Journal of Information Technology Education: Research

*An Official Publication of the Informing Science Institute InformingScience.org*

*JITEResearch.org*

**Volume 17, 2018**

# IMPACT OF THE FLIPPED CLASSROOM ON LEARNER ACHIEVEMENT AND SATISFACTION IN AN UNDERGRADUATE TECHNOLOGY LITERACY COURSE

| | | |
|---|---|---|
| Max Sommer | University of Florida, Gainesville, FL, USA | msommer15@ufl.edu |
| Albert Ritzhaupt * | University of Florida, Gainesville, FL, USA | aritzhaupt@gmail.com |

* Corresponding author

## ABSTRACT

| | |
|---|---|
| Aim/Purpose | The purpose of this study was to examine the impact of the flipped classroom model on learner achievement and satisfaction for undergraduate learners |
| Background | The context for this research on the flipped classroom was an introductory technology literacy course at a public, research university. |
| Methodology | This study employed a quasi-experimental pre-test/post-test design consisting of two groups: the treatment condition (sections in which instructors implemented the flipped classroom model for the module that was the focus of the study) and control condition (sections in which instructors lectured in the face-to-face meeting, then learners completed the practice online as homework). Learners in each group received their form of instruction and completed the same instructional activities, tests, and surveys. These data were analyzed using descriptive statistics, Analysis of Variance (ANOVA), and Analysis of Covariance (ANACOVA) models. |
| Contribution | This research adds to a growing base of literature on the flipped classroom, a special instantiation of blended learning. |
| Findings | Results indicated that there was no significant difference between the two groups in terms of learner achievement. In terms of learner satisfaction, however, there was a significant difference in which participants favored the control condition. |

Accepted by Editor Jo Coldwell-Neilson | Received: February 4, 2018 | Revised: March 14, 2018 | Accepted: May 22, 2018.

Cite as: Sommer, M., & Ritzhaupt, A. (2018). Impact of the flipped classroom on learner achievement and satisfaction in an undergraduate technology literacy course. *Journal of Information Technology Education: Research, 17,* 159-182. https://doi.org/10.28945/4059

(CC BY-NC 4.0) This article is licensed to you under a Creative Commons Attribution-NonCommercial 4.0 International License. When you copy and redistribute this paper in full or in part, you need to provide proper attribution to it to ensure that others can later locate this work (and to ensure that others do not accuse you of plagiarism). You may (and we encourage you to) adapt, remix, transform, and build upon the material for any non-commercial purposes. This license does not permit you to use this material for commercial purposes.

| | |
|---|---|
| Recommendations for Practitioners | Practitioners should select situations that are appropriate for the flipped classroom context. This should be reflected in the implementation of curriculum that would benefit from the affordances of this approach. |
| Recommendation for Researchers | Researchers should seek to replicate this study in longer durations and using rigorously developed and validated measures. |
| Impact on Society | This study suggests the flipped classroom may not be perceived by learners in an introductory technology literacy course as beneficial to their satisfaction. |
| Future Research | Future research should seek to replicate studies in technology literacy courses to identify the optimal learning situations for the blended learning environment. |
| Keywords | flipped classroom, learner achievement, learner satisfaction, blended learning; technology literacy |

## INTRODUCTION

As technological advancements continue to occur, learning environments in higher education are evolving. With the affordances that these innovations offer, learning environments that include the use of technology are approaching "instructional territory" that used to be possible only through traditional, face-to-face instruction (Bonk & Graham, 2006, p. 6). As this shift is occurring, it is vital to study the best practices and the latest opportunities offered by the learning environments that are becoming more prominent. Blended learning (BL), also called hybrid learning, combines the online learning environment and the traditional, face-to-face learning environment (Bonk & Graham, 2006, p. 5). BL has become one of the most popular trends in higher education. Norberg, Dzuiban, and Moskal (2011) predicted that BL would become "the new normal" for the delivery method of higher education courses (p. 4). According to the NMC Horizon Report: 2017 Higher Education Edition, BL designs in courses and programs is considered one of six "key trends" in higher education (Adams-Becker, Cummins, Davis, Freeman, Hall-Giesinger, & Ananthanarayanan, 2017, p. 18).

While the basic concept of BL is the combination of face-to-face and online learning, many focus on the opportunity for improved learning rather than just differentiated teaching methods. Sloman (2007) states that understanding BL "must be as much about varying learning methodology as it is about training delivery" (p. 318). Sloman goes on to discuss how BL practices can be strategically designed to foster to "what motivates learners, what support they need and how these supportive interventions can take place" (p. 318). One specific BL technique that is examined in this study is the flipped classroom (FC) model. The FC model "builds on web-based lectures that are studied prior to face-to-face classroom sessions" (Thai, De Wever, & Valcke, 2017, p. 3). This allows for learners to enter class meetings more prepared and for these face-to-face class meetings to be used for more "higher-order activities" in which the instructor is present to give feedback and support (Thai et al., p. 3). This is significantly different from what face-to-face meetings are frequently used for in higher education, which is often delivery of content in the form of a lecture.

With BL possibly becoming the norm in higher education, it is imperative to study the most effective strategies and instructional design methods of this teaching format. The nature of the problem that this study addresses derives from an instructional design approach. Peterson (2003) states that the first step in the instructional design process is to "determine the needs of the audience" (p. 228). In the case of this study, the audience is current and future technology literacy course learners and the need is to find the optimal set of instructional circumstances for those learners. While the current instructional circumstances may be considered sufficient, instructional designers and educators must ask themselves, "Is it as effective and ideal for the learners as it possibly can be?" Finding an optimal set of circumstances is especially important regarding BL environments. This is because of the countless options and multimedia tools available to instructors using this type of format, and the

endless possibilities of combinations of instructional activities and strategies that can shape a BL lesson plan. Determining the FC model's impact on learner achievement and learner satisfaction in comparison to the typical instruction can put us one step in the right direction towards finding the best practices in the BL environment for this particular context.

In this situation, the context at hand is an undergraduate introductory-level technology literacy course that employs a BL format for each of its 15 modules. In this study, the term "course" referred to a semester-long class, while the term "module" referred to a one-week-long individual topic that makes up the components of a course. This type of course is a common component of higher education curricula in the 21st century. Today, with technology all around us, "digital literacy has become increasingly critical to success in any educational discipline or occupation" (Murray & Perez, 2014, p. 88). With employers placing an increased emphasis on hiring employees who have technology skills, these types of courses are offered frequently. Within the last thirty years, many institutions of higher education "implemented computer literacy as a requirement and often placed a requirement of this literacy into the school's liberal education (general education) core requirements for all graduates" (Kleen, Rodriguez, & Fanguy, 2011, p. 162). Technology literacy courses will be defined and discussed further in the literature review.

The module that is the focus of this study (Module 5: All About Images [Part 1]) aims to achieve its objectives through instruction and practice using the Photoshop application. One objective of this module is to have learners become more visually literate, which Stokes (2002) describes as having "skills for reading and writing visually in order to derive meaning from what is being communicated" (p. 13). The Module 5 introduction webpage on the EME2040 course website states that "regardless of your profession, visual media surrounds you and it is in your best interest to better understand it." This module aims to achieve its objectives through learners getting experience with and learning the basic purposes of a popular image-editing software (Photoshop), understanding "composition and creative elements" to consider while using this software, and developing skills in the implementation and practice of using Photoshop to complete tasks and create projects (from the EME2040 course website).

While these technology skills courses may have been required for three decades, the technological advancements of recent years provide affordances that were not available years ago. This presents us with a new need, and with this need a new opportunity, to explore more pedagogical options to achieve the most effective instructional design and course strategies for the context at hand. Due to the rapid increase in technological advancements that have contributed to the many options and possibilities in the BL environment, investigation into optimal circumstances and instructional design in the undergraduate, technology literacy context is necessary and needed.

## PURPOSE AND RESEARCH QUESTION

The purpose of this study was to examine what impact a specific form of BL, the FC model, can have on both learner achievement and learner satisfaction in an undergraduate, technology literacy course. Assessing the FC model's impact on learner achievement and learner satisfaction can shed light on preferences and effectiveness of instruction for learners in the undergraduate, technology literacy course context. Gaining insight on this information can take us one step closer to the optimal circumstances for these types of learners in this type of course. The findings from this study can then be applied to comparable situations across the world, in which similar types of learners are taking similar types of courses. This study attempted to answer the following research question: what impact does implementing a FC model have on both learner achievement and learner satisfaction in a module of an undergraduate, technology literacy course?

