ from the larger United States Department of Education meta-analysis (Means et al., 2010). There are, however, two clues that may point to reasons for their lack of success. First, 25% of students had technical problems with the software needed to do their course work including in-compatible web browsers and browser plugins that would not load properly (p. 26). Second, a student quote in the study seems to indicate that in at least some of the courses, the blending of online and virtual coursework was not optimal. The student reported that, "the material in class feels rushed. I felt that we spent 2 hours" in class "on theory and all the practical work was left to teach ourselves" (p. 24).

In one of the few flipped learning studies with a large sample size and a well-documented pedagogical approach, Chen and Stelzer (2010) at the University of Illinois at Urbana–

Champaign Physics Department report on a blended learning replacement curriculum (which fits

the definition of a flipped learning curriculum even though they did not label it as such) for

teaching first year physics students. In the entrance course, a number of multimedia learning

modules (or videos) were to be watched by students at home before class to help them

understand how to apply difficult to learn physics concepts. The LMS they created for their class

allowed them to track which students were watching the videos and which were not (Chen &

Stelzer, 2010, p. 1). After the videos were viewed but before class began, students were expected

to complete their readings and then take a short quiz. The video-viewers scored 16% higher on

the quizzes than the 40% of students who did not view the videos (p. 2). It is interesting to note

that the students who did not view the videos achieved the same lower average score as the

previous year's class did before the videos were introduced (Chen & Stelzer, 2010, p. 3). This is

one of the clearest examples of a digital video and online quiz system contributing to higher

scores on a formative assessment instrument. What is not clear is whether the videos and quizzes

contributed directly to the higher test scores or whether they facilitated an increase in the number

of study hours students engaged in.

  While flipped and blended learning classes tend to perform marginally better on formal

assessments, as was discussed in the Means et al. (2010) meta review, most studies were not able

to make conclusions or even put forward strong suspicions about the direction of causality. This

inability to assign causality is in large part because most flipped and blended learning studies are

quasi-experimental which increases threats in internal validity because of the non-random

assignment of participants, and potential for "selection factors that go uncontrolled in the

experiment" (Creswell, 2012, p. 301-311). For example, Chen, Lambert, and Guidry (2010)

found that there was a positive relationship between students who utilized Internet technologies in their learning and higher scores in traditional student engagement measures; however, no causal direction could be determined (p. 1230). Their data did suggest that the use of technology seemed to have a "stronger impact earlier in the college experience," which would seem to argue for encouraging the use of technology-enabled pedagogies in first year courses (p. 1230).

Pedagogy paramount. New educational technologies that enable flipped learning "are not a panaceas but, if used wisely, can help improve student learning and allow schools to offer a greater selection of interesting courses" (Friedman & Friedman, 2011, p. 162). It is the pedagogy that will make the difference (Clark, 1994). Some new technologies can enable novel methodologies like the multimedia learning modules in the physics department mentioned earlier. One of the major challenges for flipped learning researchers is to determine what computers and what instructors do well so their strengths can be blended into methodologies to provide students the best possible learning experience (Graham et al., 2013).

Davies et al. (2013) employed a "technology enhanced flipped classroom" in their study and found that this approach was both effective and scalable for their spreadsheet skills class. It better facilitated learning than the simulation-based training as well as the face-to-face control group. Students found the flipped methodology to be more motivating as it allowed for greater differentiation of instruction (Davies et al., 2013, p. 1). Learning analytics can be helpful in monitoring student progress and, over time, can start to identify trends that identify students at risk of not succeeding in class (Arnold & Pistilli, 2012, p. 268).

Resources Required

The prospect of changing instruction so that students perform better and reduce the classroom load on campus is enticing in times of shrinking budgets and increased enrolment. As Kozma (1994) predicted, computer hardware and networks have opened up opportunities for simulations at a much lower cost than previously possible. While this might not necessarily save significant amounts of money, it does open up opportunities for increased access to education, more engaging activities, and deeper learning opportunities for students.

Lower requirements for physical space. Several studies have been published over the past four years that report institutions reducing the hours of blended learning classroom space by 30-50% and in some cases adding more sections of a class taught by the same number of instructors as before (Friedman & Friedman, 2011). One of the early institutions to reduce costs and achieve "quality improvements" for students is the University of Central Florida (Graham et al., 2013, p. 345). By reducing F2F class time and improving scheduling efficiencies, they have reduced the need to expand their physical infrastructure as the number of students taking blended learning courses has grown (Graham et al., 2013). On the other hand, if an institution's goal is to increase F2F time between individual students and instructors, a flipped methodology is one way to achieve that (DaCosta & Jones, 2007).

Davies et al. (2013) found the flipped spreadsheet skills classes they studied achieved slightly better grades than the regular F2F classes and much better than simulation software classes. Davies et al. assert than an advantage of the flipped approach in their particular case was that it accommodated larger classes than their regular F2F class (2013, p.14). It should be noted, however, that it takes a significant up-front investment by faculty and instructional design staff

to create flipped learning materials, including videos and active exercises, before the savings can be realized (DaCosta & Jones, 2007).

Factors to consider when implementing flipped learning courses. Change is often difficult. Goertler (2012, p. 6-7) identified areas that institutions and instructors often find challenging when implementing Flipped Learning courses:

- Logistics: Access, reliability, and usability of technology, especially web applications and proprietary web browser plugins - plugins should be avoided unless absolutely necessary.

- Time, space and money: While there should be savings in the long run, there will be significant upfront expenditures of time and money to set up a flipped learning curriculum.

- Preparation: Not all faculty are prepared with the technical skills to change their course delivery using new technologies or to change a class that they perceive as working well enough.

It may seem obvious but instructors who are not forced to teach flipped learning classes and who are given appropriate training are more likely to be happy teaching the new classes (Graham et al., 2013, p. 7).

Embedding Information Literacy in Curriculum and Collaboration with Faculty

In many institutions, IL instruction is offered as a single stand-alone lecture while first year students make a "field trip" to the library as part of another class, most often English composition (Anderson & May, 2010, p. 496). Pedagogically speaking, this is not ideal as many of the tools and concepts covered in the IL class will not be used by the students until much later

in the semester. This increases the likelihood that the information will be forgotten or remembered incorrectly.

Embedding considerations. One potential solution to ameliorate the suboptimal course design of the stand-alone IL class is to create materials for students to use later in their course that will assist them at their point of research need. Traditionally, these materials have taken the form of handouts given to students at the end of their field trip and more recently, in the form of screencast tutorials (Trail & Hadley, 2010). The problem with these tutorials is that they may not be at-hand when students really need them as they work on class assignments weeks later.

To be effective, handout information and tutorials need to be available proximate to the point of need for students which in many classes is the assignment information in the LMS. Embedding the research guide handout or the video tutorials relevant to the assignment into the assignment instructions would be one way to make sure that students have the help they need when they need it (Wilson, 2010, p. 30). While this alone would not be the best approach for embedding IL in a course, it would be a significant improvement in pedagogy at institutions where, because of departmental politics, the "opportunities for developing anything beyond the traditional 'one-shot' library session are rare" (Borrelli & Johnson, 2012, p. 175).

Collaborating for student success. While a single lecture and embedded research guide in subsequent coursework helps students develop research skills, it may not be as effective for helping students master critical thinking skills. Ideally, instruction and activities would be embedded and interwoven into the curriculum with librarians and faculty collaborating to develop curriculum and active learning assignments to facilitate student acquisition of critical thinking skills (Wilson, 2010).

At the University of Rhode Island, librarians and select faculty members collaborated to integrate IL into their courses over a four-year period and observed increasingly positive results. At the beginning of the collaboration, 76% of students used library resources for their research and 44% used commercial websites (Fogleman et al., 2013). Four years later, 92% of the students used library resources in their research papers (a 16% increase) and only five percent of the students used commercial websites (an amazing 39% drop from 2007) (Fogleman et al., 2013). As Parker et al. (2005) pointed out, "a strong partnership between academics and librarians is one of the key factors in the effective integration of technology and pedagogy" (p. 1).

To create effective partnerships, librarians need to build strong working relationships with faculty members responsible for the development of curricula in courses where IL instruction is present or potentially included. Once relationships are in place, librarians can work with faculty to evaluate the IL needs of the course and plan active and problem based learning IL activities (Chen et al., 2011).

Measurement Considerations

As previously mentioned, when trying to determine if a technology contributes to the effectiveness of instruction, the issue of "no difference expected" needs to be addressed (Clark, 1994; Kozma, 1994). Clark (1994) argued that technology simply delivers instruction and, as such, does not affect student outcomes one way or another. Kozma (1994) countered that while in many cases Clark was correct, sometimes technology can enable new teaching methods that may influence student learning outcomes.

A historical perspective. When Clark (1994) defended his argument that the delivery media for instruction usually does not make a difference, the technological landscape was much different. VHS video tapes were the primary means of watching on-demand educational videos. Microsoft Windows 3.11 was the dominant desktop operating system and dial-up modems using phone lines achieving speeds of 0.028 Mps were state of the art (compared to 2-20 Mps in 2016). At the same time, educational content was just starting to be distributed through relatively expensive multi-media CD-ROM applications for Windows and Macintosh. With 20+ years of maturation and significant improvements in bandwidth, hardware speed, and authoring tool usability improvements, technology is now in a position to make a significant positive impact in the delivery of instruction. These technological advances enable new approaches to instruction like flipped classrooms and problem-based learning with virtual simulations and collaboration (Becker, 2010).

Pedagogy, not technology key. While the passage of time has been kind to the pro-technology arguments of Kosma (1994), it is important to remember Clark (1994) was correct in arguing that no matter what new technology we use, if we do not also change pedagogy, the educational outcomes will stay the same (Oblinger & Hawkins, 2006). An example of this is a study that was conducted at the University of North Texas where a comparison of student retention of IL skills was measured between sections instructed in a traditional F2F class, a blended class, and an online class. In each of the three classes, the instructional materials and pedagogy were kept as uniform as possible. Not surprisingly, the researchers found that there was no significant difference in IL skills retention between the three different lecture delivery methods (Anderson & May, 2010).

In a meta-study conducted by the United States Department of Education (Means et al., 2010), flipped and blended classes were found to have statistically significantly higher summative assessment scores than F2F classes. Given the lack of information about pedagogies used in the hundreds of studies they analyzed, they stated that "the observed advantage for blended learning conditions is not necessarily rooted in the media user per se and may reflect differences in content, pedagogy and learning time" (Means et al., 2010, p. xv). Typically, early in the adoption of new technologies, users do not take advantage of all the new capabilities available to them and tend to mimic activities that they are familiar with (Oblinger & Hawkins, 2006).

Summary

The United States Department of Education meta-analysis (2010) of online learning studies makes clear that, in general, flipped and blended learning approaches to instruction at colleges and universities tend to produce "learning advantages" for students (p. xviii). While there are documented exceptions to this, including Sheridan College in Ontario (Walman & Smith, 2013), because of the wide range of methodologies that have been labeled as blended learning, it is not possible to determine what causal factors contributed to the success or failure of specific blended learning implementations in the study (Means et al., 2010). Some suppositions have been made as to what reasons might be behind the higher scores on summative assessments including additional learning time and increased opportunities for collaboration, but no strong causal links have been proven to support these hypotheses to date (Means et al., 2010).

For an institution to successfully flip courses of study, they need strong support and buy-in from instructors (Graham, 2013, p. 344). It should be noted that while a flipped learning

methodology has the potential to save money in the long run, it does take significant time, effort, and resources in the short run to create a new curriculum, train instructors, and to finally implement (DaCosta & Jones, 2007). Only when we look at the full envelope of outcomes for students, staff, and instructors can we truly measure the desirability, at an institutional level, of a new teaching method like flipped learning. To see the flipped IL curriculum used in this study, see Appendix E.

The next chapter outlines the methods used to address the research questions for both the flipped learning and control groups in this quasi-experimental, mixed-methods thesis.

Chapter Three: Methods

Introduction

This chapter describes the methodology used to obtain both the quantitative and qualitative research results in order to answer the flipped learning for IL instruction research questions below. First, this chapter describes the research design, and reviews the study population. Next, the chapter outlines the instrumentation and procedures used to gather the data, and then the mixed method data analysis used to obtain the results. Finally, ethical considerations and the necessary research permissions obtained are reviewed.

Design

This study employs a mixed methods, multi-phase, sequential, explanatory research design (Johnson, Onwuegbuzie, & Turner, 2007, p. 115). The design was chosen in order to gain a "better understanding of the research problem and question" (Creswell, 2012, p. 535) than either a quantitative or qualitative method can do respectively. Mixed-methods research consists of collecting two or more strands of qualitative and quantitative data and then integrating the results of the strands to provide a more rounded picture of the phenomenon. Another term for this is triangulation (Johnson et al., 2007, p. 115).

The study began with a quantitative phase. Quantitative research in education involves the identification of a "research problem based on trends in the field or on the need to explain why something occurs" (Creswell, 2012, p. 13). Quantitative data in this study was obtained using standardized IL questions used for the pre-test before the start of IL instruction. After the post-test, a number of pre-class quizzes and exercises were assigned and data on completion rates gathered. After the IL instruction was complete, a post-test was administered (see Appendix B for the test questions).

The research design for the quantitative portions of the study was quasi-experimental. Creswell (2012) differentiates this research design from a true experimental design by explaining that instead of randomly assigning participants to treatment and control groups, "quasi-experiments include assignment, but not random assignment of participants to groups," because the experimenter cannot artificially create groups for the experiment (p. 310). This is often done in situations where groups are already formed and where it is operationally difficult or disruptive to randomly assign individuals who are already grouped in classes.

A quasi-experimental methodology was chosen to try to determine relationships between teaching methodology and IL learning outcomes. The independent variable for the study was instructional methodology. Dependent variables were IL test scores, pre-class assignment completion data, and IL marks on the major paper completed as part of the course.

