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A Mixed Method Study: Assessing Critical Thinking, Metacognition, and Motivation in a Flipped Classroom Instructional Model

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A MIXED METHOD STUDY: ASSESSING CRITICAL THINKING, METACOGNITION, AND MOTIVATION IN A FLIPPED CLASSROOM INSTRUCTIONAL MODEL

by

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ABSTRACT

Technology has changed pedagogical methods in higher education. Educators are using technology more and integrating more active learning techniques. One pedagogical method, the flipped classroom, is suitable for integrating technology and active learning techniques. The pedagogical efficacy of the flipped classroom has not been determined despite being a potential solution for technology savvy millennial students. This mixed method study assessed critical thinking, metacognition, and motivation in higher education flipped classrooms in the United States. Human Anatomy and Physiology Society (HAPS) members teaching traditional and flipped format science courses were purposefully selected to participate in the study. A sample of 14 HAPS educators recruited 426 students enrolled in their science courses to complete the Motivated Strategies for Learning Questionnaire (MSLQ), a five-point Likert scale instrument used to measure critical thinking, metacognition, and motivation. The study was a pre-test/post-test non-equivalent control group design with semi-structured interviews for flipped classroom educators. The MSLQ was administered at the beginning and end of the fall semester (16 weeks) or the summer semester (8 weeks). A multivariate analysis of variance was used to estimate relationships between classroom format (flipped or traditional) and outcome variables (critical thinking, metacognition and motivation). The results were not statistically significant, meaning the flipped classroom was not more effective than the traditional classroom format for the outcome variables. The semi-structured interviews with flipped classroom instructors addressed the limitations and challenges of implementing a flipped classroom instructional model (FCIM). The most common limitations and challenges were preparation, in-class activities, student attitudes,

and classroom space. The findings from this study will help those making pedagogical decisions in higher education as well as educators interested in implementing FCIM.

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DEDICATION

This dissertation is dedicated to my daughter, Aubrey Zoe Brown, who made my heart full; words cannot describe the love I have for you and my grandmother, Mary Ann McCallum, a phenomenal woman, whose love, kindness, tenacity and diligence continues to “wow” me.

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LIST OF ABBREVIATIONS

CCTT	Cornell Critical Thinking Test
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
FCIM	Flipped Classroom Instructional Model
HAPS	Human Anatomy and Physiology Society
HESI	Health Education Services, Inc.
ICC	Intraclass Correlation
IRB	Institutional Review Board
MANOVA	Multivariate Analysis of Variance
MSLQ	Motivated Strategies for Learning Questionnaire
NCAT	National Center for Academic Transformation
NCRIPTAL	National Center for Research to Improve Postsecondary Teaching and Learning
POGIL	Process-Oriented Guided-Inquire Learning
STEM	Science, Technology, Engineering, & Mathematics
SCALE UP	Student-Centered Active Learning Environment for Undergraduate Programs
TBL	Team-Based Learning

CHAPTER I – INTRODUCTION

Although traditional classroom instruction has been successful in educating learners for centuries, teacher-dominated course designs are undergoing significant scrutiny these days due to schools' and universities' desires to accommodate millennial students from a variety of educational backgrounds. In 2012 the National Center for Academic Transformation (NCAT) reported that certain types of course redesigns can lead to improved learning for this student population. The NCAT report also emphasized the importance of integrating cyber-learning in the classroom by providing students with a mixture of diverse content via in-home electronics, mobile communications, and other handheld devices (Flumerfelt & Green, 2013; Tucker, 2012). Cyber-learning offers many possibilities. Proper use of instructional technology has the potential to offer students flexibility to study anytime, anywhere, as well as unlimited access to course materials. Flumerfelt and Green (2013) stated that instructional technology can provide multiple learning options for students, thus increasing the educator's ability to offer instruction to students with time pressures and different learning styles.