# RELEVANT LITERATURE

## *BLENDED LEARNING*

There are various definitions of BL that share a similar theme. In *The Handbook of Blended Learning,* Bonk and Graham (2006) simply define BL systems as those that "combine face-to-face instruction with computer-mediated instruction" (p. 5). Some classify BL by setting parameters for the amount or ratio of instruction that takes place online versus face-to-face. Allen, Seaman, and Garrett (2007), for example, define BL as "having between 30 and 79 percent of the course content delivered online" (p. 5). Some believe BL should not just be defined as a simple combination or a ratio of instructional methods, but as "a shift in instructional strategy" (Watson, 2008, p. 5). When considering BL environments, Osguthorpe and Graham (2003) state that "the central purpose that should drive all other motives is to improve student learning" (p. 231). This is supported by Garrison and Vaughan (2008), who explain that BL occurs when "face-to-face oral communication and online written communication are optimally integrated such that the strengths of each are blended into a unique learning experience congruent with the context and intended educational purpose" (p. 5). These definitions all apply to the BL instruction that is being explored in this study, as it combines online instruction with face-to-face instruction, includes a ratio of 30 to 79 percent online, and aims to combine the strengths of the face-to-face environment with the strengths of the online environment. For the purpose of this study, we will use Garrison and Vaughan's simple yet effective definition from *Blended Learning in Higher Education* that is a concise combination of these previous definitions*:* "BL is the thoughtful fusion of face-to-face and online experiences" (p. 5).

There are multiple reasons why institutions implement BL courses and programs. The main reasons BL is implemented are to improve pedagogy, to increase access and flexibility, and increase cost-effectiveness (Bonk & Graham, 2006, p. 8). Examples of frameworks that use BL to attempt to improve pedagogy include the Community of Inquiry (CoI), the Multimodal Model, and the FC model. BL that follows the CoI framework uses the affordances of the online learning environment and the face-to-face learning environment to establish a social presence, a cognitive presence, and a teaching presence (Garrison & Arbaugh, 2007, p. 159). The Multimodal Model uses "multiple modalities" to blend approaches, activities, and environments to "be most effective for and appeal to a wide range of students" (Picciano, 2009, p. 14). The FC model will be described in detail in the next section. These are just three examples; there are countless approaches that use BL to attempt to improve pedagogy. Garrison and Vaughan (2008) describe the reason for having a framework guide the practice of BL, stating that "the openness of BL redesigns, in terms of the range of possibilities, demands a strong theoretical foundation and framework" (p. 13).

The flexibility and the increased access to learning and information have also contributed to the increased adoption of BL practices. Bonk and Graham (2006) reference many programs in *The Handbook of Blended Learning* that "would not be possible if students were not able to have a majority of their learning experiences at a distance from instructors and/or other students" (p. 9). Flexibility is becoming more important as access to learning increases now that there are "more mature learners with outside commitments such as work and family" (p. 9). BL's ability to increase access to learning and learner flexibility without surrendering face-to-face social interaction makes it an attractive choice for many courses and programs. As access to learning increases with BL practices, cost-effectiveness does as well. BL provides "an opportunity for reaching a large, globally dispersed audience in a short period of time with consistent, semi-personal content delivery" (Bonk & Graham, 2006, p. 10). According to Garrison and Kanuka (2004), providing interactive learning experiences to learners "in ways that are accessible and cost effective" is a defining characteristic of BL (p. 100).

## *Flipped Classroom*

The basic concept of the FC model is that learners view web-based lectures prior to their face-to-face meetings and then, when the meeting occurs, they can engage in "group-based interactive learning activities in the classroom" (Thai et al., 2017, p. 1). A graphic to describe the FC model and how it differs from traditional instruction can be seen in Figure 1. Some simply define FC as a reversal of roles of locations: typical face-to-face components of instruction (lecture or direct instruction) being completed outside of class, and typical out-of-class components of instruction (practice) being completed within the classroom (Bishop & Verleger, 2013, p. 5). While this is accurate, this "merely represents a re-ordering of classroom and at-home activities" instead of the "expansion of the curriculum" that the FC aims to achieve (Bishop & Verleger, p. 5).

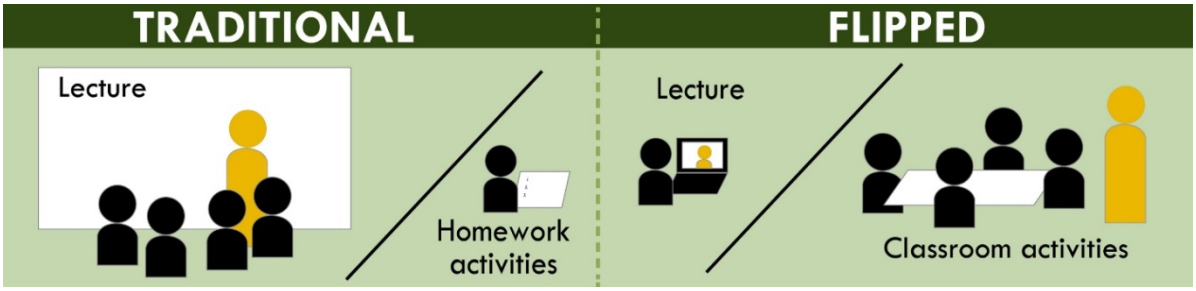


**Figure 1. Traditional instruction versus flipped classroom (University of Washington, 2017).**

The "expansion of the curriculum" includes a couple of different aspects of instruction that the FC can enhance. The initial improvement occurs outside of the classroom in the online environment; with FC, learners can "use the video resources provided, along with other materials, to learn concepts and complete tasks on their own, at their own pace, and at locations convenient" to them (Davies, Dean, & Ball, 2013, p. 3). This provides individualized instruction in which learners "can focus their efforts on their individual learning needs so they are not left behind by class discussions that go too fast or become bored by class time that is spent covering content they already know" (Davies et al., 2013, p. 3).

The other component of instruction that is enhanced with FC is what occurs inside of the classroom. Because the direct instruction (lecture in most traditional subjects) is completed asynchronously outside of the classroom, the face-to-face meeting can now be used "either to help students grasp especially challenging concepts or to help students engage in higher orders of critical thinking and problem solving" (Davies et al., p. 3). These in-class meetings "are no longer used for information transmission such as lecturing but, instead, become opportunities to diagnose student misconceptions, foster critical dialogue, and support peer instruction" (Garrison & Vaughan, 2008, p. 117). This further provides individual instruction to learners, as they can ask specific questions from the online material, engage in collaborative activities, and complete more "value-added activities" that would not have previously been possible (Asef-Vaziri, 2015, p. 72). In this study, we will refer to FC as the strategic blend of web-based, asynchronous direct instruction outside of the classroom followed by collaborative, deeper-level learning activities in the classroom.

These benefits of the FC affect both learners and instructors. Learners benefit from the increased choice in their individualized instruction of the web-based portion of the instruction through increased freedom to complete the work when convenient, options as to where to complete the work, and personal selection of how thoroughly to study instructional materials. Herreid and Schiller (2013) stated that using the FC model also benefitted instructors through finding more time for in-depth learning activities due to the learners coming into class with content knowledge (p. 62). Fulton (2012) states that instructors can require learners to complete pre-assignments about the content to help instructors adjust their lessons to fit the needs of the learners (p. 20). The FC model also allows instructors to see learning preferences of the class and modify lessons accordingly, provide an effec-

tive solution for absences (learners can still view and complete the web-based component of the class), and make it easier to create an environment in which "students are more actively engaged in the learning process" (Herreid & Schiller, 2013, p. 62).

Along with these benefits, there are some aspects of the FC model that instructors may view as negative. According to Sahin, Cavazoglu, and Zeytuncu (2015), some learners initially have trouble or are resistant because they are accustomed to traditional approaches (p. 144). They also mention that "preparing a good quality video can be very time consuming for teachers and some teachers can be resistant because of their lack of experience with the necessary technology" (Sahin et al., 2015, p. 144). Finally, Sahin et al. (2015) warn that if materials are not of high quality or do not match with the learners' level, issues can arise (p. 144). This indicates that the FC model requires extra work on the front-end of creating lesson plans for courses.

### *Technology Literacy*

Burkhardt et al. (2003) define technology literacy as "knowledge about what technology is, how it works, what purposes it can serve, and how it can be used efficiently and effectively to achieve specific goals" (p. 15). Davies (2011) states that "technology literate people know what the technology is capable of, they are able to use the technology proficiently, and they make intelligent decisions about which technology to use and when to use it" (p. 47). Ezzaine (2007) describes computer literacy, which is a component of technology literacy, as "understanding computer characteristics, capabilities, and applications as well as the ability to implement this knowledge in the skillful, productive use of computer applications to individual roles in society" (p. 178). All of these definitions and descriptions are indicative of the discipline of the course in this study. In this study, we will refer to technology literacy as awareness and knowledge of technological tools and purposes paired with practical, professional application skills.

We consider the course in which this study took place, EME2040: Introduction to Educational Technology, to be a technology literacy course that covers computer literacy. This type of course is an important component of education. Ezzaine (2007) states how "computer literacy is one of the most important skills a person can have in today's competitive environment" (p. 178). Siegle (2004) describes how technology literacy in the 21st century now demands learners to be able to achieve quick processing, critical thinking, and creative productivity through the affordances that technology offers (p. 34). While some believe that learners today are more technologically literate than generations in the past, Davies (2011) warns that this is an "incomplete" assumption because "exposure to technology does not make someone a technology expert any more than living in a library makes a person a literary expert" (p. 47). There is no doubt that this type of course is necessary in today's educational system.