Following the collection of IL test data and exercise completion data, semi-structured interviews were conducted with a sampling of students who participated in the study in order to gather qualitative data (see Appendix D for interview questions). The key characteristics of qualitative research are the exploration of "a problem and developing a detailed understanding of the central phenomenon," the collection of unstructured interview or written data from a small number of individuals, and then analyzing the data for themes and "interpreting the larger meaning of the findings" (Creswell, 2012, p. 16). In this study, students' perceptions of their IL instruction were explored.

The final quantitative data set gathered for the study was the graded marks for the students' major papers, which focused largely on IL skills (see Appendix C for the IL rubric

grading for the major paper). An outline of the research data collection procedures can be seen

below in Figure 1.

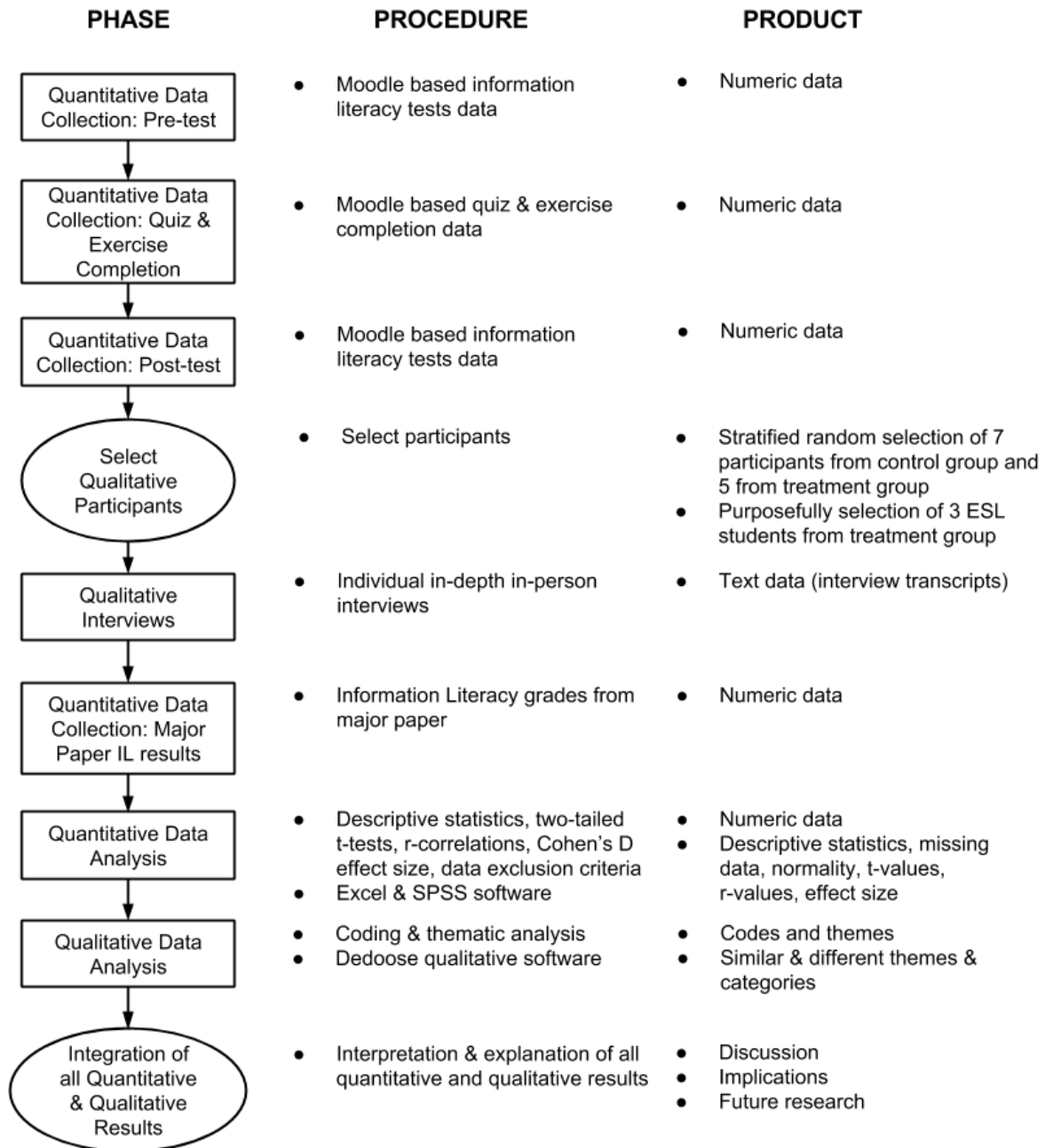| PHASE	PROCEDURE	PRODUCT
Quantitative Data Collection: Pre-test	• Moodle based information literacy tests data	• Numeric data
Quantitative Data Collection: Quiz & Exercise Completion	• Moodle based quiz & exercise completion data	• Numeric data
Quantitative Data Collection: Post-test	• Moodle based information literacy tests data	• Numeric data
Select Qualitative Participants	• Select participants	• Stratified random selection of 7 participants from control group and 5 from treatment group • Purposefully selection of 3 ESL students from treatment group
Qualitative Interviews	• Individual in-depth in-person interviews	• Text data (interview transcripts)
Quantitative Data Collection: Major Paper IL results	• Information Literacy grades from major paper	• Numeric data
Quantitative Data Analysis	• Descriptive statistics, two-tailed t-tests, r-correlations, Cohen's D effect size, data exclusion criteria • Excel & SPSS software	• Numeric data • Descriptive statistics, missing data, normality, t-values, r-values, effect size
Qualitative Data Analysis	• Coding & thematic analysis • Dedoose qualitative software	• Codes and themes • Similar & different themes & categories
Integration of all Quantitative & Qualitative Results	• Interpretation & explanation of all quantitative and qualitative results	• Discussion • Implications • Future research

Figure 1. Data collection procedures diagram.

Population

The target population of this study was University of Victoria students who participated in IL instruction in a first-year academic reading and writing course, English 135. IL is an integral part of this academic research and writing class, and in most sections of the class include a single visit to the library. Students are required to take a research and writing course as part of their degree requirements and, thus, enrolment from students representing a broad range of faculties and disciplines across campus.

Enrollment in the 2015 fall semester of English 135 was approximately 800 students. With the assistance of the English 135 program coordinator, two instructors teaching a total of three sections volunteered to participate in the study. All 106 students across the three sections were invited to participate in the study via a message in the class LMS that linked to the consent form. In the end, 73 students, or 69% of the total sample participated in all quantitative phases of the study (see Table 1). With this population and participation rate, a confidence level of 95% with a confidence interval of six percent was achieved (Creswell, 2012, p. 610).

Out of the three participating sections, students from one section were recruited to be part of the control group and were taught using primarily a traditional face-to-face instructional method that has been the default mode of IL instruction in the library. The treatment group was recruited from the two remaining classes taught by the second instructor who used a flipped learning methodology. Control group participants reported the ratio of lecture-based instruction to activities in their library instruction session to be 75% lecture and 25% activities, while the English 135 instructor estimated the in-library instruction ratio to be 90% lecture and 10% activities. The flipped group's IL in-class instruction ratio, including the library session, was

approximately 10% lecture and 90% activities.

Table 1.

Quantitative and Qualitative Sample Sizes

	Sample size	**Quantitative n**	**Qualitative n**
Control group (1 section)	35	20 (57%)	7 (20%)
Treatment group (2 sections)	71	53 (75%)	8 (11%)
Totals	106	73 (69%)	15 (14%)

Instrumentation

This section outlines in detail the methods used in order to obtain data to address each research question.

Quantitative measures. For the quantitative procedures, this study uses three assessment tools: the Web-based Augustana Student Survey Assessment of Information Literacy (WASSAIL) question bank ("ILAAP Team," 2016) (see Appendix B), pre-class assignment completion data from the class LMS (McCue, 2015), and a Rubric Assessment of Information Literacy Skills (RAILS) based ("RAILS," 2015) IL rubric (see Appendix C).

WASSAIL information literacy test. First, standardized WASSAIL multiple choice questions ("ILAAP Team," 2016) were used to create an IL test. The WASSAIL tool was designed to assess the IL skills of first and second year university students. The WASSAIL IL questions are Creative Commons licensed (BY-NC-SA) and were created by an expert group of Canadian IL librarians ("ILAAP Team," 2016). WASSAIL questions were tested for reliability

and validity in a variety of ways by the ILAPP including analyzing each question statistically "using 'goodness of fit' chi-squared tests, and kept, modified, or removed based on the results" (ILAPP Team, 2016). Where possible, questions were triangulated on concepts or answer questions in alternate forms in order to test for internal reliability (Creswell, 2012, p. 259).

The instrument consisted of 40 multiple choice questions from the WASSAIL question bank. These questions were specifically selected for the test with the assistance of an IL librarian from the University of Victoria in order to meet the specific academic and curricular needs of the first year research and writing class. The instrument was used for both the pre-test and post-test in order to measure the IL skills of the students before and after their IL instruction. Both the order of the questions, and the order in which the multiple choice answers were presented were randomized for each participant.

Pre-class assignment completion data. Second, as part of the flipped learning curriculum, a number of pre-class IL quizzes, videos, reading, and exercises were administered using the class LMS (McCue, 2015), and completion rates were used as a measure of effort (Kruck & Lending, 2003, p. 10). Because the pre-class quiz questions were created by the author and their validity has not been sufficiently verified, the participant scores on these quizzes were not analyzed. The quiz attempt data, however, was useful when combined with LMS data on pre-class videos watched and assignments completed as an additional measure of pre-class preparation effort by flipped learning participants.

Major paper information literacy rubric. An IL rubric was created and used to score the major paper assignment for the control and treatment groups on IL skills use and knowledge retention. The rubric was created with the input of the participating instructors (see Appendix C),

and was based on a rubric template from the Rubric Assessment of Information Literacy Skills website ("RAILS," 2015). RAILS operates in conjunction with the Association of College and Research Libraries, Assessment Immersion Program, and hosts a number of IL templates for higher education. These templates were created by academic librarians in order to "provide valid and reliable scores of student learning" ("RAILS," 2015).

The rubric focused on the four following IL areas:

- Determining information needs

- Critical evaluation of information and sources

- Synthesize information

- Use information ethically and legally

The rubric used a four-point scale, with higher levels of IL-related work placed in the "exemplary" category (score of 4) and the lowest quality of work place in the "unacceptable" category (score of 1). The rubric was used as a post-instruction summative measure of IL skill.

Qualitative measures. The only qualitative measure took the form of a semi-structured interview with student to explore their IL experiences both in class and in preparation for IL classes (see questions in Appendix D). The focus of the qualitative interviews was to explore and identify learner attitudes towards the traditional method for teaching IL compared to a flipped methodology. Some interview questions were asked with the specific goal of triangulating quantitative results, and in other cases to explore anomalous results.

Data Collection and Analysis

There were four different instruments used to gather data for this study, and each assessment tool was administered in a different way as can be seen in Figure 1.

WASSAIL information literacy test. The WASSAIL instrument was delivered to students in both control and treatment groups. Threats to internal validity are of special concern for quasi-experimental research designs in large part because of the non-random assignment of participants (Creswell, 2012, p. 310). In order to mitigate this threat, a pre-test/post-test methodology was used as an attempt to gauge a baseline level of IL knowledge so that any changes in performance could be measured in both the treatment and control groups. Other threats to validity for this type of research design include history, repeated testing, instrument change, and regression toward the mean (Creswell, 2012, p. 311). Of these additional threats to validity, only repeated testing represented a significant threat because of the pre-test/post-test methodology. This threat was mitigated by scheduling the pre- and post-tests seven weeks apart with significant related instruction in the intervening weeks. In addition, question and answer orders were randomized, and participants were not told their score on the pre-test or whether any of their answers were correct or incorrect.

The selected WASSAIL questions were loaded into the LMS shell for each class so that the test could be administered in the regular flow of the class. The test was assigned by both instructors as pre-class work before IL instruction began, and then as a pre-class assignment seven weeks later after the IL instruction ended. Class participation marks were given to students for the completion of the tests. The time to complete the tests was also collected. Data analysis for this quantitative phase took the following form: (a) clean and normalize the data, (b) generate descriptive statistics for appropriate questions: mean, mode, median, variance, standard deviation, and correlations. Inferential analyses were generated with the following pairs of data:

- Classroom methodology and post-test score gains using descriptive statistics as well as

correlation analysis (research question 1)

- Completion of pre-class work by the treatment group and post-test scores using descriptive statistics as well as correlation and covariance analysis (research question 2)

- Completion of pre-class work by the treatment group and IL scores on the major paper assignment for the class using descriptive statistics as well as correlation and covariance analysis (research question 5)

Pre-class assignment completion data. Because almost all the IL class pre-work was made available to students via their class LMS, tracking completion rates happened automatically within the LMS. As a student began to watch a video, or completed an assignment, the LMS would record that fact. The completion rate of these pre-class assignments was used to determine the amount of assigned work students were doing to prepare for class. A LMS report was downloaded with the completion status for each, video, quiz, and reading, for individual participants.

While integrating this instrument into the curriculum made it easier for students to complete, and more likely that they would complete it, this method does have some potential for abuse. For example, the LMS recorded when a student clicked on a video link, but could not tell us if the video was stopped. It is also possible that students did not put a full effort into the quizzes and exercises. That said, because no participation marks were attached to the pre-class assignments (other than the WASSAIL test mentioned before,) there was no incentive for students to pretend to complete the pre-class assignments.

Major paper information literacy rubric. A RAILS IL rubric template was customized in partnership with the two participating English research and writing instructors, and was to be

used by them to score the IL components of their students' major paper assignments. Because of unforeseen circumstances, only the control group used the rubric to grade the major paper. An analysis of the control group data uncovered a correlation between the major paper rubric score and the major paper grade for the control group. This correlation was strong (0.853), making the major paper final grade a strong proxy for the major paper rubric score. This is unsurprising as a large percentage of the major paper grade consists of IL-related elements, which appear in both measures.