Recently, the concept of "flipping the classroom" has garnered much attention as a possible way to improve student learning. The aim of a flipped classroom instructional model (also known simply as "flipped classroom") is to provide time flexibility for students when learning the course materials and to give them chances to interact with the content according to their own learning styles (Roehl, Reddy, & Shannon, 2013). The simplest format of a flipped classroom is where the instructor's lecture is pre-recorded, watched outside of class, and the student's homework is completed in class (Slomanson, 2014). Tune, Sturek, and Basile (2013) defined a flipped classroom approach as students conducting pre-class preparation – such as reading the textbook, watching pre-recorded lectures, completing interactive lessons – and class time is used for discussion and/or problem solving. Flipped classroom methods are also defined as the facilitation of individualized and differentiated instruction (Flumerfelt & Green, 2013). To add, Kenna (2014) stated that a flipped classroom instructional model that combines instructional technology and active learning strategies may be a more effective mode of learning for millennial students.

Active Learning

A recent transformation in education has motivated educators to distance themselves from traditional classroom lectures in favor of active learning pedagogies and transactional collaborative approaches (Everly, 2013; Finch & Jefferson, 2013). Van den Bergh, Ros, and Beijaard stated (2014) that active learning is derived from the constructivist view of learning. Active learning is asking and seeking the knowledge to answer one's own questions. Students are engaged in the learning process (Bakir, 2011; Dewing, 2010; Loeb, 2015). Active learning is an approach that integrates multiple learning methods in order for in-depth learning to occur. Some researchers have claimed that active learning promotes self-learning, prepares students to become lifelong learners, and equips students with the ability to function in a global community. It allows them to understand and identify the benefits of diversity while working well with others (Loeb, 2015). These researchers also claim that active learning strategies enhances students' adaptability, motivation, and persistence (Loeb, 2015). Active learning strategies can also heighten a student's educational experience by introducing real-world activities, which adds to the appeal of the course for students and provides students with the opportunity to offer input on course materials (Finch & Jefferson, 2013; Loeb, 2015). Furthermore, these researchers asserted that students are compelled to utilize higher-order thinking skills, such as analysis, synthesis, and evaluation (Bakir, 2011; Dewing, 2010). Unlike didactic lectures, active learning pedagogies have the potential to teach students how to process and use knowledge directly applicable to real-life scenarios. Active learning pedagogies, when compared to traditional classroom instruction, promotes increased reasoning by engaging students in application of what has been learned. (Finch & Jefferson, 2013; Everly, 2013).

Additionally, Dewing (2010) has stated that active learning increases the efficiency and effectiveness of teaching and learning. A meta-analysis study completed by Freeman, et al. (2014) noted that students in traditional lecture courses were 1.5 times more likely to fail compared to students in courses with active learning techniques. Freeman et al. found active learning techniques to vary in intensity and implementation. Active learning technqiues included group problem solving, worksheets completed during class, and the use of personal response systems.

In contrast, traditional lectures were described as instructor-focused, a “teaching by telling” approach. Equally important, Freeman et al. found an average failure rate of 33.8% for traditional lecturing while the classrom with active learning techniques had an average failure rate of 21.8%. Freeman, et al. also indicated that active learning has a greater impact on students’ mastery of higher versus lower level cognitive skills.

Research has demonstrated that active learning pedagogies enhance higher-order cognitive skills (Madhuri, Kantamreddi, & Goteti, 2012). Bloom (1980) described time-on-task as the time that students spend actively engaged in learning. If students are focused during class, complete assigned tasks, or respond in relevant ways to instruction or course materials, then they are spending time-on-task. Over 30 years ago, Bloom (1984) contended that students can learn higher-order processes (applying, synthesizing, and evaluation) when they are central in the teaching-learning process.

Overall, there seems to be numerous benefits to active learning. However, while active learning appears to create a path toward improving learning, we do not fully understand how, exactly, it does this and what course redesigns might best encourage it. Does the flipped classroom instructional model (FCIM) facilitate active learning? If so, what are the effects of FCIM on students' critical thinking abilties, metacognition, and motivation? These questions prompted the researcher to ask whether critical thinking, metacognition, and motivation levels differ in a flipped classroom compared to a traditional classroom.