While the objectives of instruction in technology literacy courses may vary depending on the program or institution, there are a few themes that surface from multiple sources. These include instilling learners with an awareness of the availability and basic purpose of technology, an understanding of the ethics of personal and social technology use, and the skills to implement and practice using technology to complete various tasks, such as solving problems, creating projects, and communicating with others (Davies, 2011, p. 47; Siegle, 2004, p. 33).

## METHOD

### *Research Context*

EME2040: Introduction to Educational Technology (will be referred to as "EME2040") is an undergraduate, technology literacy course with educational and professional applications. It is offered at the University of Florida (UF) by the College of Education (CoE). This course employs a BL format. For each module, there is a face-to-face component in which the instructor lectures about that

module's topic, usually followed by a discussion or an activity regarding the topic. The BL format of the EME2040 allows for "reduced seat time" (Bonk & Graham, 2006, p. 9), meaning the amount of time spent by instructors and learners in the face-to-face classroom is reduced. While this is a three credit-hour course, learners and instructors only meet for one hour per week. The rest of each weekly module is completed by the learners asynchronously in the online environment, which can include more activities, discussions, and projects.

Enrollment for EME2040 is open to all undergraduate learners at UF, regardless of their age, their major, or how close they are to graduation. This allows the population of learners that take EME2040 to include a wide range of academic and cultural backgrounds. Because EME2040 is a critical tracking course for students studying education at UF, the course roster is often made up of a majority of education students; however, many learners pursing other assorted majors and minors sign up for this course as well. This is because the course fulfills a General Education requirement at UF, making it a useful course for learners of all academic backgrounds. As for cultural backgrounds of learners, the EME2040 course rosters typically reflect the cultural backgrounds that make up the undergraduate population of UF.

This study took place in Module 5 of the course. In this module, learners experienced the Photoshop application, learning skills and concepts necessary to using it effectively, then practicing these skills by following step-by-step instructions to manipulate graphics and use tools to generate a specific image. The goal of the module was for learners to develop skills using Photoshop so they can apply these skills to edit and create original images in future course modules and, ultimately, their professional careers. The typical EME2040 instruction included the instructor lecturing to introduce Photoshop and its tools, then the learners engaged in a practice assignment on their own as homework, following the face-to-face meeting. For this study, however, a revised condition was introduced in which the FC model was implemented. In this case, the learners watched a recorded lecture online asynchronously prior to the Module 5 face-to-face meeting. The learners then engaged in the practice assignment during the face-to-face meeting, with the instructor encouraging collaboration and present to answer questions and offer support as needed.

## *Research Design*

This study employed a quasi-experimental pre-test/post-test design consisting of two groups: the treatment condition (sections in which instructors implemented the FC model for the module that was the focus of the study) and control condition (sections in which instructors taught the module using typical instruction). The implementation of the FC model was the independent variable in this study, while the dependent variables included learner achievement and learner satisfaction. Figure 2 displays a synopsis of the lesson plans for the two groups.

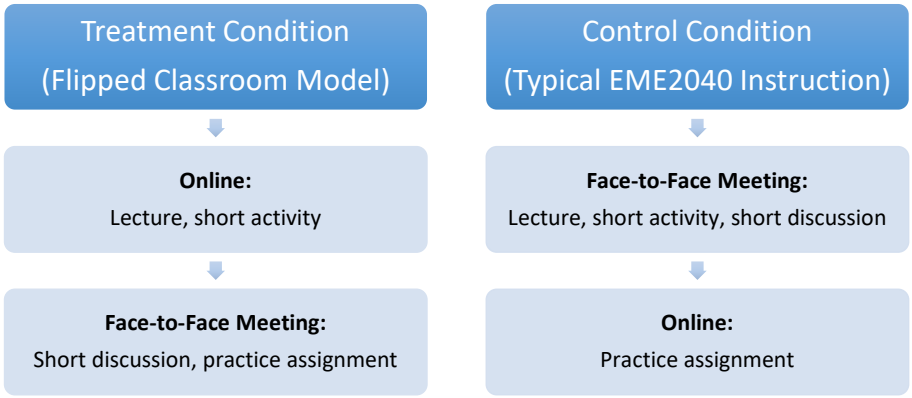


**Figure 2. Treatment condition and control condition lesson plan synopsis.**

## *PARTICIPANTS*

The participants in this study were the individuals enrolled in the course Introduction to Educational Technology (EME2040) at the University of Florida (UF) during the Fall 2017 semester. Enrollment for EME2040 is open to all undergraduate learners at UF. This course consists of five sections (separate classes) and three instructors (two of the instructors teach two sections, one of the instructors teaches one section). Learners chose which section they are in through the UF course registration process without any knowledge of this study taking place. Three of the EME2040 sections were designated as the treatment condition, and two of the sections were designated as the control condition.

In the fourth face-to-face class meeting (week four of 15) of the semester for this BL course, a short survey was collected to gather demographic and academic information of the participants. The survey also asked learners to describe their experience in using Photoshop. After data collection, there were a total of 103 participants. Data for 15 participants were deleted due to not completing Informed Consent Forms; then another fifteen were deleted due to not completing the Demographic/Academic Survey. Finally, one more participant's data was deleted because they did not complete the Photoshop Post-test.

This left the research team with data for 72 participants; 41 (56.9%) in the treatment condition group and 31 (43.1%) in the control condition group. Fifty-seven (79.2%) of the participants identified as female, and 15 (20.8%) of the participants identified as male. The mean age of the participants was 19.72 years old (SD = 1.50), with a minimum of 18 years old and a maximum of 28 years old. Information pertaining to participant ethnic backgrounds and academic majors are displayed in Table 1 and Table 2, respectively. For participant majors, the count adds up to more than 72 because some participants had multiple majors.

**Table 1. Ethnic backgrounds of participants.**

| Ethnic Background | Number of Participants (%) |
|---|---|
| White/Caucasian | 41 (56.9%) |
| Asian/Pacific Islander | 18 (25%) |
| Hispanic/Latino | 6 (8.3%) |
| Black/African American | 5 (6.9%) |
| Native American | 1 (1.4%) |
| Other | 1 (1.4%) |

**Table 2. Academic majors of participants.**

| Major | Number of Participants (%) |
|---|---|
| Elementary Education | 29 (40.3%) |
| Sports Management | 12 (16.7%) |
| Telecommunications | 10 (13.9%) |
| Public Relations | 6 (8.3%) |
| Advertising | 5 (6.9%) |
| Journalism | 3 (4.2%) |
| Exploratory | 3 (4.2%) |
| Health Science | 1 (1.4%) |
| Pre-School Education | 1 (1.4%) |
| Spanish | 1 (1.4%) |
| Art Education | 1 (1.4%) |
| History | 1 (1.4%) |
| Business | 1 (1.4%) |
| Family, Youth, and Community Service | 1 (1.4%) |

Fourteen (19.4%) participants also reported that they have minors, with 5 (6.9%) Business minors and 1 (1.4%) participant each with the following minors: Spanish, Photography, Sociology, Mass Communications, Non-Profit Organizational Leadership, Education, Theatrical Performance, Communication Studies, and Disabilities. As for prior Photoshop experience, 29 (40.3%) participants reported they had no experience, 30 (41.7%) said they had limited experience, 13 (18.1%) said they had moderate experience, and no participants said they had extensive experience.

## *INSTRUMENTS*

This study included various data collection instruments to attempt to answer the research question. These data collection instruments and their rationale related to the research question are summarized in Table 3. Each data collection instrument is described in detail in terms of their components, their purpose, and their source or design rationale.

**Table 3. Data collection instruments and rationale related to the research question.**

| Data Collection Instruments | Rationale |
|---|---|
| Demographic/Academic Survey | This survey recognized whether the sample represents the target population. |
| Photoshop Pre-test | This pre-test gathered baseline scores for the participants. This helped determine the impact of the method of instruction on learner achievement. |
| Practice Assignment | This assessment examined how the participants performed on a practice instructional task to explore if there is a correlation between score and the method of instruction. |
| Transfer Assignment | This assessment further examined how the participants performed on a transfer instructional task to explore if there is a correlation between score and the method of instruction. |
| Photoshop Post-test | This post-test gathered final scores that were compared to the baseline scores determined by the pre-test. Comparing these two scores for participants will help determine the impact of the method of instruction on learner achievement. |
| Learner Satisfaction Survey | This survey gathered the participants' satisfaction of the instructor and aspects of the module to observe if there is a correlation between learner satisfaction and the method of instruction. |

### Demographic/Academic Survey

The first item presented on the survey was a unique identification (ID) code for each participant. This ID was used throughout the entire study; participants used their unique IDs for all data collection instruments to link each participant's data together, and so participants can remain anonymous to the research team. Following the ID, this survey consisted of five items questioning the participants about demographic information (including age, gender, and ethnic background), academic information (what majors and minors participants are pursuing at UF), and information about their Photoshop experience. For the question pertaining to Photoshop experience, learners were asked to describe their backgrounds in using Photoshop, giving them four options: no experience, limited experience, moderate experience, and extensive experience. This information was gathered for data

analysis later in the study pertaining to Photoshop experience playing a role in learner achievement on assessments and assignments during the study.