The validity of this phase was high as the participants' use of IL skills was measured in their major paper assignment that was worth 25% of their grade for the class. In order to help maintain reliability between instructor grading of IL skills, both instructors were involved customizing the selected RAILS IL rubric so that they had the same basis for marking the students' IL efforts. Unfortunately a lack of time and resources made it impossible to implement further mechanisms to verify the reliability of their IL marking on the major paper assignments for participating students.

Similar to the approach used with the WASSAIL instrument, the data analysis for this quantitative phase took the following form: (a) clean and normalize the data, (b) generate descriptive statistics including: mean, mode, median, and standard deviation. Inferential analyses were used to evaluate pairs of data:

- Major paper and post-test scores using correlation and covariance tests (research question 1)

- Completion of pre-class work and major paper scores, using correlation and covariance tests (research question 5)

Student interviews. Out of the 73 participants in the study, 12 were selected for qualitative interviews using a stratified random sampling, and three ESL students were purposefully selected. The interviews were recorded with a digital audio recorder, and were held over a two-week period starting approximately eight weeks after the first IL pre-test was completed. Experimenter bias can potentially be a problem when researchers conduct interviews (Creswell, 2012, p. 229). Given the author's positive experiences using the treatment pedagogy in other settings, care was taken to "bracket" this personal bias when interviewing study participants (p. 229).

The interview data was transcribed and entered into a qualitative and mixed methods analysis software package. This was a cloud-based tool, called Dedoose ("Dedoose," n.d.). In order to work within British Columbia's privacy laws, the data was stripped of any personally identifiable information prior to uploading them into a private, secure login space. Interview transcripts were then analyzed and coded by the author. Following the initial coding, the codes were reviewed and grouped into a manageable number of codes and, finally, those codes were collapsed into four themes (Creswell, 2012, p. 244). With the themes from the interviews identified, the main findings were then summarized. Finally, limitations and suggestions for future research were outlined (Creswell, 2012, p. 258).

In order to validate the accuracy of the findings, two primary methods were employed. First, questions about time spent on pre-work and engagement levels were triangulated from similar questions in the quantitative strands of the study. Secondly, an external audit by an expert in the field of qualitative educational research was conducted to ensure that findings from the qualitative portion of this study were: (a) grounded in the data, (b) all inferences were logical, (c)

all themes appropriate, (d) what degree of researcher bias influenced the study, and (e) identify

strategies used for increasing credibility (Creswell, 2012, pp. 259-260). Other strategies to

validate the findings that were not pursued because of a lack of time and resources and should be

considered delimitations to the study include: (a) calculate inter-rater reliability rates by using

one or more independent researchers to code the interview data in addition to the primary

researcher, and (b) member check by conducting follow up interviews with participants to verify

if researcher interpretations are fair and accurate (Malterud, 2001, p. 485).

Mixed Methods Data Analysis Procedures

One of the methods employed after the data from each strand was collected and analyzed

was the triangulation of concepts between the strands to validate the responses in order to put

forward stronger conclusions (Creswell, 2012, p. 259). In addition, the researcher was able to

modify and inform the student interviews based on input from the quantitative instruments in

order to "refine, extend or explain the general picture" of the whole research environment

(Creswell, 2012, p. 542). A major limitation of multi-phase mixed methods designs is the extra

complexity of integrating the various strands and types of research together into a coherent

whole. Plans were made to take advantage of the richness that this extra complexity provides

(Creswell et al., 2011, p. 66).

Research Permission and Ethical Considerations

In order for this research proposal to move ahead, appropriate permissions were obtained

from The University of Victoria Human Research Ethics Board, the English Department, the

Library, instructors of the English sections involved, and librarian instructors. Informed consent

was sought from all student participants through their class LMS. The key initial contacts for

departmental permissions were the English department head and the University Librarian.

Because all the quantitative instruments were embedded in the course curriculum via the LMS, a perceived power-over issue for students mistaking the LMS embedded invitation to participate as an instructor-directed mandate to participate was possible (University of Victoria Ethics Board, 2013, p. 25). Care was taken in the invitation to make clear that participation or non-participation in the study would in no way affect their marks and that their instructors would not know who was and was not participating in the study until after final grades were submitted.

A small compensation for time spent, in the form of $10 Tim Horton gift cards, was given to the interview participants in the qualitative strand of research in recognition of the extra time and inconvenience that the interview process imposed on them. Care was taken to make sure that the participants knew that they would receive the compensation for time spent whether they completed the interview process or not (University of Victoria Ethics Board, 2013, p. 12).

Summary

This chapter described the methods used to obtain the quantitative and qualitative research data in order to answer the flipped learning for IL instruction research questions. The research design, study population was reviewed. Next, the instrumentation and procedures used to gather the data were outlined, followed by the mixed method data analysis used to obtain the results. Finally, ethical considerations and research permissions were reviewed.

Chapter Four: Results

Introduction

This chapter discusses the results of both the quantitative and qualitative phases of the study. Each of the quantitative tests are reviewed, including the IL pre-test and post-tests, pre-class assignment completion rates, as well as participant IL grades on their major paper assignment. Participant comments from the qualitative interviews relevant to research questions will also be presented. Because data was collected using four different instruments, the results of each will be reviewed individually in turn before examining correlational results.

WASSAIL Information Literacy Test

A pre-test/post-test methodology was used to administer the WASSAIL IL test in an attempt to quantify the difference in IL knowledge for both the control group and the flipped learning treatment group. Participants were tested before IL instruction took place, and then after instruction.

Excluded data. A review of the log data associated with the IL pre-test/post-tests showed that eight participants took less than 10 minutes to complete at least one of the 40-question multiple choice tests. It was determined from tests of the instrument and an analysis of the log data that it was not reasonably possible to complete the test in less than 10 minutes without guessing answers to questions. Because of this, the data from those eight participants were excluded from all of the pre-test/post-test data analysis. Three other participants had negative scores on the test which is another indicator of random guessing at answers, so their data was excluded. In total, 11 participants' data was excluded for the reasons outlined, leaving the data from 62 participants left to analyze.

Pre-test results. As is sometimes the case with quasi-experimental sample selection, the pre-test results indicated that there was a statistically significant difference in pre-instruction information literature ability between the control group (M=58, SD=19) and the flipped learning treatment groups (M=47, SD=21) conditions; $t(30)=2.04$, $p= 0.05$. The flipped learning group scored significantly lower on the test than the control group before any instruction took place, highlighting the importance of using a pre-test/post-test methodology to measure the difference between test scores rather than using only a post-test methodology. This result was not unexpected because the control group had a significantly lower section number than one of the two treatment groups, and as was discussed in the limitations section of chapter 1, lower numbered sections usually have higher average grades due to staggered enrollment access based on grades (e.g., section A01 would typically have higher grades than a section numbered A24). This, however, is only known through anecdotal evidence (Richard Pickard, personal communication, June 2015).
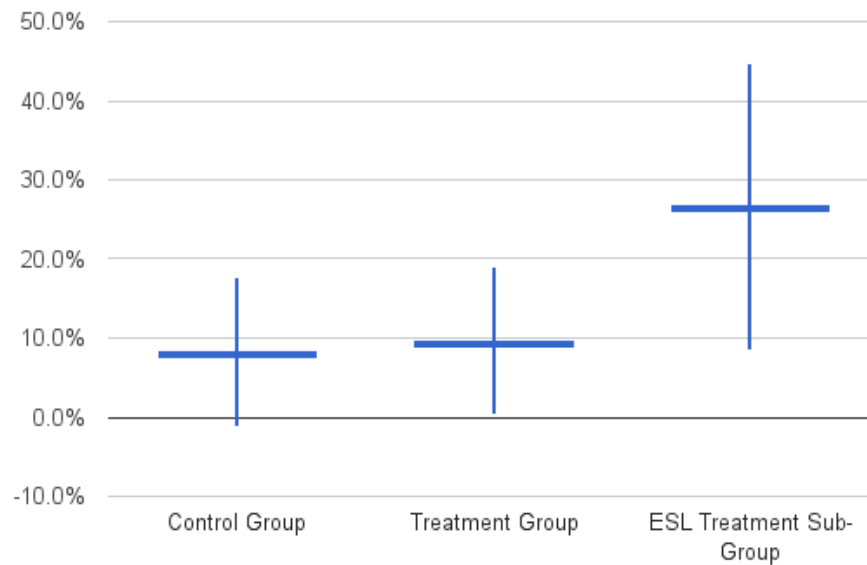
Descriptive results for pre-test and post-test. While the lecture format control group scored higher on the IL pre-test and post-test than the flipped learning treatment group, the treatment group experienced a higher test score gain between the pre-test and post-test (see Table 2). The control group registered a mean gain of eight percent (SD=21) and the treatment group a gain of 10% (SD=24).

Table 2.

Information Literacy Pre-Test and Post-Test Descriptive Statistics.

	Control Group	Treatment Group	ESL Treatment Sub-Group
n	17	45	6
Pre-Test (mean)	58%	47%	30%
Post-Test (mean)	67%	57%	56%
Post-Test confidence level	7%	9%	23%
Pre- to Post-Test GAIN (mean)	8%	10%	27%
Pre- to Post-Test GAIN confidence level	9%	9%	18%
Minutes to complete Post-Test (median)	21	21	40

A breakdown of the treatment group's test score gains yielded interesting findings. While the overall treatment group gain between the pre-test and post-test was 10%, the gain for the English as a Second Language (ESL) sub-group was 27% (SD=23) as can be seen in Figure 2.

Figure 2. Information literacy pre-test and post-test gains by group with confidence intervals.

      The last descriptive statistic comes from the measurement of the time it took to complete the information post-test by each of the groups. The median time to complete for both the lecture format control group and flipped treatment group was 21 minutes. Interestingly, the ESL treatment sub-group participants completed the post-test in a median time of 40 minutes as can be seen in Figure 3.
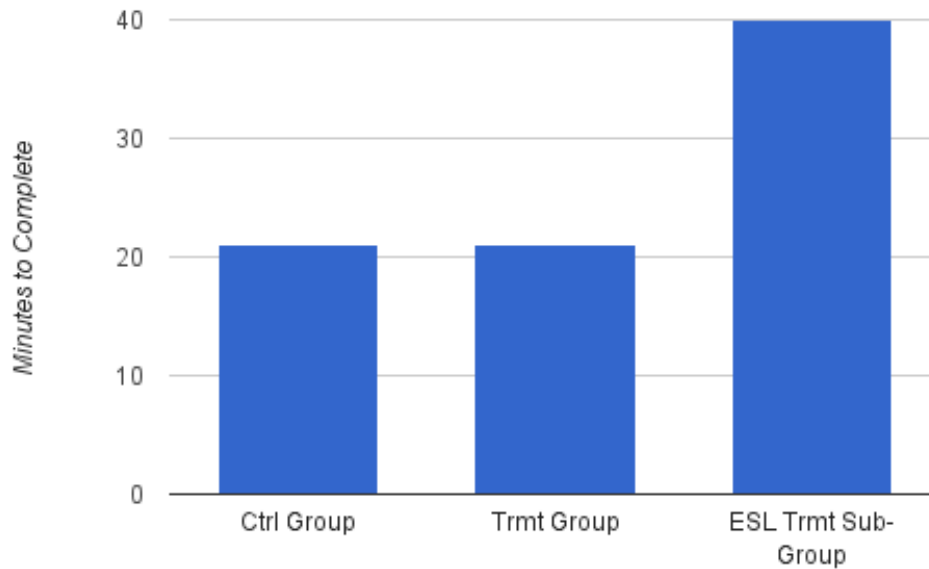
Figure 3. Information literacy post-test minutes to complete.

T-test gain results. The t-test analysis of the pre-test to post-test gains between the control group, and flipped learning treatment group shows that while the treatment group registered a larger 10% gain (SD=24) than the control group's eight percent gain (SD=21), the gain did not rise to the level of a significant difference (conditions: $t(30)=0.342$, $p= 0.05$) (see Table 3).

Table 3.

T-Test Control Group vs. Treatment Group Gain, Assuming Unequal Variances

	n	Mean	SD	t-cal	t-crit	df	p	Decision
Control Group	17	8.24	21.04	0.342	2.042	30	0.368	Reject
Treatment Group	45	10.39	23.95					

None of the other t-tests performed comparing the control group to treatment sub-groups rose to the level of a significant difference, although the ESL treatment sub-group came closest (see Table 4). The control group's mean grade increased eight percent (SD=21) and the mean grade of the ESL treatment participants increased by 27% (SD=23), conditions; $t(7)=1.614$, $p=0.05$. While the sample size of six ESL participants is not ideal for a parametric test like a t-test, it is sufficient when researching phenomenons with larger effect sizes as was the case with the ESL participants (Norman, 2010, p. 627-628).

Table 4.

T-test Control Group vs. ESL Treatment Sub-Group Gain, Assuming Unequal Variances

	n	Mean	SD	t-cal	t-crit	df	p	Decision
Control Group	17	8.24	21.04	1,614	2.365	7	0.075	Reject
ESL Treatment Sub-Group	6	26.67	22.67					

Cohen's D effect results. Cohen's D effect size tests were conducted to determine the size of the gain for the flipped learning treatment effect relative to the control group's effect size. A small Cohen's D effect is between 0.20 and 0.50. A medium effect is between 0.50 and 0.80. A large effect is above 0.80. The treatment group had an effect size of (0.067) (see Table 5). This effect size was consistent with what was reported in the Department of Education meta-review by Means et al. (2010) for similar sized studies using quasi-experimental designs (p. 34) . Unfortunately, this small effect size did not rise to the level of statistically significant difference

because it was inside the margin of error. A larger sample size was needed in order for an effect size this small to be outside the margin of error. The treatment group as a whole showed no significant effect (0.067), however the ESL treatment sub-group participants had a large effect size (0.863).