Research on the Flipped Classroom Model

This section summarizes research from the flipped classroom model in the K–12 setting. There is a limited amount of empirical research on the effects of FCIM. However, case studies exist that document teachers' perspectives of implementing FCIM and changes in student outcomes, e.g., engagement and achievement (Hamdan, McKnight, McKnight, & Arfstrom, 2013). One case study includes a high school in Minnesota that flipped the math curriculum for the Fall 2010 semester because the old math textbooks did not meet the state's new math standards; they faced a financial crisis that prevented the school from buying new textbooks. Instead, instructors stored recorded lectures on YouTube for free and embedded the videos in Moodle to create a distraction-free zone for students. Some of the benefits were more class time because a lecture that would require an entire class period was demonstrated in a 10-minute video. This also allowed students to work at their own pace because the 10-minute video could be accessed at any time and viewed as often as needed. During class, educators observed students solving problems, worked with students that had trouble understanding concepts, encouraged students to help each other, and offered praise to students. Students liked the change, and the videos were brief, approximately 10 to 15 minutes in length. Moreover, if students had to miss class, the videos were readily available, so they did not fall behind. After the implementation of the flipped classroom, math mastery increased from 29.9 percent in 2006 to 73.8 percent in 2011, as reported by the Minnesota Comprehensive Assessments. In addition, ACT scores increased from an average composite score of 21.2 in 2006 to 24.5 in 2011 (Fulton, 2012; Hamdan, McKnight, McKnight, & Arfstrom, 2013).

Likewise, another high school, attended by inner-city kids, introduced FCIM for all of their ninth-grade classes. Before implementing the flipped classroom model, over 50% of the students were failing English and 44% were failing math. The failure rate dropped nearly 33 percentage points. After the introduction of FCIM, only 19% of the students failed English and 13% failed math. The discipline cases dropped from 736 in 2009 to 249 in 2010 to 187 in 2011, resulting in a 74% drop in two years (Johnson, 2013; Logan, 2015).

The benefits of a flipped classroom include students' ability to self-pace through course material, educators receiving positive feedback on lecture videos, and students' academic improvements. Despite the benefits from a flipped classroom, causality cannot be inferred from most studies due to the lack of quantitative data as well as experimental and control groups. Such shortcomings necessitate rigorous improvements of both experimental design and analysis to adequately quantify the effects of FCIM (Calimeris & Sauer, 2015).

Statement of the Problem

Currently, the flipped classroom model is a popular instructional model and has attracted many proponents. The use of flipped classroom instruction may have the potential to positively improve student learning at all educational levels and settings. To date, the K–12 setting is where most flipped classroom “experiments” have been conducted due to secondary instructors of chemistry Jonathan Bergmann and Aaron Sams. They popularized and developed methodologies for the flipped classroom (Logan, 2015). The FCIM typically involves three steps: (1) students read specific content from their textbooks, (2) students watch recorded video lectures outside of class, and (3) students complete in-class course work exercises. Educators facilitate active learning activities that require students to apply the knowledge they acquired from the textbook and pre-recorded lecture (Milman, 2012). In FCIM, educators can circulate among students as well as engage and address questions one-on-one with students without standing in the front of the classroom (Chen, 2016). FCIM educators may also implement “just-in-time teaching” to tailor their instruction to meet students’ needs based on web-questions submitted prior to class or clicker-questions administered at the beginning of class (Abeysekera & Dawson, 2015).

A review of previous studies reveals limited quantitative research on flipped learning and a lack of research that links best practices to a flipped classroom model (Galway, Corbett, Takaro, Tairyan, & Frank, 2014; Chen, Wang, Kinshuk, & Chen, 2014). Since the flipped classroom model is in development stages, the flipped model’s pedagogical efficacy has yet to be determined. According to Milman (2012), no quantitative research exists to substantiate its use. Few published studies have demonstrated the effectiveness of the flipped classroom approach; this paucity of research necessitates exploration into whether the flipped classroom approach increases student learning as assessed by objective examinations (Galway, Corbett, Takaro, Tairyan, & Frank, 2014; Tune, Sturek, & Basile, 2013). Leading the researcher to ask how FCIM impacts student's critical thinking, metacognition, and motivation when compared to the traditional classroom and what are higher education educators' opinions on implementing FCIM. This study will attempt to assess the impact of flipped learning on critical thinking, metacognition, and motivation in higher education, contribute quantitative research on flipped learning to determine the pedagogical efficacy of FCIM, and provide suggestions for the implementation of the flipped classroom model in higher education science courses.