### Photoshop pre-test and post-test

The pre-test was designed and used in this study for two reasons; the first being to collect a baseline score from each participant. This was helpful when considering learner achievement and comparing this baseline score to the score participants received on their post-test that was taken following the study. The other reason the pre-test was used was to "check on the equivalence of the groups" (treatment condition and control condition) (Gribbons & Herman, 1997, p. 3). This was useful because if results on the learner achievement measures later in the study showed one group performing better than the other, the researchers "can rule out initial differences" as a description of the results (Gribbons & Herman, 1997, p. 3). The Photoshop Pre-test was an eight-item multiple choice assessment. It was designed by the research team based on the learning objectives for the Photoshop lesson delivered in the EME2040 Photoshop lecture and assignments that followed. It included questions pertaining to underlying Photoshop concepts, starting a Photoshop project, Photoshop tools, and completing a Photoshop project.

The post-test was designed to collect a final score for considering learner achievement by comparing it to the baseline score from the pre-test. The items were the same as the items on the Pre-test, but the questions were presented in a different order. Also, the multiple-choice answer distractors for each question were presented in a different order on the post-test. Because the two assessments were taken by participants exactly three weeks apart from one another with multiple instructional events in-between, the participants were unlikely to remember individual items from the Pre-test when they completed the post-test. Participants never received feedback from their Pre-test, so they did not gain knowledge about those specific assessment items in terms of if they were correct or incorrect.

### Practice Assignment

The Practice Assignment was the key assessment during Module 5, and consequently, a rubric was designed to assess student work products. This instrument was used to gather scores to contribute to analyze learner achievement in the study and to examine what the impact of different instructional methods was on participants' ability to practice the skills they learned from the lecture. The criteria used to assess the Practice Assignment were specified in a detailed rubric, which was made available to all students in the Learning Management System. The rubric used eight "Essential Components" of the final image to assess the learners on their achievement. This is useful for learners because they can check to make sure these components are involved, and it is beneficial for instructors because it is a straightforward, objective way to score the students' assignments.

### Transfer Assignment

The Transfer Assignment was the key assessment in Module 6, the module following the primary instruction of the study that occurred in Module 5. This instrument was used to gather scores to contribute to analyze learner achievement in the study and to examine what the impact of different instructional methods was on transferring skills to application. Ford, Smith, Weissbein, Gully, and Salas (1998) describe transfer of learning to occur when learners "acquire knowledge, skills, and attitudes and then apply these capabilities to other contexts" (p. 218). While the Practice Assignment was detailed in directions and protocol, the Transfer Assignment was open-ended and did not give participants specified instructions about exactly what to do. Instead, the directions simply asked participants to "design an image that correlates to an aspect or theme related to your field of study or area of interest." While the Practice Assignment assessed practicing the skills gained from viewing the Module 5 lecture, the Transfer Assignment assessed the participants' ability to transfer those skills to a new and creative application. The criteria used to assess the Transfer Assignment was specified

in a detailed rubric, which was also posted in the Learning Management System for participants to review prior to submitting their assignment.

### Learner Satisfaction Survey

The Learner Satisfaction Survey was presented to participants at the end of the study, during Module 7. The purpose of this survey was to collect information on the satisfaction of the learners in terms of the instructor and aspects of the material in order to determine what impact the different instructional methods had on learner satisfaction. This survey was taken from a similar study that Lim, Morris, and Kupritz conducted in 2007. These researchers used their survey to compare the learner satisfaction of participants in online learning instruction with the satisfaction of those taking part in BL instruction. While the study being described in Lim, Morris, and Kupritz's (2007) paper compares online learning to BL instead of comparing two forms of BL, the component of the survey that was used here still captured learner satisfaction and allowed the researchers to analyze the data to compare two methods of instruction.

The Learner Satisfaction Survey was a 10-item Likert scale type of survey, with the participants choosing a response for each item on a five-point scale. A Likert scale type of survey was implemented as part of this study because these surveys are "widely used in the social sciences, both as research tools and in practical applications" (Matell & Jacoby, 1971, p. 657). Each item brought attention to an aspect of the instructor or the module material, and the participants were to select their perception of that aspect of instruction from "ineffective" to "very effective." The range of responses (from 1-5, respectively) were: "ineffective," "somewhat effective," "moderately effective," "effective," and "very effective." The survey items included instructor helpfulness, concern, willingness to listen to learners, use of examples, availability of extra help, use of questioning, command of the subject matter, presentation of information, ability to summarize important points, and use of web technologies in instruction. Cronbach's $\alpha$ for this survey was measured as .93.

## *Procedures*

Prior to the semester beginning, the research team (one member who is also one of the instructors) met with the other two instructors to discuss plans for the study in the upcoming semester. The purposes of this meeting were to inform the other instructors of the study that would be taking place in the upcoming semester and to designate which sections would be part of the treatment condition (using the FC model for instruction) and which sections would be part of the control condition (using typical instruction). To limit the likelihood that the time of the day may act as an extraneous variable in the study, it was attempted to assign as close to an equal amount of morning and afternoon classes to each type of instruction as possible. The result of this was having three treatment condition sections (one morning, one midday, and one afternoon) and two control condition sections (one morning and one afternoon). This step was taken because Johnson and Christensen (2008) state that an extraneous variable "makes the interpretations of the research findings very difficult" (p. 42). The researcher and one instructor each taught one treatment condition section and one control condition section, and the third instructor taught only a treatment condition section (to make up five sections total).

As for informing the other two instructors of the study that would be taking place in the following semester, Table 4 was presented by the researchers at this meeting and acted as a synopsis for the instructional events that took place from weeks 4-7 during the semester regarding the study. Module 4 and Module 7 topics are not included in this table because while events occurred for the purposes of the study, the topics of these modules were unrelated to the study. Module 5: All About Images (Part 1) is the module in which the different instructional methods were implemented. The first event of the study did not take place until the fourth week of the semester, during the Module 4 face-to-face class meeting.

Before each face-to-face class meeting throughout the study, the researchers met with the other two instructors to discuss plans for the study and to train the instructors to ensure consistency between the class sections. For the Module 4 face-to-face meeting, the researchers informed the instructors prior to this class meeting that the only aspects of the study that had to be completed that week were the Demographic/Academic Survey and the Photoshop Pre-test.

**Table 4. Instructional and research events across course modules.**

| Control Condition: Typical EME2040 Instruction | Treatment Condition: Flipped Classroom Model |
|---|---|
| MODULE 4:<br>1. Demographic/Academic Survey<br>2. Photoshop Pre-test | MODULE 4:<br>1. Demographic/Academic Survey<br>2. Photoshop Pre-test |
| MODULE 5: All About Images (Part 1)<br>• In-Class<br>1. Face-to-face Lecture<br>2. Photoshop Tools Handout<br>3. Short Discussion<br>• Online<br>4. Practice Assignment | MODULE 5: All About Images (Part 1)<br>• Online<br>1. Web-based Lecture<br>2. Photoshop Tools Handout<br>• In-Class<br>3. Short Discussion<br>4. Practice Assignment |
| MODULE 6: All About Images (Part 2)<br>1. Transfer Assignment | MODULE 6: All About Images (Part 2)<br>1. Transfer Assignment |
| MODULE 7:<br>1. Photoshop Post-test<br>2. Learner Satisfaction Survey | MODULE 7:<br>1. Photoshop Post-test<br>2. Learner Satisfaction Survey |

The Demographic/Academic Survey was presented online using Qualtrics. Instructors provided each participant with a unique identification (ID) code. The instructors provided the participants with files that contained these ID codes to use as a reference, as this ID code would be used instead of participant names for all study events and materials. Instructors also kept these files on hand in case participants needed them. After completing the survey, the participants were asked to complete the Photoshop Pre-test. This Pre-test was also presented to participants online using Qualtrics. Participants entered their ID codes in the designated area and then completed the eight-item multiple choice Pre-test.

Prior to Module 4, the research team created two new Microsoft Excel spreadsheets for data collection and storage. The researchers were the only ones with access to these data. The first spreadsheet consisted of only two data points: the participants' names and their corresponding ID codes. The purpose of this spreadsheet was so course credit could be given to participants for completing course assignments following the completion of the study. After this spreadsheet was created and participants were given their individual ID codes, the spreadsheet remained unopened until the data analysis was complete. Only after the data analysis process was complete did the researchers open this spreadsheet and link the ID codes back to the participants' names so course credit could be awarded. The second spreadsheet consisted of the participants' ID codes and was used to post the corresponding data from surveys, assignments, and tests used in the study for each participant.