Table 5.

Cohen's D Effect size: Pre-Test and Post-Test Gain Compared to Control Group

	Treatment Group	ESL Treatment Sub-Group
Cohen's D Test between Control & Treatment Groups	0.067	0.863

Pre-Class Assignment Completion

 Included data. Because no participation marks were awarded for the quizzes and pre-class exercises and these activities were integral parts of the learning curriculum, there were no problems with participants randomly guessing answers to questions in order to earn participation marks like there was for the IL tests. As a result, no data from participants was omitted from this analysis. In all, there were 53 participants in the flipped learning treatment group for this analysis. By design, no members of the control group completed the quizzes and pre-class exercises because those activities were part of the flipped learning curriculum.

 The online pre-class quizzes were used by the author as a measure of pre-class effort (Kruck & Lending, 2003, p. 10) in combination with completed exercises, videos, and tasks as measured by completion rates in the LMS. This was done because the quizzes were created by

the author and had not been sufficiently evaluated for validity and reliability. In addition, from a

pedagogy perspective, the pre-class quizzes in particular were assigned as a formative

assessment, to give students direct feedback on how well they were prepared for class.

Descriptive statistics. Overall, the treatment group completed an average of 34 (SD=14)

pre-class tasks, which included short videos, quizzes, readings, and assignments. The ESL sub-

group completed slightly more pre-class assignments on average, with 35 tasks completed

(SD=14).
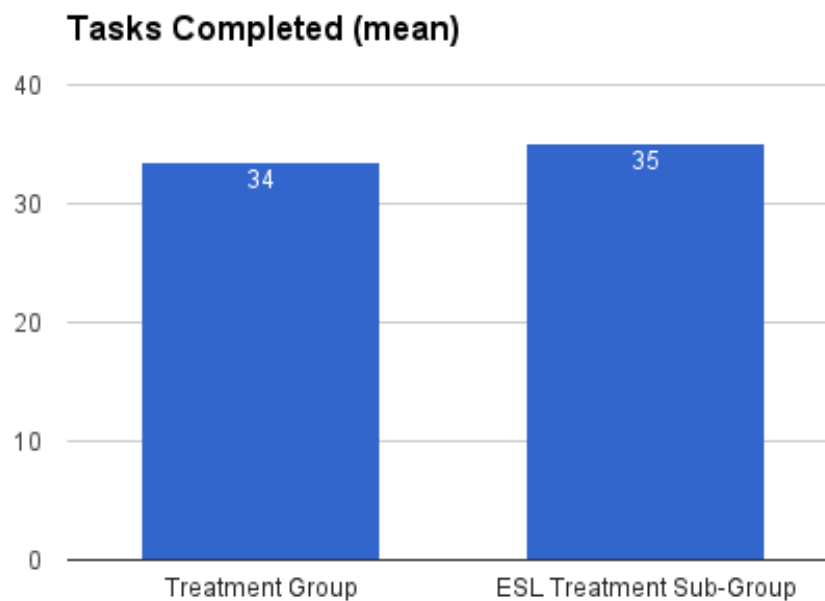
Figure 4. Tasks completed by treatment groups.

Major Paper Information Literacy Rubric

A RAILS project IL rubric was selected, and then modified with the input of the two

participating instructors, in order grade the IL portions of the major paper assignment for the

course. Both instructors agreed to use the rubric to grade the IL portions of their students' major

paper; however, while the control group instructor used the rubric, the treatment group professor

did not due to unforeseen circumstances. Fortunately, a correlation analysis of the control

group's rubric score and major paper grade showed a strong Pearson correlation of 0.853

between the two evaluations as can be seen in Figure 5. This was not surprising as much of the

criteria for the major paper grade was made up of IL components. Because of this strong

correlation, the author used the major paper grade as proxy for the unavailable treatment group
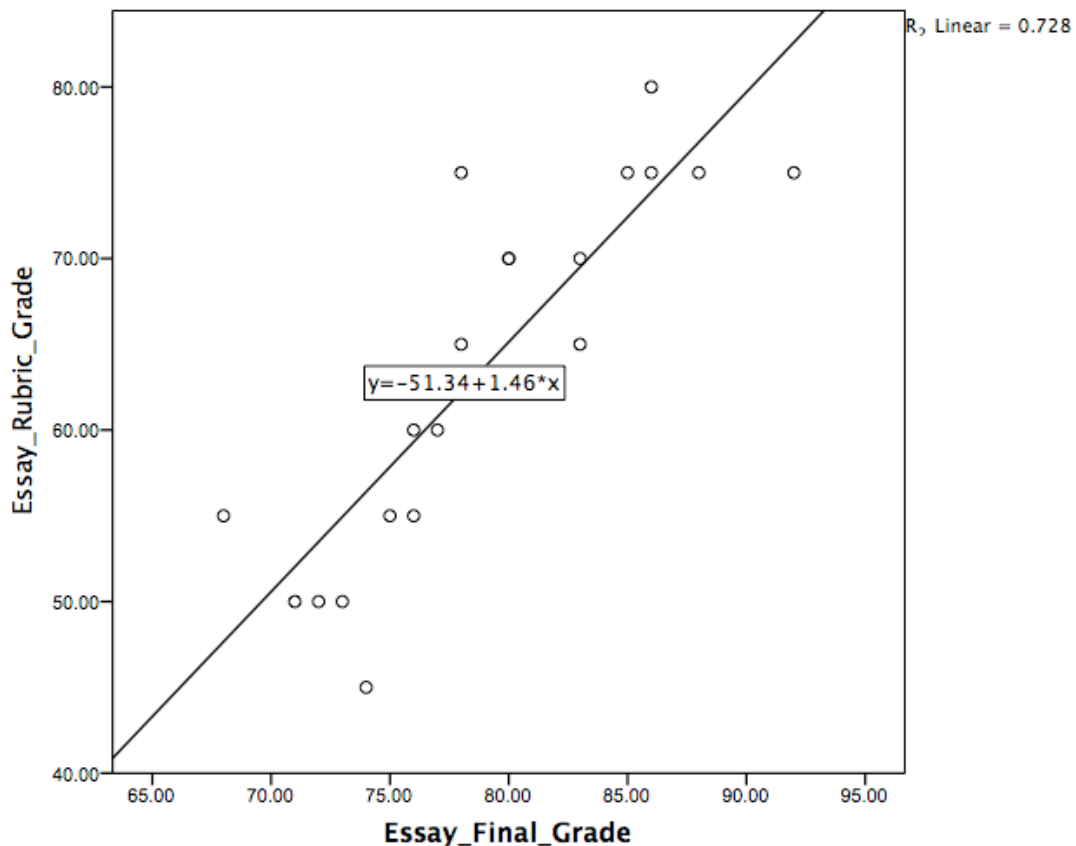
rubric score.

R_2 Linear = 0.728

$y=-51.34+1.46*x$

Figure 5. Correlation between major paper grade and rubric score for control group.

Descriptive statistics. The mean major paper grade for the control group was 79%

(SD=6) and for the treatment group 74% (SD=11). As can be seen in Table 6, the ESL treatment

sub-group participants scored a mean grade of 73%. The more interesting use of the major paper

grade data was in the correlational analysis between it and other measures.

Table 6.

Major Paper Grade Descriptive Statistics

	Control Group	Treatment Group	ESL Treatment Sub-Group
Major Paper Grade (mean)	79%	74%	73%
Major Paper 95% Confidence Interval	(76%, 82%)	(70%, 78%)	(71%, 74%)

The final exam and major paper grades were strongly correlated for the control group but

not for the ESL treatment sub-group participants (see Table 7). Reasons for this will be reviewed

in the discussion section of this paper.

Table 7.

Final Exam Grade Descriptive Statistics

	Control Group	Treatment Group	ESL Treatment Sub-Group
Final Exam Grade (mean)	80%	71%	56%
Final Exam 95% Confidence Interval	(77%, 83%)	(66%, 76%)	(46%, 66%)

Student Interviews

A number of themes gradually emerged over the 15 interviews with participants in the study. When questioned about their feelings on the lecture format of the in-library IL sessions, the overall feedback of traditional methodology participants was mixed with some finding the mainly lecture format engaging and others felt it was not. Among the flipped learning treatment group, the hands-on nature of the in-class sessions was appreciated by all interviewed. Feedback on the flipped pre-class work was mostly positive, with some students feeling overwhelmed by the amount of out-of-class work required by all their classes, especially out-of-class graded assignments. When asked specifically about the pre-class videos, the flipped learning group participants overall found the videos helpful with some finding them entertaining, and one participant did not appreciate their humorous tone.

Mixed reviews for traditional in-library information literacy instruction. Control group participants were asked about their perspectives on their in-library lecture-based IL instruction. In short, the control group's feedback was mixed. Participant A said that, "the best

part [of the library session] was the handout because it was useful later on if I need to remember how to do something." While other lecture-based participants reported that they learned useful research tips, they also had to listen to quite a bit of information that had already been covered previously by their English instructor. Participant B had mixed feelings, and reported that "for me [the library session] was [not that helpful] because I already knew most of the information. The quotation marks around the search terms; I never knew that before [and that was valuable to learn]." Some participants coped with the repetition by starting to search for articles on their major paper topic during the lecture, and said things similar to Participant C's comment: "I'm pretty sure a few other people did the same thing. It wasn't super like you had to follow along. It was pretty relaxed." Participant D said that "[the librarian instructor] was really detailed. In a good way. He even gave us handouts." In the end though another interviewee said, as an aside when talking about the library session, "I prefer more hands on [classes]."

Flipped pre-class assignments generally helpful and allow for differentiated learning. When asked overall if they preferred the flipped learning method for IL instruction, all participants interviewed preferred it to traditional instruction. Participant E from the treatment group summed it up by saying that, "[the flipped classes] were much more hands on for sure, and that's a good way to do it. It's definitely better [to] get someone to do [IL work] rather than just tell them how."

Seven out of eight flipped participants interviewed found quizzes and pre-class exercises helpful, but participant E made it clear that they should be offered as optional scaffolding for those who need them with no grades or participation marks attached. On the other hand, participant F said that, "[the quizzes] gave you a good idea about what you actually understood,

and let you know if you were prepared for class." A comment was made about providing differing levels of student support by participant E: "people differ in how much aid they need. If they feel like they need more help, it's there for them. If they are confident enough to go it on their own, then that should be their choice without having to worry about a penalty."

The pre-class videos were generally found to be short and helpful by flipped learning participants with some notable exceptions. Participant E did not appreciate the entertaining tone of the videos, and participant G said that the videos "were kind of funny, [and] got the point across." On the other hand, participant H said that the pre-class videos were "way more engaging because it was easier to watch a video than have someone tell you the stuff rather than read it." She went on to say that, "it is [also] a lot easier to get distracted while watching a video." These comments underscored the desire of some students to make the pre-class exercises and videos optional aids to differentiate learning and help students who need them prepare to take part in hands-on activities in-class. If the pre-class activities are to be treated as optional scaffolding, this needs to be clearly communicated to students so that they can make an informed decision as to whether or not they would personally benefit by watching the videos and completing the exercises.

Flipped face-to-face time engaging and helpful. When asked about the in-class activities, the feedback from the flipped learning participants was almost uniformly positive. A big part of that positive perspective stemmed from being able to move instruction into pre-class work in order to free up class time for active learning, which has the potential to be more interesting and memorable than a traditional lectures (McNaught, 2011, p. 284). Another positive aspect of the flipped portions of F2F classes that participant E mentioned, was that "having [a

teacher] available in class to ask questions and having more [of] a guiding hand in how you're [learning a new skill] makes the in-class time a much more effective learning tool." Instructors being able to spend more one-on-one time with struggling students is a key component of a successful flipped learning class.

Participant I reflected that while she took away more from some flipped classes than others, "with every [in-class] activity there was at least something to take away from it, or something that you understood better." One of the goals of the flipped learning curriculum was to engage in hands on activities in class that would help learners make progress on their major paper assignment as they practiced the new skills that they had been introduced to in the pre-class work. When asked if the in-class sessions helped him make progress on his major paper, participant E said, "yes, absolutely, for sure." He went on to say that "the [in-class activities afforded time for] more hands on work, and personally that's how I learn much better. Show me rather than just tell me." The "show me rather than tell me" comment came up a few times in the interviews. Participant E summed up his feelings on the in-class activities this way:

> "I would like to see more flipped classes. Hand on learning is a much more integrated learning style and feels a little more natural; and you can get your project moving forward if you use it effectively. That's the big thing. So many courses are just lecture, lecture, lecture, constantly being talked to and being told this is how you should do it, whereas if you are shown how to do it, then you can find your own style, and your own way of thinking, and your own way of doing it and that's generally more [effective] than being told how to do it."

Group work is another important aspect of in-class flipped learning that facilitates peer tutoring and mentoring. Participant F said that he "found that the group work really made sure that everybody was [understanding] whatever topic we were on. Anyone who didn't [understand were helped] by a group member." Two aspects of the group work were identified by an participant I as potential problems depending on the makeup of the group: "some people contributed more than others, [and] some [students] took [the in-class project] seriously when their peer's didn't." She went on to say that group work is "really helpful to get everyone else's thoughts and opinions of the same topic." Participant F added that he felt that another helpful aspect of group work was the ability to see some of their classmates work so that they could compare their own work, and to get ideas for how to proceed with aspects of class assignments.