Theoretical Foundation

The flipped classroom instructional model is grounded in constructivist theories of learning and pedagogy. Piaget's theory of cognitive development, for instance, supports the active and collaborative learning component of a flipped classroom as teaching is learner-centered not lecture-centered.

Cognitive development occurs via an assimilation/accommodation mechanism. Assimilation is the translation of incoming information into a form understood by the learner, and accommodation connotes the state in which the learner changes current knowledge to understand new knowledge and experiences (Piaget, 1955). According to Piaget's theory, learning occurs when we act on and apply new ideas and concepts. Often

Piaget's "radical constructivism" is grounded in the creation of meaning at an individual level and how meaning develops within a group (Kemp, 2011).

In FCIM, students can work individually or in groups to improve their learning while the educator is present. Unlike in a traditional classroom, cognitive development often occurs while the student is studying without help from the educator and/or peers. Vygotsky is credited with "social constructivism" in which the focus is on how knowledge is created socially, economically, and politically (Kemp, 2011). Problem solving, inquiry learning, active learning, and collaborative learning are often linked to a FCIM, the foundation of the social constructivist theory (Logan, 2015).

According to Vygotsky (1997) treating the student like a sponge who can eagerly absorb knowledge is inadequate. Knowledge is gained through personal experience and requires students to perceive and respond to knowledge, therefore establishing new reactions and developing new forms of behavior based on old and new information.

Some students are unable to make immediate connections between old and new information; these students may not have the prior knowledge to make the connection or may need time to digest the information. In a FCIM, students are introduced to new concepts via pre-recorded lectures viewed at home, which gives students time to process the information and make connections by watching the pre-recorded lecture as many times as necesssary before the next class session. During a traditional lecture, students are expected to acquire what the educator stated quickly, within a limited time frame. This can be burdensome for students who might feel averse to asking the educator to repeat or provide another example of a concept. Frequently, by the end of class, students have forgotten their question, have to attend another class, or think they will figure it out later, which may or may not happen.

The Motivated Strategies for Learning Questionnaire (MSLQ), the instrument used in this study, is based on the theoretical basis that includes a social cognitive view of motivation and self-regulated learning. Self-regulated learning is defined as “being metacognitively, motivationally, and behaviorally active in one’s own learning processes and in achieving one’s own goals” (Eccles & Wigfield, 2002, p. 17).

Since students’ motivations and learning strategies may vary from course to course, the MSLQ was designed to measure undergraduate college students’ motivations and self-regulated learning as they relate to a specific course. For the purposes of this study, the MSLQ best supports the constructs of interest: critical thinking, metacognition, and motivation.

Another theorist, Bloom, has contributed to our knowledge of cognition, notably through his *Taxonomy of Educational Objectives*. Pappas, Pierrakos, and Nagel (2013) described Bloom’s taxonomy as a hierarchical model used to classify instructional activities based on cognitive difficulty. The hierarchy includes knowledge, comprehension, application, analysis, synthesis, and evaluation. The first three levels are categorized as lower-order thinking skills and the remaining three as higher-order thinking skills. Theoretically, a flipped classroom strategy will encourage higher-order thinking skills and allow students to assess their abilities to analyze, synthesize, and evaluate in class as well as complete lower cognitive work outside of class. This strategy is consistent with Bloom’s influential text (Galway, Corbett, Takaro, Tairyan, & Frank, 2014; McLaughlin, et al., 2014).

Purpose of the Study

The purpose of this study is to determine the effectiveness of a flipped classroom instructional model in the higher education setting by analyzing students' critical thinking, metacognition, and motivation.