The next instructional events that occurred during the study were those included in Module 5: All About Images (Part 1). For the treatment condition sections, homework was assigned to watch the web-based lecture and complete the Photoshop Tools Handout prior to the Module 5 face-to-face meeting. The web-based lecture was led by the researchers and used the screen-capture technology Capto to record the researcher's screen as he discussed and displayed examples of underlying Photoshop concepts, starting a Photoshop project, an overview of Photoshop tools, and completing and saving a Photoshop project. The lecture lasted 26 minutes and 30 seconds. In Gagne's Nine Events of Instruction (as cited in Kruse, 2009, p. 2), this lecture played the role of the fourth event, "where new content is actually presented to the learner." This lecture was posted online for viewing in the Module 5 section of the course website for the treatment condition sections; learners could watch it whenever convenient for them, as long as it was prior to the Module 5 face-to-face class meeting.

Along with viewing the web-based lecture, learners in the sections implementing the FC model were to complete the Photoshop Tools Handout asynchronously prior to the Module 5 face-to-face meeting. The Photoshop Tools Handout was an activity to give the learners an opportunity to practice minor aspects of what they learned from the lecture. This assignment is not worth a significant amount of points and was not collected as data for the study. Instead, it was simply reviewed by instructors as "complete" or "incomplete." It also helped learners with their future assignments by introducing them to using the Photoshop application and its interface. It asked learners to find fourteen Photoshop tools on the Photoshop interface and to insert screenshots of these tools in a table. All of the tools that the learners were required to find in the handout were used at some point in the Practice Assignment assessment that occurred later in the study. Garrison and Vaughan (2008) describe activities that act as a bridge between the content and the future activity as instructional events "that provide entry points for connecting new information with the recall of prior, related learning experiences" (p. 114).

For the control condition sections, the lecture and the Photoshop Tools Handout took place during the Module 5 face-to-face course meeting. Prior to this face-to-face meeting, the researchers met with the other two instructors to train them on how to best deliver the lecture, facilitate the short discussion, and organize the rest of the instruction for Module 5. As part of the training, the two instructors viewed the web-based lecture that the researcher had recorded and were supplied with the same script that the researcher used to present the web-based lecture. The researcher also informed the other instructors to explain and display through a projector the on-screen actions taken while giving the lecture, providing the instructors with explicit instructions on examples to show participants as they lecture about Photoshop. The instructors were also told by the researchers to encourage the learners to follow along by performing the same examples being explained on their own computers. As for the short discussion, the researchers gave each instructor a script that included the topics that the discussion should cover. This instructors' meeting ensured that the different instructors would be consistent in their face-to-face lectures and discussions, so all participants receive consistent instruction.

Treatment condition sections of the course viewed the web-based lecture and completed the Photoshop Tools Handout activity asynchronously, prior to attending the Module 5 face-to-face meeting. This face-to-face meeting in these FC model sections began with the same short discussion that the control condition sections ended with, covering the same topics to ensure consistency. Following the conclusion of the discussion, the rest of the face-to-face meeting time was used for participants to complete the Practice Assignment. While the participants were in the act of completing the assignment, the instructors provided support and assistance to learners while also encouraging learners to have discussions, assist one another, communicate, and collaborate (this was also part of the training that the researchers shared with other instructors prior to this module). The researchers informed the instructors to do this to take advantage of the FC model's "learner-centered opportunities in class for greater teacher-to-student mentoring and peer-to-peer collaboration" (Roehl, Reddy, & Shannon, 2013, p. 46).

After the participants submitted their Practice Assignments, files were immediately downloaded so that only the ID codes labelling the assignments could be viewed by instructors instead of the participants' names. The instructors assessed each assignment based on the Practice Assignment Rubric. When finished with grading, the instructors sent the participants' ID codes and correlating Practice Assignment scores to the researchers for storage. When assessment of the Practice Assignments was complete, the scores were saved securely with the correlating ID codes in the Microsoft Excel spreadsheet. For the rest of the study, the events for both the treatment condition sections and the control condition sections were held constant. For the next module, Module 6: All About Images (Part 2), participants arrived at their Module 6 face-to-face meeting and received directions about the Transfer Assignment. Instructors also reminded participants to label their assignments with only their ID codes instead of their names. The rest of the Module 6 face-to-face meeting was dedicated to allowing participants to brainstorm ideas for this Transfer Assignment and start to work on it for those who were ready. After this meeting, participants were to complete the Transfer Assignment asynchronously and submit it via the Learning Management System prior to the Module 7 face-to-face meeting.

After the participants submitted their Transfer Assignments, files were immediately downloaded so that only the ID codes labelling the assignments could be viewed by instructors instead of the participants' names. Prior to grading these Transfer Assignments, the researchers met with the other two instructors to discuss consistency using the Transfer Assignment Rubric. Because this assignment and its rubric were more open-ended and subjective than the Practice Assignment, it was necessary to find consistent, common ground in grading and establish inter-rater reliability among instructors (Gwet, 2014, p. 4). To do this, the researchers and the two other instructors independently graded the first 28% (20 out of 72) of the Transfer Assignments that were submitted. Scores for each individual submission were discussed in-depth, with conversations between instructors covering the rubric, professional appearance, theme, and proof of mastery over Photoshop concepts. This lead to consistency in grading among instructors by the end of the meeting.

The instructors assessed the rest of the Transfer Assignments independently. When finished grading, the instructors sent the participants' ID codes and correlating Transfer Assignment scores to the researchers for storage. The last events of the study for the participants took place during the Module 7 face-to-face meeting. Participants arrived at the meeting, logged on to the computer-lab computers in the classroom to complete the Photoshop Post-test. Participants inputted their ID codes and took multiple choice assessment that was presented online using Qualtrics. After participants completed the Photoshop Post-test, they were asked to complete the Learner Satisfaction Survey. This was also presented online using Qualtrics and completed on the computer-lab computers in the classroom. When participants were finished with this survey, events of the study were officially complete.

# RESULTS

This study examined the research question, "What impact does implementing a flipped classroom (FC) model have on learner achievement and learner satisfaction in an undergraduate, technology literacy course?" The data analysis procedures that were used are reported, and then results are presented by learner achievement and learner satisfaction as dependent measures.

## *DATA ANALYSIS*

Descriptive statistics were computed for each of the measures in the study. This study employed the Analysis of Covariance (ANACOVA) and Analysis of Variance (ANOVA) models to compare the mean response between the treatment group and the control group in terms of the learner achievement and learner satisfaction quantitative data (Keith, 2014, p. 155). An ANACOVA was run on the learner achievement data from the Photoshop Pre-test/Photoshop Post-test, while ANOVAs were run for the Practice and Transfer Assignments and the Learner Satisfaction Survey. Levene's Test for Equality of Variances was used to test if homogeneity of variance was equal across groups (Brown &

Forsyth, 1974, p. 364). An alpha value of .05 was used for tests of significance. The researchers also assessed normality by examination of skewness and kurtosis. The statistical software SPSS Version 24 was used to analyze the data in this study.

## *Learner Achievement*

### Photoshop pre-test/Photoshop post-test

The researchers collected and analyzed data from participants using the same assessment (with questions and multiple-choice answers in a different order) both prior to and following the instruction. The researchers coded responses from these assessments as correct (1) or incorrect (0). The maximum amount of points that could be achieved on each of these assessments was eight. The assumption of homogeneity was met, indicated by Levene's Test of Equality of Error Variances at $F(1,67) = 2.91$, $p = .09$. There were no severe departures from normality for the post-test, as skewness was -.30 and kurtosis was -.78. The descriptive statistics (mean and standard deviation) for these assessments can be seen in Table 5. The difference between the treatment and control groups on the Photoshop Post-test while controlling for the Photoshop Pre-test was not statistically significant at $F(1,69) = 0.22$, $P = .64$.

**Table 5. Photoshop Pre-test/Post-test descriptive statistics.**

| | Pre-test (max = 8) | | Post-test (max = 8) | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Control | 3.10 | 1.51 | 6.55 | 1.06 |
| Treatment | 3.53 | 1.87 | 6.51 | 1.23 |

### Practice Assignment

The researchers collected and analyzed graded scores from the Practice Assignment, which had participants follow specific directions to create an image using the Photoshop application. The researchers and other instructors graded these assignments based on a rubric with a range of 0-4 points, using increments of 0.5 points. The assumption of homogeneity was not met, as Levene's Test of Equality of Error Variances was statistically significant at $F(1,69) = 4.58$, $p = .04$. For the Practice Assignment, skewness was -2.52 and kurtosis was 9.17. Likely because this was a straightforward and simple assignment for participants, scores were very high, resulting in the distribution being high. The descriptive statistics (mean and standard deviation) for this assignment can be seen in Table 6. For this assignment, the difference between the treatment and control groups was not statistically significant at $F(1,71) = 0.52$, $p = .47$.