ESL students' perspectives were similar to their native English speaking classmates in many respects, but different in one key area and that was their perception of pre-class work. ESL students found traditional lectures in their other classes generally "boring." ESL participant J said that "if the teacher just talks in the class it seems boring, too boring." This may be related to increased cognitive loads that some ESL students experience as they struggle to keep up with the pace of a lecture and understand the material presented. The pre-class videos not only facilitated review later in the semester but also enabled students to rewind and listen again if they didn't catch a word, and as participant K said, "pause to take notes of the important concepts and skills." ESL participant K went on to say that the videos were "very helpful and concise. I watched every one of the videos and would sometimes go back to them if I couldn't remember something I needed for an assignment or paper." ESL Participant J, who had weaker English conversational skills, reported that he would spend three hours working through the pre-class

videos and assignments that most students completed in 15 to 30 minutes. He said, "I needed to take notes and find some words that I didn't know and then [I could] understand what they mean." Flipping seems to be an effective tool for differentiating learning for ESL learners.

Overall, it appears that the pre-class work helped ESL students reduce their in-class cognitive load because they could prepare for the in-class activities at their own pace and spend the time they needed to look up words and concepts. This may have allowed them to arrive at class at a higher level of preparedness than for a traditional lecture. When asked if they would prefer more flipped classes, the consensus of the ESL interviewees was summed up by participant K who said, "definitely more flipped classes."

Students feeling overwhelmed. Two issues emerged during the interviews that triangulated with data from the pre-test and post-tests that helped explain unexpectedly low grades by some participants on the post-test. One issue that was mentioned by two of eight flipped interviewees that could have a significant impact on how flipped learning is implemented in higher education is that they felt they had too many graded assignments to complete; they felt overwhelmed, especially at the end of the semester. For example, participant I said about the pre-class exercises that "if they were for marks I definitely would have put more time into taking notes or reading more about it, but because it wasn't for grades it wasn't a high priority." On the other hand participant H acknowledged that some graded assignments were a good incentive to get the pre-class work done. When asked if classmates might superficially complete assignment if they were for participation marks only, one student, participant I, strongly agreed The heavy academic load on students may have been a motivating factor for some to quickly and

superficially complete assignments that would grant them participation marks, so they could spend more time on graded assignments.

ESL participant K said that the awarding of participation marks for pre-class exercises completed would be a motivator to, "help me focus a bit more on remembering things, and review the material either before or as I did the assignment." This feedback conflicts with some native English language speakers who found the number of assignments with marks attached to them in their first year of university overwhelming.

Correlational Results

Pre-class task completion and post-test grade. Is there a relationship between students in the flipped learning group who complete the pre-class work and those in the same group who do not complete pre-class work with their IL post-test score? Overall, there was no correlation between pre-class task completion and post-test results for the flipped treatment group.

Major paper grade and post-test grade. A correlational analysis of the treatment group's major paper grade and post-test grade indicated no correlation (r=0.030, n=45, p=0.851). There was also no correlation for the control group (r=0.035, n=17, p=0.894), or any treatment sub-group. This will be reviewed in more detail in the chapter 5 discussion, however it would seem to indicate that the IL post-test in this case was not a good measure of authentic IL learning.

Major paper grade and final exam grade. One would hope there was a strong correlation between the major paper grade and final exam grades, and for the most part this was true. The control group had a strong and significant correlation (r=0.752, n=17, p=0.001) (see Table 8). The treatment group as a whole had a weak but significant correlation (r=0.321, n=53,

p=0.019). The ESL treatment sub-group participants showed no correlation between major paper and final exam grades (r=0.142, n=7, p=0.762). The results of ESL treatment sub-group participants will be discussed further in the chapter 5 discussion.

Table 8.

Correlation Between Major Paper and Final Exam Grades

	Control Group	Treatment Group	ESL Treatment Sub-Group
Correlation (r) - Major Paper & Final Exam	0.752	0.321	-0.142

Major paper grade and pre-class task completion. Correlations between major paper grades and pre-class task completion were particularly interesting because they were integral parts of the course and were not as liable to be adversely affected by students guessing at multiple choice questions in order to earn participation marks as quickly as possible. Unfortunately, because the pre-class tasks were part of the flipped learning treatment group's curriculum, a correlational analysis for the lectured format control group was not possible.

The treatment group showed a weak correlation between major paper grades and pre-class tasks completed with an r-value of 0.335 (n=53, p=0.014) as can be seen in Table 9.

Table 9.

Correlation between Major Paper Grade and Pre-Class Task Completion

	Control Group	Treatment Group	ESL Treatment Sub-Group
Correlation (r) - Major Paper & Tasks Completed	N/A	0.335	-0.717

The ESL treatment sub-group participants showed a strong negative correlation between pre-class tasks completed and major paper grade (r=-0.717, n=7, p=0.070). This ESL result was just outside the margin of error. This was a somewhat puzzling trend for the ESL students (see Figure 6). This will be addressed in the chapter 5 discussion.
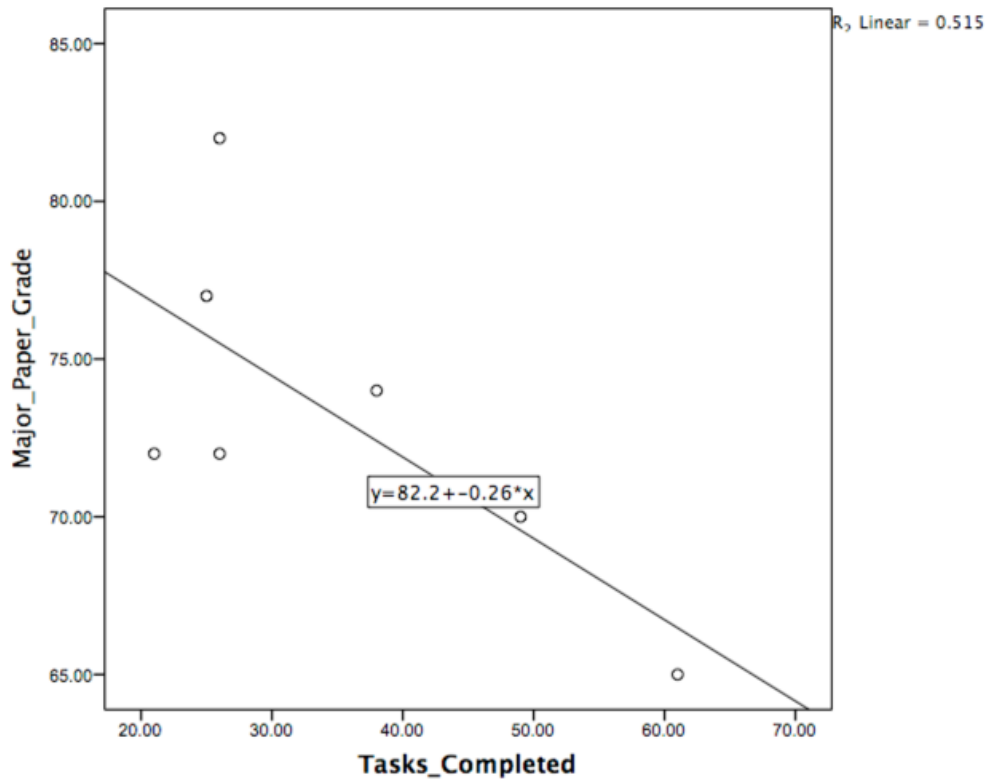
Figure 6. Correlation between major paper grade and pre-class tasks completed for ESL participants.

Research Questions Answered

Research Question 1. How does a flipped learning methodology differ from a traditional teaching method in terms of undergraduate student achievement on IL and research skills test scores for students at the University of Victoria?

The flipped learning treatment group made a two percent larger gain between the IL pre-test and post-tests than the control group; however, the margin of error was larger than the two percent effect size, thus there was no significant difference. The ESL treatment sub-group showed an even larger 19% gain, but because of the small sample size this effect was still within the margin of error, thus there was no significant difference. When looking at effect sizes for per-

test/post-test gains, the only treatment sub-group that showed a large effect size relative to the control group was the ESL sub-group with a Cohen's D score of 0.863.

Unfortunately, a relatively large number of participants did not put significant effort into the post-test in particular, as evidenced by there being no correlation between participants' major paper and post-test grades as would be expected. Also, some participants took an exceptionally short time to complete the tests, causing their data to be excluded. Interview comments about students feeling overwhelmed at the end of the semester and the granting of participation marks to students for completing the pre-test/post-tests helped explain why some students appear to have resorted to guessing answers to post-test multiple choice questions at the end of the semester.

Research Question 2. What is the relationship between completion of pre-class work (pre-training) and IL post-test scores for flipped learning participants?

There was no correlation found between the IL major paper grades and the post-test scores. This was an unexpected result and can be explained by the previously discussed awarding of participation marks for the post-test completion. The only sub-group that had a weak correlation between pre-class work and the post-test grade was the ESL group. This may have been due to their tendency to take pre-class work and tests more seriously on average than the other participants in the study.

Research Question 3. What effect does a flipped learning methodology have on learner perception on IL instruction compared to a traditional approach?

Flipped learners had a more positive perception of their instruction than learners in the class with a traditional teaching method. Feedback from lecture-based learners on their

information more literacy instruction was mixed. Flipped learners on the other hand appreciated the active nature of the in-class activities that the pre-class videos and assignments facilitated. They also found the in-class tasks that helped them make progress on their major paper assignments particularly helpful.

The flipped learning pre-training was noted in particular by ESL learners as being preferred to face-to-face lecture-based instruction. The pre-class materials helped reduce in-class cognitive load and stress for ESL learner J, and as observed by the author, allowed him to arrive in class closer to the same preparedness level as his English speaking peers.

Research Question 4. What results emerge from comparing the quantitative test data of student achievement using different pedagogies with the qualitative interview data, exploring potential factors leading to differences in test scores?

An important finding emerged by following up on results from the WASSAIL IL test with a related interview question. Some participants completed the IL post-test in unrealistically short periods of time, and some other participants scored up to 55% lower on their post-test compared to their pre-test. This led to a question in the student interviews about whether or not their classmates might complete a test for participation marks by just guessing at answers to questions. The response from four out of five flipped participants was, yes, they felt that a number of their friends would guess at questions on a test for participation marks, especially if they were under time constraints for other graded assignments. This triangulated with the IL post-test and major paper data that showed no correlation between the two sets of data, which was also not expected.

Another anomalous result from the correlational analysis of the pre-class task completion data and the major paper results was a strong negative correlation between those two paired sets of data for the ESL students (-0.717). This sharply contrasted with the small positive correlation for all the other participant students. Again, the interviews provided some insight into why this might have happened. The ESL student who struggled the most with his conversational English mentioned how much they appreciated the pre-class assignments. It appears, but cannot be confirmed, that possibly students with weaker English language skills completed more pre-class work and spent more time working on the assignments in order to compensate for their language weakness. On the other hand, if that is the case, ESL students with stronger language skills completed fewer pre-class assignments. More research needs to be done to explore this phenomenon further.

Research question 5. What is the relationship between flipped learning pre-class work completed and achievement on the major paper assignment?

As expected, there was a weak relationship between pre-class work and major paper grades for the flipped learning group (r = 0.335). Because only the treatment group had an opportunity to complete the pre-class work, only the data for the flipped learning group could be analyzed. As was just discussed, there was a large difference in results for ESL participants compared to their native English speaking counterparts. The ESL treatment sub-group registered a strong negative correlation (r = -0.717), compared to the native English speakers who showed a weak positive correlation between pre-class work and their major paper grade (r=0.329).

Summary

This chapter discussed the results of both the quantitative and qualitative phases of the study. The IL pre-test and post-tests were reviewed, along with pre-class assignment completion rates, and participant IL grades on their major paper assignment. Quotes from qualitative interviews with participants, relevant to research questions were also presented. Lastly correlational results were reviewed.

Chapter Five: Discussion

Overview of the Study

The purposes of this study were to: 1) determine whether or not a well-designed flipped learning methodology would lead to higher formative and summative assessment scores for IL instruction than a more traditional methodology; and 2) discover learner attitudes towards flipped learning and traditional IL instruction. To evaluate the flipped learning approach, a mixed methods, multi-phase sequential, explanatory research design was used in order to both quantify and more deeply explore the impact of this teaching method on IL learners. This included collecting quantitative IL test data, and pre-class assignment completion data. Next, quantitative data was collected at the end of the semester in the form of a post-test as well as grades on the major paper assignment in order to measure IL skills retention. Lastly, a sampling of students were interviewed to explore their attitudes towards the method of IL instruction used in their class. This methodology allowed for the triangulation of findings in order to increase the validity of the results. This chapter will summarize significant results, and conclusions, as well as suggest implications and possible directions for future research.

Interpretation of Findings

In spite of a gain of two percent for the flipped learning treatment group, which was in line with gains found in the 2010 United States Department of Education meta-review by Means et al., the sample size (n=62) was not large enough for the observed effect size to be outside the margin of error (p. 34). In addition, the researcher's decision to award participation marks for pre-test and post-test completion appears to have muddied the data, with some participants clearly not putting in a strong effort on the post-test as evidenced by there being no correlation

between the post-test and major paper grades, short completion times by some, and others recording large drops in scores between the tests.

Flipped learning ESL participants registered an 18% gain in test scores over the control group, which was much higher than the overall treatment group's two percent gain. Because of the small ESL sample size this gain was short of significance in a two-tailed t-test, conditions: $t(7)=1.614$, $p=0.05$. The t critical for a one-tail test was 2.365. In addition, the Cohen's D effect size for the ESL participants was strong (0.863). Potential explanations for these gains by ESL students came from both quantitative and qualitative data. A review of the raw WASSAIL IL data for ESL students seems to show that they took the tests more seriously than the rest of their classmates. Only one of the seven ESL participants appears to have guessed on the tests as indicated by a very short completion time, while none of the rest scored lower on their post-test than pre-test. This compared to the rest of the flipped learning participants with seven out of 39 appearing to have guessed on their tests, and an additional 15 scored lower on their post-test than pre-test. During interviews, ESL students reported spending between 30 and 180 minutes working on pre-class work before each flipped class compared to the 15 to 30 minutes reported by other learners.