Justification

To help educators better serve and meet the needs of their students, this study investigates the pedagogical efficacy of the flipped classroom instructional model. Today, students experience unique challenges and demands that previous generations did not. College and university students have myriad obligations beyond the classroom. For example, work and family obligations can cause students to miss a lecture occasionally and thus fall behind. Also, students who spend many hours commuting may be unable to prepare and study for class. A FCIM implementation in higher education may help relieve some of these temporal pressures and provide students with relatively consistent instruction.

Moreover, the FCIM can be beneficial for educators. For example, educators that co-teach a course can review each other's videos to reference concepts previously discussed. FCIM in higher education can offer greater transparency and specificity via pre-recorded lectures as colleagues can give constructed feedback on the material covered without attending the class session. This could result in a higher level of consistency among multiple instructors that teach the same courses (McDonald & Smith, 2013).

Focus on Science

This study's goal is relevant to all higher education instructors but will focus on science educators for the sake of brevity and the researcher's scientific background and experience in the biological sciences. The researcher instructs biology at an undergraduate institution and has direct access to other science lecturers through the Human Anatomy & Physiology Society (HAPS). Moreover, science literacy in the United States is declining, further justifying the need for studies that focus on Science, Technology, Engineering, and Mathematics (STEM) disciplines. Beard and others have asserted that America has lost its competitive edge in the sciences. For America to regain its global prowess, it is necessary to introduce new techniques to inspire in students a passion for STEM (Beard, 2013; Jeschofnig & Jeschofnig, 2011).

According to McFarlane (2013), the responsibility of the science educator is to ensure that the curriculum and instructional methods reflect contemporary pedagogy and study materials. The learning process should not be dominating and dicating, but it should engage students and focus on critical thinking, metacognition, and motivation.

Several challenges arise upon implementation of a flipped classroom, which are common when changing modes of instruction or experimenting with new pedagogical methodologies. Science educators struggle with adapting a FCIM primarily due to the large amount of information covered during a semester. Nonetheless, this study provides useful information for lecturers who might be ambivalent about adapting a flipped classroom instructional model. This study attempts to provide enough information so that educators can make informed decisions about whether a flipped classroom approach might prove efficacious within their classrooms.

Millennial Students

A study completed at the University of California, Berkeley, revealed that only 20% of the students in a lecture setting retained the information presented after eight minutes of lecturing, and only 15% of the total number of students paid attention (Richardson, 2003). The researcher's study has the potential to enhance educators' knowledge about how to provide a more effective mode of instruction for millennial students. For example, millennial students have been exposed to technological devices such as tablets, cell phones, and other mobile devices throughout their lives, and these devices have significantly impacted how they communicate and learn (Logan, 2015). In addition, millennial students demonstrate different cognitive skills than previous generations and are often dubbed the "Google Generation" (Holman, 2011). According to Holman (2011), millennial students spend an average of 20 hours a week on the internet. Educators can tap into this time by posting lectures, podcasts, and other educational resources to pique students' interests. Subsequently, introducing courses that appeal to a technologically savvy generation and to learners who want to be actively engaged can prove beneficial for millennial students. Implementing more flipped classrooms in higher education institutions encourages environments that serve the needs of multifaceted learners whose epistemologies are informed by connection to technology. On a larger scale, higher education institutions that offer flipped learning may be able to help students to better develop their creativity as well as critical thinking, communication, and collaboration skills, which can be vital for academic and professional success.

Research Questions

1. Are students' critical thinking, metacognition, and motivation impacted in a flipped classroom instructional model compared to a traditional classroom?
2. What are educators' opinions on the limitations/challenges of implementing a flipped classroom instructional model in higher education?

Assumptions

The primary assumption is educators participating in the study understand the distinctions between a traditional and flipped classroom format. Educators will be asked to disclose their classroom format at the beginning of the study. The second assumption is that participants will answer all questions honestly. Student participants' confidentiality will be preserved, and students will be informed that they may withdraw at any time without consequence. The final assumption is the instrument is reliable and valid. The instrument has been employed in numerous studies and proven reliable and valid (Feiz, Hooman, & kooshki, 2013).