**Table 6. Practice Assignment descriptive statistics (max = 4).**

| | *M* | *SD* |
|---|---|---|
| Control | 3.62 | 0.69 |
| Treatment | 3.71 | 0.35 |

### Transfer Assignment

The researchers collected and analyzed graded scores from the Transfer Assignment, which had participants creatively apply the knowledge they gained from instruction and practice to an open-ended

project. The researchers and instructors graded these assignments based on a rubric with a range of 0-4 points, using increments of 0.5 points. The assumption of homogeneity was met, indicated by Levene's Test of Equality of Error Variances at $F(1,69) = 0.03$, $p = .87$. There were no severe departures from normality for this assignment, as skewness was -.06 and kurtosis was -.49. The descriptive statistics (mean and standard deviation) for this assignment can be seen in Table 7. For this assignment, the difference between the treatment and control groups was not statistically significant at $F(1,71) = 0.13$, $p = .72$.

**Table 7. Transfer Assignment descriptive statistics (max = 4).**

| | *M* | *SD* |
|---|---|---|
| Control | 2.82 | 0.68 |
| Treatment | 2.88 | 0.75 |

### *Learner Satisfaction*

The researchers collected and analyzed responses from the Learner Satisfaction Survey, which gathered information pertaining to the participants' perceptions of the instructor and the instruction. It was a Likert-scale type survey, with responses coded as ineffective (1), somewhat effective (2), moderately effective (3), effective (4), and very effective (5). The maximum score possible on this survey is 50, with a minimum of 10. Levene's Test of Equality of Error Variances was statistically significant at $F(1,70) = 11.70$, $p = .001$; therefore, the assumption of homogeneity was not met. However, there were no severe departures from normality for this assignment, as skewness was -1.28 and kurtosis was 1.88. The descriptive statistics (mean and standard deviation) for this survey can be seen in Table 8. For this survey, the difference between the treatment and control groups was statistically significant at $F(1,72) = 8.77$, $p = .004$, in favor of the control condition.

**Table 8. Learner Satisfaction Survey descriptive statistics (max = 50).**

| | *M* | *SD* |
|---|---|---|
| Control | 47.19 | 3.04 |
| Treatment | 43.85 | 5.69 |

## Discussion

With BL environments gaining popularity and even predicted to become the norm in higher education (Norberget et al., 2011, p. 4), this research aimed to contribute to BL knowledge and shed light on the best BL practices in a specific context of an undergraduate technology literacy course. The research examined two different BL techniques in an undergraduate, technology literacy course and measured their impacts on learner achievement and learner satisfaction. The researchers collected and analyzed data from the control condition group, in which participants received typical instruction (live lecture in class, practice for homework), and the treatment condition group, in which participants received instruction through the flipped classroom (FC) model (web lecture viewed prior to class, practice collaboratively in class).

## *Learner Achievement*

The first part of the research question aimed to assess the impact of the FC model on learner achievement in an undergraduate, technology literacy course. Following data analysis, it was found that there were no statistically significant differences between the treatment group and the control group on any of the learner achievement measures. The instruments that collected data that measured learner achievement included the Practice Assignment, the Transfer Assignment, and the Photoshop Post-test (while controlling for the Photoshop Pre-test). This indicates that the FC model had no statistically significant impact on learner achievement in this undergraduate, technology literacy course.

Prior research on the FC model suggests that individualized instruction opportunities prior to class meetings and the collaborative practice activity opportunities during class meetings can contribute to achievement (Garrison & Vaughan, 2008). However, the results of the study indicated that these proposed advantages either did not occur or did not lead to a significant impact on participants. One possible reason for these advantages not occurring or not leading to a significant impact on learner achievement is the nature of the content of the Photoshop modules being overly simple and not complex. Sweller, Ayres, and Kalyuga (2011) state that learners process information in working memory, and one of the two categories that can impose a load on working memory is called "intrinsic cognitive load" (p. 57). Intrinsic cognitive load is defined as "the intrinsic nature of the information and that load" that is imposed on working memory (Sweller et al., 2011, p. 57). Sweller (1994) states that the primary determinant of intrinsic cognitive load is element interactivity, which is "the extent to which the elements of a task can be meaningfully learned without having to learn the relations between any other elements" (p. 304). Sweller goes on to describe important characteristics that contribute to element interactivity, describing these characteristics to be that a task is simple and that any material that needs to be learned "is simple to learn and largely independent of every other element" (p. 304). The content presented in the Photoshop modules that took place in this study appear to follow these descriptions of low element interactivity: tasks were simple (for example, "click the paint bucket tool to select a foreground and background color"), and each skill that needed to be learned was largely independent of other Photoshop skills (for example, learners did not need to understand how to use the paint bucket tool to understand how to use the text tool). This low element interactivity suggests that the information presented during instruction also had low intrinsic cognitive load.

This low intrinsic cognitive load is also evident from the high mean scores from both groups on the instruments that assessed the participants on their Photoshop knowledge through low-level direct practice and recall (Bloom, 1956, p. 20). This includes the Practice Assignment, which evaluated participants based on their ability to follow directions to practice their new knowledge of Photoshop skills, and the Photoshop Post-test, which assessed participants' Photoshop knowledge at the conclusion of the study. For the Practice Assignment, the treatment group recorded an average score of 3.71 ($SD$ = .35) and the control group recorded an average of 3.62 ($SD$ = .69) (the maximum points possible was four). For the Photoshop Post-test, the treatment group recorded an average score of 6.51 ($SD$ = 1.23) and the control group recorded an average of 6.55 ($SD$ = 1.06) (the maximum points possible was eight). These high scores in both groups, regardless of the type of instruction, indicate that the Photoshop content presented was not complex, did not have high element interactivity, and did not impose a large load on working memory. Despite any differences in instruction, "intrinsic cognitive load cannot be altered" (Sweller, 1994, p. 308). The simplicity of the content and the low intrinsic cognitive load may have eclipsed any differences in instruction. This is supported by Sweller (1994), who states that "students are readily able to handle low element interactivity material with almost any form of presentation" if intrinsic cognitive load is low (p. 308).

It is worth noting that the other category that imposes a load on working memory that affects learning is "extraneous cognitive load," which is related to instructional design, the presentation of materials, and "the instructional procedures being used" (Sweller et al., 2011, p. 57). Sweller et al. state that

the extraneous cognitive load can be high when presentations of information is "unnecessary and extraneous to the learning goals" (p. 57). This does not appear to be a factor in this situation, however, as "an extraneous cognitive load may have minimal consequences when dealing with material that has low element interactivity because the total cognitive load may be relatively low" (Sweller, 1994, p. 310).

The fact that the difference between treatment and control groups in terms of learner achievement was not statistically significant, however, is a valuable finding pertaining to the context of this study and the FC model's potential impact on learners in this context. An introductory technology literacy course may not contain highly complex, high intrinsic cognitive load material as components of its curriculum. The results of this study show that these types of courses may not benefit from the FC model, as the form of instruction does not matter when content is simple and has a low intrinsic cognitive load. It is important that educators understand this and evaluate the complexity and the intrinsic cognitive load of the content when considering implementation of the FC model.

## *Learner Satisfaction*

The second part of the research question aimed to assess the impact of the FC model on learner satisfaction in an undergraduate, technology literacy course. Following data analysis, it was found that there was a statistically significant difference between the treatment group and the control group in terms of learner satisfaction, with participants favoring the control condition (non-FC model). This was displayed through analysis of the sole instrument of the study that measured learner satisfaction, the Learner Satisfaction Survey. While this survey focused on the effectiveness of the instructor, many of its items apply to the delivery of instruction in general, which stems from the facilitation of course content by the instructor.

The treatment group (FC model) responded with an average score of 43.85 ($SD$ = 5.69) on this survey and the control group responded with an average of 47.19 ($SD$ = 3.04) (the maximum points possible was 50). This indicates that the FC model had a significant impact on learner satisfaction, as participants favored the non-FC model instruction. Results vary in research when discussing learner satisfaction in using the FC model. For example, Herreid and Schiller (2013) found that learners "really like" the FC model due to learner-centered advantages such as learners moving at their own pace, the more time allotted for more engaging in-class activities, and the easier process for learners who miss class (p. 62). Missildine, Fountain, Summers, and Goselin (2013), however, conducted a study that found that learners were less satisfied with the FC instruction than the other forms of instruction, with learners claiming the FC model "required more work," and learners did not observe value of the new methods (p. 599). The results of this study indicate that implementing the FC model in a technology literacy class can have a significant impact on learner satisfaction, leaving learners more dissatisfied than through other methods of instruction.

One possible explanation for this finding is that learners "are initially resistant to new teaching methods" (Hawks, 2014, p. 268). This is the idea that learners are preconfigured to prefer what they are accustomed to, and any new method that is introduced will result in some dissatisfaction. This is supported by Herreid and Schiller (2013), who found the FC model to lead to positive satisfaction in the long-term but warned that learners new to the method of instruction may be initially resistant, which could lead to learners arriving "unprepared for class to participate in the active learning phase of the course" (p. 63). This makes sense in the case of this course, as class each week was taught using typical instruction (non-FC model), and then the new method was implemented solely for Module 5.