Taken together, the large gain in test scores and significantly more time spent completing pre-class exercises are reflective of significant extra effort some ESL students put into using the pre-class materials to "catch up" to their native English speaking counterparts. This makes sense when put in the context of the high cognitive load some ESL students experience in class, and the mitigating effect that pre-training videos and exercises have on in-class cognitive load.

The control group's interview feedback on the in-library IL session was mixed. These mixed feelings seem to have been largely due to the repetition of IL instruction in the library session that had already been covered in their English class. A larger student engagement issue came into focus contrasting the previous control group participant's comment with the following flipped learner's comment about their flipped library IL session: The flipped class was "more hands on, and personally that's how I learn much better. Show me rather than just tell me, [and then let me apply it to my own project]."

Another related issue, which made it difficult for librarians teaching lecture-based sessions, was that students arrived at the in-library IL session with widely varying levels of knowledge about academic libraries in general and library databases in particular. For example, participant L said, "I didn't know about the library database to begin with," and went on to say that she found the lecture informative. Other students commented about the repetitive nature of the instruction.

The flipped learning treatment group's feedback was mostly positive for the pre-class exercises and videos. Another area where there was mixed feedback was whether to assign participation marks, graded marks, or no marks at all for pre-class work. One student in particular reported that their overall workload was too heavy in general, and more assignments with grades attached to them added to their stress. Others felt graded pre-class work was an incentive for them to engage more deeply with the assignments, knowing that marks were attached to their completion.

Educational Implications

The flipped learning pedagogy is a style of teaching that encourages some of the best aspects of active learning environments. Rather than revolutionizing the way classes are taught with high tech software or hardware, flipped learning encourages educators to rethink how they can incorporate more active learning activities into their classes. A key feature of flipped learning that appeals to many educators is the potential it has to free up F2F class time for more hands-on, engaging, group work. This is typically done by utilizing video and LMS technologies to facilitate the pre-class instruction, but it is not the technologies per se that makes the difference, it is the way the technologies are used to change the way class time is utilized (Kozma, 1994, p.16).

While some flipped learning practitioners recommend using participation marks as an incentive for learners to complete pre-class work (Fineday, 2013), researchers should be cautious when using such incentives for research instruments. Participation marks may encourage some students to do the absolute minimum to gain the extra marks, thereby reducing the validity of the instrument. In retrospect, it seems obvious that any measurements not integral to course completion should be graded for marks or, if not graded, no participation marks awarded for completion in order to avoid this potential problem.

Something that should be considered for other pre-class work is to treat it as optional scaffolding for those who want it or need it. Students could opt in or out of the "scaffolding marks" at the beginning of the semester. Depending on how students progress early in the semester, there might be a need for this decision to be revisited for those who opted out but are struggling to keep up. The correlation between pre-class work and major paper grades was small

but positive which might be explained by not all participants feeling the need to complete the pre-class work.

The flipped learning pre-class videos and exercises facilitated differentiated learning for all students, but the feedback from the interviews was that it was especially helpful for ESL learners. Pretraining has been shown to reduce the cognitive load on students in the class following the pretraining (Musallam, 2010, p. 92). Because of the high cognitive load experienced by some ESL students struggling to translate technical academic language into their native tongue in traditional face-to-face lecture classes, their perspective on flipped learning as pretraining was of particular interest. One ESL student who had strong English conversational skills summed up her flipped pre-class experience this way: "The videos are much more user-friendly than a lecture if you're still learning the specialized vocabulary of a subject or of university in general. Being able to pause, rewind, and look for other online resources is huge." This verbal appreciation for the pre-class videos and exercises was supported by the high rate of pre-class work completed by ESL students in the LMS. Because of this, they arrived to class closer to the level of preparedness of their native English speaking classmates, ready to participate in the active learning exercises, and having a significantly reduced cognitive load. This contrasts with traditionally formatted classes in which some ESL students reported that they were not able to keep up with the instructor's lecture pace.

Feedback on the in-class flipped activities was almost uniformly positive. The active learning work in-class was appreciated, especially since almost all the in-class activities helped learners make progress on their major paper assignments. These meaningful in-class activities not only helped learners practice the skills they were introduced to in the pre-class work, but also

acted as scaffolding for their major paper assignments. One student commented during their interview that the in-class work helped him to get started on his major paper assignment much earlier than he would if left to his own devices. The results of group work activities, especially when shared with the whole class, gave learners insight into how their peers tackled major paper-related tasks, which was also identified as being helpful in the interviews.

It is clear from the student interviews that those flipped participants interviewed on the whole prefer the active learning exercises that flipped learning pedagogies enable. That is not to say that more traditional classes cannot incorporate active learning exercises into their instruction, because many do. What a properly designed flipped learning curriculum does, however, is free up more fact-to-face class time for hands on activities, and potentially allows students at different levels of knowledge and ability to move closer to the same level before class by way of pre-class instruction and activities. The interviewed ESL students seemed to benefit particularly from a rich set of pre-class activities and exercises that allowed them to catch up to their English speaking counterparts before flipped F2F classes.

Limitations

Despite the findings in this thesis, there are a number of limitations to the methods employed that should be taken into account before a reader attempts to implement the flipped IL methodology used in this study. First, the study used a quasi-experimental design, which means that the treatment and control groups were not randomly selected and therefore unforeseen confounding variables may have affected the results. For example, the wide range of mean pre-test scores indicated that the average level of knowledge about IL varied significantly between the three classes.

Secondly, because of limited time and resources, the participant interviews were only coded by the author. This did not allow for a calculation of inter-rater reliability for the coding and themes in the interview data.

Third, while both instructors collaborated on the customization of the IL rubric for the grading of major paper assignments, only the control group instructor used the rubric. While a strong (0.853) correlation was found between the rubric score and major paper grade for the control group, it is possible that because of the different learner composition of the other two treatment groups, they may not have had such a strong correlation. For example, the presence of ESL participants in treatment group two may have impacted the rubric score / major paper correlation value.

Fourth, because of the problem previously mentioned with participation marks inadvertently encouraging a significant minority of students to guess answers to questions on the IL post-test, the WASSAIL IL results should be treated with care. Researchers should consider administering similar instruments during class time to encourage participation and eliminate the perverse incentive of participation marks.

Fifth, because of the small sample size in this study, combined with an expected small effect size, the observed effects were well inside the margin of error. Because of this, the author relied more heavily the qualitative strand of the study than otherwise might have been the case.

Future Research

There are a number of areas where future research into flipped learning pedagogies for IL instruction are needed. First, there is a need for larger sample sizes for quantitative flipped IL research so that the effect size of the intervention is larger than the margin of error in the study.

An attempt was made in this study to obtain a larger sample size, but the author was not successful in obtaining a larger sample.

Second, additional research is needed to study the effects of flipped learning on ESL students participating in IL instruction. The results of this study were positive, especially the reported effects of pre-training on lowering learner cognitive load in class. Larger quantitative and qualitative samples would allow researchers to make more definitive statements about the effect size of flipped IL instruction for ESL learners, and more deeply explore their attitudes towards flipped learning.

Third, ESL treatment sub-group participants were observed to have a strong negative correlation (-0.717) between their pre-class task completion and major paper results, which was quite different from the small positive correlation for all other participants (0.335). The author surmises that ESL students with weaker English language skills completed more pre-class work and spent more time working on the exercises in order to compensate for this weakness. More research needs to be done to explore this phenomenon further.

Fourth, some participants reported high stress levels due to the number of graded assignments across all their classes, which is cause for concern. This is especially true when considering how to implement flipped learning in a class, because some practitioners considered best practice to award participation marks for pre-class work in order to encourage students to complete the work (Fineday, 2013). It should be noted that other students felt that participation marks would be helpful to encourage them to complete the pre-class assignments; however, if a significant portion of students are already feeling overwhelmed, this could exacerbate the problem. More research in this area is needed, particularly into the effects of making pre-class

work optional, partially optional, or potentially a negotiation between the instructor and individual participants based on their specific needs.

Conclusions

The results from this research indicate that students who participated in the flipped learning, IL instruction strongly preferred it to traditional teaching methods. The pre-class exercises were generally found useful by participants; however, some preferred that the exercises be made explicitly optional to reduce the number of assignments for grades that students have to complete. While the IL pre-test/post-test data indicates a two percent larger gain for the flipped learning treatment group, that gain is well within the margin of error and is not significant. The larger gain of 19% by ESL treatment sub-group students is encouraging, but because of the very small sample size, it is also within the margin of error. Future quantitative research, especially with ESL students, should endeavour to obtain larger sample sizes so that more generalizable conclusions can be drawn.

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Appendices

Appendix A: Literature Review Spreadsheet with Searches and Articles

http://goo.gl/iLP5YX

Searches:

	Date	Database	Search Term(s)	Limiters	Hits
1	8/10/2013	UVic Summon	Blended + Learning		203391
2	8/10/2013	UVic Summon	Blended + Learning	Journal Articles	23348
3	8/10/2013	UVic Summon	Blended + Learning + Library		160843
4	8/10/2013	UVic Summon	Blended + Learning + Library	Journal Articles	8645
5	8/10/2013	UVic Summon	Blended + Learning + "research skills"		1655
6	8/10/2013	UVic Summon	Blended + Learning + "research skills"	Journal Articles	250
7	8/10/2013	UVic Summon	Blended + Learning + "research skills"	Journal Articles + Peer Review	234
8	8/10/2013	UVic Summon	"Blended Learning" + "research skills"		226
9	8/10/2013	UVic Summon	"Blended Learning" + "research skills"	Journal Articles	74
10	8/10/2013	UVic Summon	"Blended Learning" + "research skills"	Journal Articles + Peer Review	60
11	8/10/2013	UVic Summon	"Blended Learning" + "research skills" + Library	Journal Articles + Peer Review	35
12	8/10/2013	UVic Summon	"Flipped Classroom" + "research skills" + Library	Journal Articles + Peer Review	1
13	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning" OR "blended pedagogy") AND "information literacy" AND ("academic library" OR "academic libraries")	Journal Articles + Peer Review	70
14	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning" OR "blended pedagogy") AND ("information literacy" OR "research skills") AND ("academic library" OR "academic libraries") NOT "virtual reference"	Journal Articles + Peer Review	63
15	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning" OR "blended pedagogy") AND ("information literacy" OR "research skills") AND ("academic library" OR "academic libraries") NOT ("virtual reference" OR "distance learning")	Journal Articles + Peer Review	27
16	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning" OR "blended pedagogy")	Journal Articles + Peer Review	95

			AND ("information literacy" OR "research skills") NOT ("virtual reference" OR "distance learning" OR "second language" OR "nurse" OR "IFLA")		
17	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills") NOT ("virtual reference" OR "distance learning" OR "second language" OR "nurse" OR "IFLA" OR "Emergency Medicine" OR "medical")	Journal Articles + Peer Review	68
18	8/10/2013	UVic Summon	("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills") NOT ("virtual reference" OR "distance learning" OR "technology literacy")	Journal Articles + Peer Review + not book review + After Jan 2008	83
19	1/11/2013	UVic Summon	("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills") NOT ("virtual reference" OR "distance learning" OR "technology literacy")	Journal Articles + Peer Review + not book review + Between Jan 2002 - Jan 2008	51
20	1/11/2013	Google Scholar	("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills") -("virtual reference" OR "distance learning" OR "technology literacy")	No patents, date range: 2005-2013.11.01. Reviewed top 70 results	1770
21	2/11/2013	ERIC	("blended learning" OR "hybrid learning") AND ("information literacy" OR "research skills")	No limiters	21
22	4/8/2014	UVic Summon	("flipped classroom" OR "flipped class" OR "flipped learning") AND "information literacy"	Journal Articles + Peer Review	66
23	4/8/2014	Google Scholar	("flipped classroom" OR "flipped class" OR "flipped learning") AND "information literacy"	No patents. Reviewed top 1000 results	1958
24	4/8/2014	UVic Summon	*"constructivist learning theory" AND "education"*	Journal Articles + Peer Review	1903
25	4/8/2014	Google Scholar	*"constructivist learning theory" AND "education"*	No patents. Reviewed top 1000 results	8100
26	4/14/2014	UVic Summon	"cognitive Load theory" AND "education"	Journal Articles + Peer Review	1930
27	4/14/2014	Google	"cognitive Load theory" AND	No patents.	8730

		Scholar	"education"		Reviewed top 1000 results	

Articles:

Se arc h #		Article Name	Journal	Issue	URL
18	y	2. Does the Method of Instruction Matter? An Experimental Examination of Information Literacy Instruction in the Online, Blended, and Face-to-Face Classrooms	The Journal of Academic Librarianship	Volume 36, Issue 6, November 2010, Pages 495–500	http://www.sciencedirect.com/science/article/pii/S0099133310002132
18	x	Writing and Publishing in a Blended Learning Environment to Develop Students' Scholarly Digital Ethos	Behavioral & Social Sciences Librarian	Volume 32, Issue 2, 2013	http://www.tandfonline.com/doi/abs/10.1080/01639269.2013.787251#.UIR7q2RVB6Y
18	x	Information Evaluation Instruction: A Three Term Project with a First Year Experience Course	Communications in Information Literacy	Vol 6, No 2 (2012)	http://www.comminfolit.org/index.php?journal=cil&page=article&op=view&path%5B%5D=v6i2p173
18	x	Using assignment data to analyse a blended information literacy intervention: A quantitative approach	Journal of Librarianship and Information Science	March 2013 vol. 45 no. 1 53-63	http://lis.sagepub.com/content/45/1/53
18	x	8. Pushing Library Information to First-Year Students: An Exploratory Study of Faculty/Library Collaboration	Australian Academic & Research Libraries	Jun2010, Vol. 41 Issue 2, p90-99. 10p.	http://web.ebscohost.com/ehost/detail?sid=8c6f32a0-36cf-44c2-8a9e-6dd5383c4301%40sessionmgr15&vid=1&hid=12&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=a9h&AN=54389934
18	x	Integrating library instruction into a problem-based learning curriculum	Aslib Proceedings	Vol. 63 Iss: 5, pp.517 - 532	http://www.emeraldinsight.com/journals.htm?articleid=1951068&show=abstract
18	x	Engaging online learners: The impact of Web-based learning technology on college student engagement	Computers & Education	Volume 54, Issue 4, May 2010, Pages 1222–1232	http://www.sciencedirect.com/science/article/pii/S0360131509003285
18	x	Investigating relationships between features of learning	Educational Technology	April 2012, Volume 60, Issue 2, pp 271-	http://link.springer.com/article/10.1007%2Fs1142

	designs and student learning outcomes	Research and Development	286	3-011-9226-1
18 x	Exploring the relationships between Web usability and students' perceived learning in Web-based multimedia (WBMM) tutorials	Computers & Education	Volume 50, Issue 1, January 2008, Pages 386–409	http://www.sciencedirect.com/science/article/pii/S0360131506001126
18 x	Blended university teaching using virtual learning environments: conceptions and approaches	Instructional Science	January 2012, Volume 40, Issue 1, pp 141-157	http://link.springer.com/article/10.1007%2Fs11251-011-9170-9
18 x	Students' Readiness for and Attitudes toward Hybrid Foreign Language Instruction: Multiple Perspectives	CALICO Journal	January 2012, Volume 29, Issue 2, Pages 297-320	http://journals.sfu.ca/CALICO/index.php/calico/article/view/9
18 x	Strategizing computer-supported collaborative learning toward knowledge building	International Journal of Educational Research	Volume 49, Issue 1, 2010, Pages 1–9	http://www.sciencedirect.com/science/article/pii/S0883035510000303
19 x	Developing Students' Information and Research Skills via Blackboard	Communications in Information Literacy	2007, Vol. 1, Issue 1	http://ezproxy.library.uvic.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=llf&AN=502914661&site=ehost-live&scope=site
19 x	17. A blended method for integrating information literacy instruction into English composition classes	Reference Services Review	2006, Vol. 34 Iss: 3, pp.368 - 388	http://www.emeraldinsight.com/journals.htm?articleid=1567417&show=abstract
19 x	18. Evolving instruction in biology: using the web to improve in-class instruction	Reference Services Review	2004, Vol 32, Issue 4, Pages 374-382	http://www.emeraldinsight.com/journals.htm?articleid=861801&show=abstract
19 x	20. Self-Regulated Learning and New Literacies: an experience at the University of Barcelona	European Journal of Education	Volume 41, Issue 3-4, pages 437–452, Sep/Dec 2006	http://onlinelibrary.wiley.com/doi/10.1111/j.1465-3435.2006.00275.x/abstract
20 x	21. User Centred Information Literacy Education: Application of Multimedia in e-Learning and Blended Learning	The 3rd International Conference on Education and Information Systems	2005	http://www.swiminfo.dk/pdf/EISTA05_E721YC.pdf
18 x	The development of a blended learning approach to delivering information skills training to large health related student audiences	Health information and libraries journal	ISSN 1471-1834, 09/2011, Volume 28, Issue 3, pp. 230 - 236	http://web.ebscohost.com/ehost/detail?sid=1afe4bd0-5794-4321-9748-789aa5847de6%40sess

	with limited staff resource			ionmgr4&vid=1&hid=12&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=mnh&AN=21831223
18 x	The Design of Online Tertiary Courseware for a Blended Learning, Project-Based, E-Business Management Program in the Middle East	International Journal on E-Learning	Volume 7, Issue 4, October 2008	http://www.editlib.org/p/24305
19 x	Blended Learning: a way to efficient literature search	German Medical Science	12/19/2007	http://www.egms.de/static/en/journals/mbi/2007-7/mbi000094.shtml
20 x	22. Blended learning: a mutual approach to embedding information literacy into the curriculum	Libranian's Information Literacy Association Conference	2005	http://www.lilacconference.com/dw/archive/resources/2005/parker.pdf
20 x	23. Assessing the Integration of Information Literacy into a Hybrid Course Using Screencasting	MERLOT Journal of Online Learning and Teaching	2010	http://jolt.merlot.org/vol6no3/trail_0910.htm
20 x	24. Information Literacy and IT Fluency: Convergences and Divergences	Reference & User Services Quarterly	Vol. 46, No. 3, Spring 2007	http://www.jstor.org/stable/view/20864692
20 x	25. Information Smoothies: embedding information skills in assessed learning	Assessment, Teaching & Learning Journal (Leeds Met)	Vol 9, Summer 2010	http://repository-intralibrary.leedsmet.ac.uk/open_virtual_file_path/i2346n226947t/Information%20Smoothies.pdf
20 x	26. The effect of information literacy on physical education students' perception of a course management system	Learning, Media and Technology	Volume 36, Issue 4, 2011	http://www.tandfonline.com/doi/abs/10.1080/17439884.2010.542160#.UnVFMZRVBLg
21 x	27. Information Evaluation and Online Coursework	Knowledge Quest	v38 n3 p28-31 Jan-Feb 2010	http://web.ebscohost.com.ezproxy.library.uvic.ca/ehost/detail?sid=ce76fd7d-2fd4-4435-949b-cf98f1acdb24%40sessionmgr4&vid=1&hid=21&bdata=JnNpdGU9ZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=tfh&AN=49791604
x	28. Hybrid Learning in a Canadian	Higher	9/17/2013	http://www.heqco.ca/Sit

	College Environment	Education Quality Council of Ontario		eCollectionDocuments/ Sheridan_Hybrid_Colleg e_Programs.pdf
x	29. Measuring self-regulation in online and blended learning environments	The Internet and Higher Education	Volume 12, Issue 1, January 2009, Pages 1–6	http://www.sciencedirect .com/science/article/pii/ S1096751608000675
x	30. Flipping the classroom and instructional technologyintegration in a college-level information systemsspreadsheet course	Educational Technology Research and Development	Vol 61, Issue 4, Pages 563-580, June 11, 2013	http://www.academia.ed u/4189880/Flipping_the _Classroom
x	Developing Models and Theory for Blended Learning Research	Draft version from chapter soon to be printed - Blended Learning: Research Perspectives II.	2013	In Zotero
x	34b. Emerging Practice and Research in Blended Learning	Handbook of Distance Education	2012	In Zotero
x	19. Using multimedia modules to better prepare students for introductory physics lecture	Physical Review Special Topics - Physics Education Research	Vol 6, Issue 1, June 11,2010	http://prst- per.aps.org/abstract/PR STPER/v6/i1/e010108
x	31. The Clark-Kozma Debate in the 21st Century	Academia.edu	2010	https://www.academia.e du/462857/The_Clark- Kozma_Debate_in_the_ 21st_Century
x	32. Blended Learning	EDUCAUSE Centre for Applied Research, Research Bulletin	Vol 2004, Issue 7, March 30, 2004	https://net.educause.ed u/ir/library/pdf/erb0407.p df
x	33. Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies	US Department of Education	September 2010	http://www2.ed.gov/rsch stat/eval/tech/evidence- based- practices/finalreport.pdf
x	34. The Flipped Class: Myths vs. Reality	The Daily Riff: Be Smarter. About Education.	7/9/2013	http://www.thedailyriff.co m/articles/the-flipped- class-conversation- 689.php
x	35. Crises in Education: Online	Creative	Vol 2, Issue 3, July	http://dx.doi.org/10.4236

		Learning as a Solution	Education	22, 2011	/ce.2011.23022
	x	36. Media Will Never Influence learning	Educational Technology Research and Development	Vol. 42, No. 2 (1994), pp.21-29	http://link.springer.com/article/10.1007/BF02299088
	x	37. Will Media Influence learning?	Educational Technology Research and Development	Vol. 42, No. 2 (1994), pp.7-19	http://link.springer.com/article/10.1007/BF02299087
	x	38. The Myth about No Significant Difference	Educause Review	November/December 2006, pp. 14-15	

Appendix B: Information Literacy Test

https://goo.gl/gUecFz

1. You are doing research on the history of filmmaking. You searched for the term "moving picture" in the library catalogue and no results were found. What is the most likely reason for this?
> a. The library does not have any books on this topic
> b. *"Moving picture" is not the best search term
> c. I do not know
> d. The search should have been limited to videos

2. Generally speaking, the best place to find a scholarly article is:
> a. The library catalogue
> b. The college/university archives
> c. I do not know
> d. *A library database

3. You are searching for articles on gender discrimination in the workplace. You searched a library database using the keywords gender, discrimination, and workplace, but got too many results. How would you refine your keywords to get fewer results?
> a. I do not know
> b. Use broader terms for workplace
> c. *Use narrower terms for discrimination
> d. Use synonyms for gender

4. In APA citation style, you must include a DOI (digital object identifier) in journal article citations. What is the purpose of a DOI?
> a. *It is more stable than a URL and provides more permanent access to the article
> b. It shows which library database an article is found in
> c. It allows you to identify the copyright holder of the article
> d. I do not know

5. Your research question is "How have recent natural disasters in the Philippines affected the mortality rate of infants?" You enter this phrase into an article database and get zero results. Why?
> a. This type of information is unavailable to researchers outside the Philippines
> b. The library does not have any articles on this topic
> c. *The question hasn't been broken down into searchable keywords that the database can process
> d. I do not know

6. You are researching the effects of bitumen production on water quality in the last fifty years and you have found some statistics. Which of the following statistics would be most useful for your topic?

      a. The rate of cancer diagnoses among oil and gas industry employees exposed to bitumen

      b. *The level of lake sediment contamination in bitumen production regions

      c. I do not know

      d. The percentage of the caribou population that remain in northern regions

7. You have to find articles on childhood vaccination and its connections to autism. To make sure you don't miss any relevant information, the best set of keywords to use in your search would be:

      a. *childhood, vaccination, immunization, autism

      b. I do not know

      c. childhood, vaccination, youth, health

      d. autism, childhood, shots, causes

8. Generally speaking, which of the following sources would NOT be an appropriate source for a first-year psychology paper on learning and memory?

      a. Fitzgerald, L.D., & Walker, A. (2005). Learning. In N. Salkind (Ed.), Encyclopedia of human development (pp. 781-787). Thousand Oaks, CA: Sage.

      b. * Learning and memory. (2012). Retrieved September 6, 2013 from http://www.brainfacts.org/sensingthinking-behaving/learning-and-memory/

      c. I do not know

      d. Klingberg, T. (2013). The learning brain: Memory and brain development in children. Oxford: Oxford University Press.

9. You are doing research on declared religious affiliation among college students. Your professor suggests you read work by a specific long-standing expert in the area to inform your research. After doing this, you also come across a current scholarly article by a different scholar which contradicts some of the expert's claims.

      a. *Incorporate the current scholarly article into your research along with the long-standing expert's work

      b. Ignore the current scholarly article because the long-standing expert is an established authority in this area

      c. Consider the long-standing expert's work to be outdated and proven incorrect

      d. I do not know

10. Which of the following is NOT a characteristic of scholarly journals?

      a. Often published only a few times a year

      b. I do not know

c. Written for a knowledgeable audience
d. *Contain short articles written by journalists

11. Databases allow you to search for specific pieces of information in certain fields of the database record, so that you don't have to rely on a general keyword search. By choosing to search for Margaret Atwood in the author field in a database, you will find:
   a. I do not know
   b. Books or articles written about Margaret Atwood
   c. *Books or articles written by Margaret Atwood
   d. Books or articles written by and/or about Margaret Atwood

12. When searching in a library database, what words would "stress*" find, in addition to "stress"?
   a. I do not know
   b. tension, pressure, strain
   c. distressed, distressful, stressful
   d. *stressed, stressing, stress-related

13. Which of the following is a characteristic of a scholarly article?
   a. I do not know
   b. Provides a professor's opinion about a controversial event
   c. *Contains a relevant list of references
   d. Is written by a journalist

14. You are searching in a database for articles on feminism, but you are getting too many results and most of them don't look relevant. Generally speaking, what will happen if you use a narrower term for feminism?
   a. You'll get more articles, fewer of them on topic
   b. *You'll get fewer articles, more of them on topic
   c. I do not know
   d. You'll get the same number of articles

15. You are writing a paper on the connection between video game violence and aggression in teens. You are summarizing a journal article in which the author quotes another researcher. Which of the examples below is an acceptable reference to a source referred to in another source?
   a. I do not know
   b. *A 2008 study by Ferguson found no causal relationship between violence in video games and aggression in individuals (as cited in Stenson, 2010, p. 119).
   c. Ferguson conducted a study on the relationship between violent video games and aggression in individuals, and concluded that the study shows no causal relationship between the two variables (Stenson, 2010, p. 119).

d. A 2008 study concluded that the research "'shows no evidence of a causal relationship between violent video game exposure and aggression'" (Stenson, 2010, p. 119).