Another possible explanation for the significantly lower learner satisfaction findings from the treatment condition is that the web-based, video lecture used was poorly designed for the FC model. The lecture that participants watched for the FC model was 26 minutes and 31 seconds long and was comprised exclusively of a recording of the researcher's screen while the researcher narrated the lec-

ture script. According to Guo, Kim, and Rubin (2014), these characteristics being present in an instructional video can have a negative effect on learner engagement (p. 42), which could lead to lower satisfaction scores. Guo et al. state that videos that include the instructor's "talking head" (instructor's upper body put in one of the corners of the video so learners can see facial expressions and cues) and videos that are broken up into shorter chunks of less than six minutes are more engaging (p. 45). Mayer and Moreno (2003) support this, as they found that having a presentation "broken down into bite-size segments" can reduce cognitive overload that can lead to frustration and dissatisfaction of learners (p. 47). Milman (2012) states that it is "very important not only to ensure that videos are short, but also to make certain that all of the steps of the procedure are introduced adequately so students understand it thoroughly" (p. 86). These instructional video design principles were not followed in designing the lecture used in this study, which could have led to the FC model becoming less engaging, inducing cognitive overload, and frustrating the learners more than assisting them.

It is also worth noting, however, that participants had "learner control" when viewing the web-based lecture (Lawless & Brown, 1997, p. 119). This could have been expected to possibly overcome design issues such as having a video that is not broken up into chunks or segments. Learner control pertaining to viewing the web-based lecture includes the learner being able to pause the video, skip ahead, and go back to re-watch aspects of the lecture. It is also expected that the learners in the context of this study already have the knowledge of how to control a web-based video lecture, as they are a part of the "YouTube Generation" (and the lecture was uploaded and posted to YouTube) (Dreon, Kerper, & Landis, 2011, p. 4).

The web-based, video lecture was essentially the in-class, live lecture but recorded on a computer and posted online for learners to view asynchronously. While this was a research design decision to increase consistency between conditions, Bishop and Verleger (2013) warned that when implementing a FC model, it should be more involved than merely employing a "re-ordering of classroom and at-home activities" (p. 5). This statement is made evident in this study, where moving the lecture online without following the appropriate design principles may have resulted in dissatisfaction for learners who partook in the FC model. These findings demonstrate that when implementing a new or different instructional method, it is imperative to make sure all instructional materials and resources are designed to support that new method.

## *Limitations and Delimitations*

While this research was diligently prepared, the research does have limitations and delimitations. One limitation that can have potentially impacted the researchers' ability to answer the research question is that the material did not have high enough intrinsic cognitive load and was not complex enough to allow for the forms of instruction to make a difference (Sweller, 1994, p. 308). The content of the modules and the assessments being studied was visual literacy, and it was taught by using the Photoshop application. While one must develop certain skills to become proficient at using Photoshop, this is not content that is exceedingly in-depth or difficult. This could have potentially lead to the learner achievement scores that were predominantly high on the low-level assessments of Photoshop knowledge that followed instruction (Practice Assignment and Photoshop Post-test), regardless of the instruction that the participants received; this resulted in the researchers being unable to evaluate the impact of the different forms of instruction that were examined.

The instruction delivered in this study was delivered by three different instructors: a researcher, and two others. This is considered a limitation because there are inherent differences between the instructors, resulting in natural differences in delivery and facilitation of instruction. This could have resulted in extraneous variables affecting data. To counter this, the researchers conducted weekly meetings throughout the study in which the three instructors discussed plans for the following module, and the researchers trained the other instructors on delivery of content and grading of assignments to encourage consistency. This included the researchers sharing and discussing lesson plans, assignment rubrics, lecture scripts, and discussion scripts. The study also violated some of the statistical assump-

tions of ANOVA, specifically the Practice Assignment. While ANOVA is robust to violations, this could have influenced the results.

Also, this study did not include random assignment and selection of participants. This is due to the fact that students self-select into the sections of the course. The researchers also did not have the resources to conduct a study using participants outside of the course (or content outside of the course). Another limitation of this study is the fact that the Photoshop Pre-test and Photoshop Post-test, instruments used in this study, were not validated. These were short, eight-item assessments, and included some items that turned out to be too simple. These instruments were designed by the researchers. It is also important to note that the Practice Assignment and Transfer Assignment were assessments that were taken from the curriculum without any field testing or validation techniques.

Finally, the Learner Satisfaction Survey that was used in the study focused strongly on the instructor (nine out of the ten survey items focused on the instructor). While this survey gave insights on the learners' feelings and satisfaction towards the instructor, this focus may take away or distract from the goal of gathering learner satisfaction data pertaining to the method of instruction in general. It was decided to use this particular survey, despite its shortcomings, for a couple of reasons. First, it was a satisfaction survey that was already validated in empirical research and used in a study in which different methods of instruction were being compared (Lim et al., 2007, p. 41). The researchers did not have the time or resources to design and develop a new instrument and test it for validity. While the survey focuses on the instructor, the instructor's role is a key difference in the two methods of instruction being studied (the FC model and typical instruction). Also, many of its items apply to the delivery of instruction in general, which stems from the facilitation of course content by the instructor. The researchers made the decision that gaining insight into the learners' satisfaction towards the instructor will shed light on their feelings and satisfaction for the instruction in general.

## *Recommendations for Practice*

As more institutions of higher education are adopting BL techniques and strategies, educators are finding themselves with countless options of how to deliver instruction. When it comes to using the FC model, this study provides insight on its impact on learner achievement and learner satisfaction in the context of an undergraduate, technology literacy course. The findings of this study demonstrated that the FC model does not have a significant impact on learner achievement when content or learning outcomes are not complex and do not impose a high intrinsic cognitive load on the working memory of learners (Sweller et al., 2011, p. 57). In contexts in which the material includes low intrinsic cognitive load content, multiple forms of instruction can be approximately equal in effectiveness, as the simplicity of the content overcomes any differences in instruction. When making decisions about pedagogical techniques, educators need to consider the content they are teaching and choose a strategy that makes sense for that content. In cases where educators have simple, straightforward material to teach, the FC model may not be worth the time and resources it takes to switch to a new form of instruction.

This study also illustrated that the FC model can have a significant impact on the satisfaction of learners, leaving them dissatisfied with the new method that is implemented. This could occur because learners are preconfigured and resistant to change, or it may occur when instructional materials are not well-designed for the type of instruction that is being used. Educators and decision-makers who are considering implementing a FC model should be aware that learners may be dissatisfied early in the implementation. This should not stop them from considering the FC model, however, as the resistance may occur only recently and learner "satisfaction may not be a good indicator of learning" (Missildine et al., 2013, p. 599).

### *Recommendations for Future Research*

One obvious recommendation is to execute the study in a second iteration with the FC model applied to all modules of the course, instead of just one module. Students may need practice with the FC model to avoid a possible novelty effect in the course. Results from this future study could help to address this concern and would also provide a more complete picture of the influence of the FC model in an introductory, technology literacy course. . Also, it would be beneficial to examine other BL methods aside from the FC model for introductory, technology literacy courses such as the one in this study. This is because the findings of this study suggest that due to the low intrinsic load of the content, the FC model does not seem to be the best fit for this type of course, as the lack of impact on learner achievement makes the time and energy it takes to implement a FC model difficult to justify. The instructional design approach of finding an optimal set of circumstances for learners in this context, however, should still be pursued. To do this, other instructional strategies that can take place in the BL environment should be studied. In these studies, it would be valuable if a longer period of implementation of a new instructional strategy could be used so initial resistance to change is not a factor that needs to be considered in terms of learner satisfaction. Finding the best possible instructional techniques that can positively impact learner achievement and learner satisfaction for undergraduate technology literacy courses would be valuable for researchers, educators, and institutional leaders to understand.

## Conclusion

Quantitative evidence from this study found that the flipped classroom (FC) model had no significant impact on learner achievement and a significant impact on learner satisfaction, in favor of non-FC instructional methods, in an undergraduate, technology literacy course. These findings pertaining to learner satisfaction may have been influenced by design aspects of the learning materials used in the FC model condition or learners' initial resistance to change. This demonstrates that when implementing a new or different instructional method, it is imperative to make sure all instructional materials and resources are designed to support that new method. In terms of learner achievement, the findings of this study demonstrated that the FC model does not have a significant impact when content or learning outcomes are not complex and do not impose a high intrinsic cognitive load on the working memory of learners. While the FC model has many advantages and affordances, it does not seem to be the best possible instructional technique in the context of introductory, technology literacy courses. This is a valuable finding pertaining to the context of this study, as it is important that educators understand this and evaluate the complexity and the intrinsic cognitive load of the content at hand when considering implementation of the FC model. These findings, along with discussion of these findings, suggests other possible instructional strategies in the blended learning (BL) environment should be investigated empirically to find an optimal set of circumstances for learners in this context.

## References

Adams-Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., & Ananthanarayanan, V. (2017). *NMC horizon report: 2017 higher education edition.* Austin, Texas: The New Media Consortium.