16. You are researching the dramatic decline in honey bee populations since 2007. An article written in 2007 suggests widespread pesticide overuse is responsible for bee population decline. Another article, written in 2012, concludes the proliferation of wireless communication devices and transmission towers to be the cause. In this case, should you:
      a. I do not know
      b. Use the 2007 article because pesticide overuse seems like a more likely cause for the decline
      c. *Consider that both may have valid conclusions
      d. Use the 2012 article because it is more recent research

17. Your research topic is the effects of burning coal on air quality. Which source would most likely provide you with objective information for your topic?
      a. *A study featured in a peer-reviewed periodical
      b. The latest annual report from a major automobile manufacturer
      c. An interview with an influential lobbyist on a news program
      d. I do not know

18. When searching a specialized database for articles on your topic, it is recommended to use the terminology specific to the database. Which parts of the database record are good sources for terms to use in your search?
      a. I do not know
      b. Document type, title
      c. *Subject headings, abstract
      d. Author affiliations, journal title

19. Which of the following searches would give you the least number of results?
      a. *Canada AND history AND women
      b. I do not know
      c. Canada AND history
      d. Canada OR history

20. Which of the following means to rewrite the words of an author in your own words?
      a. Plagiarize
      b. I do not know
      c. Quote
      d. *Paraphrase

21. For a paper on drinking and post-secondary students, which of the following would be the best website to find authoritative information on the medical effects of alcohol use?

       a. *Health Canada - www.hc-sc.gc.ca

       b. I do not know

       c. Mothers Against Drunk Driving - www.madd.ca

       d. Canadian Counselling and Psychotherapy Association - www.ccacc.ca

22. You are writing a paper about gun violence and you use information from the National Rifle Association (NRA) website. In this case, which of the following website evaluation criteria is most important to consider?

       a. *Accuracy, bias, objectivity

       b. I do not know

       c. Accuracy, functionality, relevance

       d. Accuracy, objectivity, website domain (.com, .org, .edu, .net)

23. Read the following excerpt from a news article. Which of the citations below likely refers to the research study mentioned in the news article?

       "A new study, published recently in the journal Clinical Oncology, suggests a critical breakthrough has been made in leukemia treatment for infants. New York Times reporter Kate Jones spoke to the study's coinvestigator, Harold Jenkins, about the significance of the study's findings."

       Select one:

       a. *Jenkins, H. (2013). The role of immunomodulatory agents in the treatment of infants with acute lymphoblastic leukemia. Clinical Oncology, 6(2), 35-48.

       b. Shah, R. (2013). The role of immunomodulatory agents in the treatment of infants with acute lymphoblastic leukemia. In H. Jenkins (Ed.), Clinical oncology (pp. 35-48). New York: Springer.

       c. I do not know

       d. Jones, K. (2013, June 6). Researchers find key to treating babies with cancer. New York Times, pp. A1, A7-A8.

24. What is "peer review"?

       a. A process for guaranteeing that the research described in articles is completely accurate and indisputable

       b. *A process for ensuring that academic articles have been examined by other experts in the field before publication

       c. An alternative way of publishing an article without having to submit it to a professional editor

       d. I do not know

25. How are call numbers organized in the library?
      a. By title
      b. I do not know
      c. By author
      d. *By subject

26. You are writing an argumentative paper on school uniforms. Which of the following sources would provide the best evidence for your argument that school uniforms prevent bullying in schools?
      a. *A study comparing disciplinary records and school police data at a school where uniforms are required with a school where they are not required
      b. I do not know
      c. A documentary featuring interviews with students in a school where bullying is a problem
      d. A poll of student opinions on the impact of school uniforms on bullying

27. To physically locate a book on the shelf, you will need the:
      a. Barcode number
      b. *Call number
      c. International Standard Book Number (ISBN)
      d. I do not know

28. You have been assigned a paper on an oppressed population in Canada. You have decided to focus on systemic racism toward aboriginal peoples. What group of key concepts best describes this particular topic?
      a. I do not know
      b. *aboriginal, Canada, racism
      c. aboriginal, causes, racism
      d. aboriginal, oppression, population

29. Which of the following choices is NOT a secondary source?
      a. A report stating the government's position on climate change
      b. I do not know
      c. *A journal article reporting the results of a new study on climate change
      d. A book summarizing current thinking about climate change

30. What is the purpose of the Subject Headings found in library database records?
      a. They allow librarians to keep track of how many articles the library has on a topic
      b. *They make it easier for people to find other articles on the same topic by using a standardized way to describe what the article is about
      c. I do not know

    d. They are tags added by database users so that they can find the articles again in future searches

31. Which of the following pieces of information do you NOT need for a journal article citation?
    a. Volume number
    b. I do not know
    c. Author
    d. *International Standard Serial Number (ISSN)

32. You need to find information on what happened in Parliament last week. The best source for this type of information is:
    a. *News magazine
    b. Course textbook
    c. Academic journal
    d. I do not know

33. Which of the following items is NOT a secondary source?
    a. I do not know
    b. Dissertations about To Kill a Mockingbird
    c. *A work of literature such as To Kill a Mockingbird
    d. Books about To Kill a Mockingbird

34. You have to write a research paper on the broad topic of stress and post-secondary students. You want to narrow that topic down to the relationship between stress and academic performance. The research question that best reflects this narrowed focus is:
    a. I do not know
    b. What factors determine the academic performance of post-secondary students?
    c. How does stress affect students' experience of post-secondary education?
    d. *How is the academic performance of post-secondary students affected by stress?

35. Plagiarism is:
    a. Using the ideas of another person instead of using your original thoughts
    b. I do not know
    c. Failing to use the correct citation style when citing your sources
    d. *Including the ideas of another person in your writing without giving them credit

36. The most efficient way to search for reliable articles for your research paper is to:
    a. Search for articles in web search engines
    b. I do not know
    c. Go to the periodical stacks and look through the magazines and journals
    d. *Search for citations in library databases

37. Which of the following is the best piece of information to use in helping you evaluate the quality of a video you find on YouTube?
- a. *Source of the video
- b. Viewer Comments
- c. I do not know
- d. Number of views

38. You're researching a paper on the psychological effects of stress on students and you've found some statistics. Which of the following statistics would be most useful for your topic?
- a. The rate of students dropping out after their first year
- b. I do not know
- c. The percentage of students enrolled at your institution who report drinking alcohol to relieve stress
- d. *The number of students reporting psychological symptoms of stress in a research survey

39. You have been assigned a paper on climate change mitigation methods in North America. You have decided to focus on the use of nuclear power as a possible alternative energy source in Canada. What group of key concepts best describes this particular topic?
- a. effects, limitations, nuclear power
- b. climate change, limitations, nuclear power
- c. I do not know
- d. * Canada, climate change, nuclear power

40. You've been given the following APA citation:

> Profen, I. B. (2004). The impact of alcohol on university students' ability to concentrate during exams. College Students, 38 (3), 30-45. doi:10.1037/0735-7044.121.1.21

What are you looking for?

Select one:
- a. *A journal article
- b. A book chapter
- c. A magazine article
- d. I do not know

Appendix C: Information Literacy Major Paper Rubric

https://goo.gl/Ta2IYf

Criteria	4 - Exemplary	3 - Proficient	2 - Marginal	1 - Unacceptable
1 Determine Information Needs	● Defines scope of research question/thesis effectively. ● Research question/thesis is interesting, creative and/or original. ● Sources directly address key concepts or answer research question/thesis	● Defines scope of research question/thesis adequately. ● Sources relate to key concepts or answer research question/thesis.	● Defines scope of research question/thesis, but scope is incomplete or inadequate (too broad, too narrow). ● Sources partially relate to key concepts or answer research question/thesis.	● Does not articulate a clear research question/thesis. ● Sources do not relate to key concepts or answer research question/thesis.
2 Evaluate Information and sources critically	● Sources selected are varied, highly relevant and of high quality. ● Provides thorough analysis of information and sources; applies relevant criteria consistently. ● Questioning of assumptions leads to an informed understanding of information and sources. ● Carefully examines context of information and presents it relevantly.	● Sources accessed are appropriate and relevant but not comprehensive ● Appropriately analyzes information or sources by applying relevant criteria ● Questions assumptions related to information and sources ● Explores some contexts of information and sources	● Sources accessed are limited and unvaried ● Provides superficial analysis of information or sources ● Acknowledges and/or contextualizes some assumptions related to information and sources	● Information sources are inappropriate, of poor quality and/or lack relevance. ● Does not provide analysis of information or sources ● Does not acknowledge or contextualize assumptions related to information and sources.
3 Synthesize Information	● Meets all "Proficient" descriptions AND: ● Creatively organizes and synthesizes information to support the purpose/format of the product ● Develops meaningful insights based on a variety of sources and perspectives. ● Achieves intended purpose with depth and clarity.	● Content organization supports the purpose/format of the product ● Integrates sources with each other and with one's own argument ● Appropriately represents major positions on the topic ● Achieves intended purpose.	● Attempts to organize content but does so inadequately ● Somewhat engages with sources ● Inadequately represents other positions and/or fails to acknowledge some major perspectives ● Engages with sources in a simple manner tending toward summary	● Does not organize content in a manner that supports the purpose/format of the product ● Does not integrate sources with each other or with one's own argument ● Misrepresents or fails to acknowledge other positions on the topic

4 Use Informati on Ethically and Legally	● Chooses appropriate citation style and follows conventions correctly ● Accurately cites in-text and in reference list ● Consistently distinguishes between common knowledge, source information and own analysis ● Accurately and appropriately quotes, paraphrases and summarizes; represents information true to original context	● Cites sources following style conventions in-text and in references list; some minor errors ● Consistently distinguishes between common knowledge, source information and own analysis ● Accurately quotes, paraphrases and summarizes; represents information true to original context.	● Provides source citation/acknowled gement; fails to follow style conventions ● Inconsistently distinguishes between common knowledge, source information, and/or own analysis ● Inconsistently attempts to quote, paraphrase and/or summarize.	● Does not attribute sources ● Does not clearly distinguish between common knowledge, source information, and/or own analysis ● Plagiarizes (intentionally or unintentionally)

Note: If a score falls between categories, give the lower score.

Based on: https://www.lanecc.edu/library/instruction/handouts/il_rubric.pdf which was "Adapted from the AAC&U VALUE Information Literacy Rubric and other rubrics on: http://railsontrack.info/ " **CC-BY-NC**

Appendix D: Qualitative Interview Questions

https://goo.gl/6H3f4Y

Preliminary Information:
1. Participant's Name:
2. Instructor Name & Section:
3. Date:

- Welcome. Before we start I just want to make sure that, you agree to participate in this interview for this study in Information Literacy instruction that has been approved by the Campus Ethics Office and agree for audio of the interview to be recorded?
- Just a reminder that if at any time you are not comfortable with a question you don't have to answer, or if you would like to end the interview, that is fine as well.
- This interview will have no impact on your grades for your English class, and all identifying information from this interview will be edited out before it is included in any published work.
- Do you have any questions or concerns?

Information Literacy Class Questions:
1. Information Literacy involves recognizing when information is needed & being able to locate, evaluate, use, cite & communicate that information. Can you tell me what teaching methods were used to teach information literacy in your English class? [Lecture Format, Flipped, Active Learning, Other?]
2. A flipped class typically has videos and readings to be completed before class and then hands-on learning activities in class. Have you taken a flipped class before?
   a. [if yes] Can you tell me more about the other flipped class?
   b. [if yes] What did you think of the format? That's interesting, why? Can you talk more about that?
3. Do you use software like Zotero or Refworks to keep track of your references and citations?
   a. If yes: What software did you use? Why did you select that software for references and citation?
   b. If no: Why don't you use bibliographic software? [Didn't know? Wasn't taught in class? Not easy to use?]
4. What did you typically do in preparation for each information literacy class?
   a. Approximately how much time, on average, did you spend doing the pre-class work for your information literacy related classes?
5. What search tools did you use most often when looking for journal articles for your major paper? [Summon, Google Scholar, Databases, Other]
   a. What tools did other students use?
6. Please describe the differences between Primary, Secondary, and Tertiary Sources?

     a. On a scale of 1 to 10, how confident are you in differentiating between Primary, Secondary, and Tertiary Sources as you conduct your research?

7. Please describe the differences between Scholarly, Peer Reviewed, and Popular sources?
     a. On a scale of 1 to 10, how confident are you finding high quality, peer reviewed sources for research papers in general now? That's interesting, why? Can you talk more about that?

8. On a scale of 1 to 10, how confident are you in constructing clear and specific thesis statements?
     a. Interesting… can you go into more detail?

9. What is your understanding of academic integrity?
     a. On a scale of 1 to 10, how confident are you adhering to standards of academic integrity in your research and writing?

10. [Deleted Question]

11. What citation style did you use for your English major paper? What citation style is used in your academic discipline? Which do you prefer and why?

12. [Deleted Question]

Control Group Only:

13. Can you explain how the "in-library" information literacy session was structured? Pre-class preparation? In class?

14. On a scale of 1 to 10, how useful was the session for you?
     a. Can you tell me more about that...
     b. What did you like best about the session?
     c. What did you like least about the session?

For Flipped students only:

15. [Deleted Question]

16. Can you tell me about the pre-class work you did before the information literacy classes? What were some of the activities?
     a. What did you think of the videos? How many videos did you watch? On a scale of 1 to 10, how helpful were the videos for you?
     b. What did you think of the CourseSpaces exercises & quizzes related to the videos? On a scale of 1 to 10, how helpful were the exercises & quizzes for you?
     c. Would you have been more likely to complete all the videos, exercises & quizzes if grades were attached to them?
     d. Thinking about your classmates, do you think that they would be more or less likely to complete the pre-work if participation marks were given rather than graded quizzes?
     e. How did the information literacy pre-class work differ from homework for the rest of the course?
     f. Did the pre-work prepare you for the in-class activities?

g. Did you spend more or less time doing the flipped IL work compared to the regular pre-class homework?
h. How much time do you feel is appropriate for the pre-work? More or less than ½ hr.
17. What did you think of the in-class activities for the information literacy classes?
    a. Can you describe some of the activities?
    b. On a scale of 1 to 10 how helpful were the exercises?
    c. What were the advantages and disadvantages of the in-class group work?
    d. Did the in-class activities that were designed to help you make progress on your major paper, actually help you make progress on your major paper?
18. What difficulties did you experience or observe others experience while participating in the flipped classes? Can you elaborate?
19. Would you prefer to take a flipped or lecture based English class? Why?
20. If I asked your peers if they would prefer to take a flipped English class, how would they respond?

Appendix E: Information Literacy Flipped Learning Curriculum

https://richmccue.com/2016/07/14/undergraduate-information-literacy-curriculum-materials/