Allen, I. E., Seaman, J. & Garrett, R. (2007). *Blending in. The extent and promise of blended education in the United States*. Needham, MA: Sloan-C. Retrieved from http://sloanconsortium.org/sites/default/files/Blending_In.pdf

Asef-Vaziri, A. (2015). The flipped classroom of operations management: A not-for-cost-reduction platform. *Decision Sciences Journal of Innovative Education*, *13*(1), 71-89. https://doi.org/10.1111/dsji.12054

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. *ASEE National Conference Proceedings, Atlanta, GA, 30*(9), 1-18.

Bloom, B. S. (1956). *Taxonomy of educational objectives. Vol. 1: Cognitive domain*. New York: McKay.

Bonk, C. J., & Graham, C. R. (2006). *The handbook of blended learning: Global perspectives, local designs*. John Wiley & Sons.

Brown, M. B., & Forsythe, A. B. (1974). Robust tests for the equality of variances. *Journal of the American Statistical Association*, *69*(346), 364-367. https://doi.org/10.1080/01621459.1974.10482955

Burkhardt, G., Monsour, M., Valdez, G., Gunn, C., Dawson, M. Lemke, C., Coughlin, E., Thadani, V., & Martin, C. (2003). *21st century skills: Literacy in the digital age*. North Central Regional Educational Laboratory and the Metiri Group. Retrieved from https://pict.sdsu.edu/engauge21st.pdf

Davies, R. S. (2011). Understanding technology literacy: A framework for evaluating educational technology integration. *TechTrends*, *55*(5), 45-52. https://doi.org/10.1007/s11528-011-0527-3

Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development, 16,* 563-580. https://doi.org/10.1007/s11423-013-9305-6

Dreon, O., Kerper, R. M., & Landis, J. (2011). Digital storytelling: A tool for teaching and learning in the YouTube generation. *Middle School Journal*, *42*(5), 4-10. https://doi.org/10.1080/00940771.2011.11461777

Ezziane, Z. (2007). Information technology literacy: Implications on teaching and learning. *Journal of Educational Technology & Society*, *10*(3), 175-191.

Ford, J. K., Smith, E. M., Weissbein, D. A., Gully, S. M., & Salas, E. (1998). Relationships of goal orientation, metacognitive activity, and practice strategies with learning outcomes and transfer. *Journal of Applied Psychology*, *83*(2), 218-233. https://doi.org/10.1037/0021-9010.83.2.218

Fulton, K. (2012). The flipped classroom: transforming education at Byron High School: A Minnesota high school with severe budget constraints enlisted YouTube in its successful effort to boost math competency scores. *THE Journal (Technological Horizons In Education)*, *39*(3).

Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education*, *10*(3), 157-172. https://doi.org/10.1016/j.iheduc.2007.04.001

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95-105. https://doi.org/10.1016/j.iheduc.2004.02.001

Garrison, D. R., & Vaughan, N. D. (2008). *Blended learning in higher education: Framework, principles, and guidelines*. San Francisco, CA: John Wiley & Sons.

Gribbons, B., & Herman, J. (1997). True and Quasi-Experimental Designs. *ERIC/AE Digest,* 1-7.

Guo, P. J., Kim, J., & Rubin, R. (2014, March). How video production affects student engagement: An empirical study of MOOC videos. *Proceedings of the first ACM Conference on Learning Scale,* 41-50. https://doi.org/10.1145/2556325.2566239

Gwet, K. L. (2014). *Handbook of inter-rater reliability: The definitive guide to measuring the extent of agreement among raters*. Advanced Analytics, LLC.

Hawks, S. J. (2014). The flipped classroom: now or never? *AANA Journal*, *82*(4), 264-269.

Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching*, *42*(5), 62-66.

Johnson, B., & Christensen, L. (2008). *Educational research: Quantitative, qualitative, and mixed approaches*. Sage.

Keith, T. Z. (2014). *Multiple regression and beyond: An introduction to multiple regression and structural equation modeling*. Routledge.

Kleen, B., Rodriguez, S., & Fanguy, R. (2011). A 2011 review: Computer literacy requirements for bachelor's degree programs in US public universities and colleges of business. *Issues in Information Systems, XII*(2), 162-170.

Kruse, K. (2009). *Gagne's nine events of instruction: An introduction*. Retrieved from http://kvccdocs.com/online-certification/content/L-09/Gagne.pdf

Lawless, K. A., & Brown, S. W. (1997). Multimedia learning environments: Issues of learner control and navigation. *Instructional Science*, *25*(2), 117-131. https://doi.org/10.1023/A:1002919531780

Lim, D. H., Morris, M. L., & Kupritz, V. W. (2007). Online vs. blended learning: Differences in instructional outcomes and learner satisfaction. *Journal of Asynchronous Learning Networks*, *11*(2), 27-42.

Matell, M. S., & Jacoby, J. (1971). Is there an optimal number of alternatives for Likert scale items? Study I: Reliability and validity. *Educational and Psychological Measurement*, *31*(3), 657-674. https://doi.org/10.1177/001316447103100307

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist*, 38(1), 43-52. https://doi.org/10.1207/S15326985EP3801_6

Milman, N. B. (2012). The flipped classroom strategy: What is it and how can it best be used? *Distance Learning*, *9*(3), 85-87.

Missildine, K., Fountain, R., Summers, L., & Gosselin, K. (2013). Flipping the classroom to improve student performance and satisfaction. *Journal of Nursing Education, 52*(10), 597-599. https://doi.org/10.3928/01484834-20130919-03

Murray, M. C., & Pérez, J. (2014). Unraveling the digital literacy paradox: How higher education fails at the fourth literacy. *Issues in Informing Science and Information Technology*, *11*, 85-100. https://doi.org/10.28945/1982

Norberg, A., Dziuban, C. D., & Moskal, P. D. (2011). A time-based blended learning model. *On the Horizon, 19(*3), 207–216. https://doi.org/10.1108/10748121111163913

Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: Definitions and directions. *Quarterly Review of Distance Education*, *4*(3), 227-233.

Peterson, C. (2003). Bringing ADDIE to life: Instructional design at its best. *Journal of Educational Multimedia and Hypermedia*, *12*(3), 227-241.

Picciano, A. G. (2009). Blending with purpose: The multimodal model. *Journal of Asynchronous Learning Networks*, *13*(1), 7-18

Roehl, A., Reddy, S. L., & Shannon, G. J. (2013). The flipped classroom: An opportunity to engage millennial students through active learning. *Journal of Family and Consumer Sciences*, *105*(2), 44-49. https://doi.org/10.14307/JFCS105.2.12

Sahin, A., Cavlazoglu, B., & Zeytuncu, Y. E. (2015). Flipping a college calculus course: A Case study. *Journal of Educational Technology & Society*, *18*(3), 142-152.

Siegle, D. (2004). The merging of literacy and technology in the 21st century: A bonus for gifted education. *Gifted Child Today*, *27*(2), 32-35. https://doi.org/10.4219/gct-2004-129

Sloman, M. (2007). Making sense of blended learning. *Industrial and Commercial Training*, *39*(6), 315-318. https://doi.org/10.1108/00197850710816782

Stokes, S. (2002). Visual literacy in teaching and learning: A literature perspective. *Electronic Journal for the Integration of Technology in Education*, *1*(1), 10-19.

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, *4*(4), 295-312. https://doi.org/10.1016/0959-4752(94)90003-5

Sweller, J., Ayres, P., & Kalyuga, S. (2011). *Cognitive load theory* (Vol. 1). New York, NY: Springer Science & Business Media. https://doi.org/10.1007/978-1-4419-8126-4

Thai, N. T. T., De Wever, B., & Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers & Education*, *107*, 113-126. https://doi.org/10.1016/j.compedu.2017.01.003

University of Washington. (2017). *Flipping the classroom*. Retrieved July 14, 2017 from http://www.washington.edu/teaching/teaching-resources/engaging-students-in-learning/flipping-the-classroom/

Watson, J. (2008). Blended learning: The convergence of online and face-to-face education. Promising Practices in Online Learning. *North American Council for Online Learning,* 1-17.

## BIOGRAPHIES

**Max Sommer** received his Bachelor of Arts Degree in geography from the University of Florida in December of 2015. He also graduated with a UFTeach Minor. In December of 2017, Max received his Master of Arts in Education (MAE) Degree in Curriculum and Instruction with an emphasis on Educational Technology at the University of Florida. The following semester, Max began his doctoral studies in the same program. In January of 2017, Max began working as a teaching assistant and instructor for the course EME2040: Introduction to Educational Technology. Throughout his academic career, Max has also worked as an Education Assistant for the Education Department at the Florida Museum of Natural History.

**Dr. Albert D. Ritzhaupt** is an associate professor of educational technology in the School of Teaching and Learning at the University of Florida. His primary research areas focus on the design and development of technology-enhanced learning environments, and technology integration in education. His publications have appeared in multiple venues, including the *Journal of Research on Technology in Education*, *Computers in the Schools*, *Journal of Computing in Higher Education*, *Computers & Education*, *Behavior Research Methods*, *Journal of Interactive Learning Research*, *Journal of Computers in Mathematics and Science Teaching*, *Journal of Educational Computing Research*, and *Computers in Human Behavior*.