Delimitations

This study is confined to students taught by university/college teachers who are members of HAPS. The second delimitation is student participants are enrolled in a science course at a two-year or four-year educational institution in the United States.

Definitions of Terms

Key terms are defined here for clarification.

Active learning: engaged in learning or "thinking" about learning in a meaningful way. "Any instructional method that requires students to do meaningful learning activities and to think about what they are doing" (Van den Bergh, Ros, & Beijaard, 2014, p. 773). A technique that "teaches the student how to process and use knowledge and promotes reasoning by engaging the student in applying what has been learned" (Everly, 2013, p. 148).

Cognitivism: "knowledge or awareness of the world" (Good, 2007, p. 268). "The capacity to perceive and acquire knowledge and understanding" (Safina, 2015, p. 31). An approach through which the acquisition of knowledge and cognitive processes, such as thinking, problem solving, and information processing are the focus (Ertmer & Newby, 2013). "A transaction between a knower and their environment in which the knower and the known are logically interdependent" (Good, 2007, p. 268).

Constructivism: an approach through which the learner constructs knowledge. Knowledge cannot be immediately understood and used; the learner must construct their own knowledge to understand (Piaget, 1952). "There are multiple realities constructed by individuals. The human mind does not copy reality from outside directly; rather, it constructs reality" (Boghossian, 2006, p. 715). A theory that "views knowledge as the natural consequence of a constructive process, views learning as an active process of constructing knowledge, and views instruction as the process of supporting construction of knowledge" (Boghossian, 2006, p. 714). "Allows for human emotion, social interaction, and a more empowered sense of learning to bring about greater gains to the learner" (Gomboc-Turyan, 2012, p. 14).

Critical thinking: the ability to interpret, analyze, make inferences, explain, and self-regulate one's own thought processes. "Reflective thinking focused on deciding what to believe or do" (Ennis, 1987, p. 10). Involves "good reasoning, reasoned judgment, or taking a rational approach" (Horvath & Forte, 2011, p. 5). "A deliberate and purposeful cognitive activity that involves regulation of one's own thinking and behavior to meet certain standards" (Horvath & Forte, 2011, p. 10). "A mode of thinking-about any subject, content, or problem- in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it." "A self-directed, self-disciplined, self-monitored, and self-corrective thinking" (Horvath & Forte, 2011, p. 77). Dispositions important to critical thinking are "open-mindedness or flexibility, habitual use of plans, willingness to engage in and persist at a complex task, willingness to abandon nonproductive strategies in an attempt to self-correct, and an awareness of the social realities that need to be overcome" (Halpern, 1998, p. 452).

Extrinsic motivation: "doing something because it leads to a separable outcome, one feels externally propelled into action" (Ryan & Deci, 2000, p. 55). "Motivation directed at attaining or avoiding something outside the self" for example an external reward (Walker, Greene, & Mansell, 2006, p. 4).

Flipped classroom instructional model: an "educational technique that consists of two parts: interactive group learning activities inside the classroom, and direct computer-based individual instruction outside the classroom" (Bishop & Verleger, 2013, p. 5). A classroom that integrates "the regular and systematic use of interactive technologies in the learning process" (Strayer, 2012, p. 172). "A pedagogical method, which employs asynchronous video lectures and practice problems as homework, and active, group-based problem-solving activities in the classroom" (Bishop & Verleger, 2013, p. 2). "Teachers shift direct learning out of the large group learning space and move it into the individual learning space, with the help of one of several technologies" (Hamdan, McKnight, McKnight, & Arfstrom, 2013, p. 4).

Flipped classroom approach: "when students conduct significant pre-class preparation, including watching pre-recorded lectures, while traditional class time is reserved for discussion and/or problem solving of the relevant topics" (Tune, Sturek, & Basile, 2013, p. 316).

Higher-order thinking skills: the ability to analyze, synthesize, and evaluate knowledge. Often require "problem solving, decision making, reasoning, and creative thinking" (Horvath & Forte, 2011, p. 6). Complex skills that "require judgment, analysis, synthesis and are not applied in a rote or mechanical manner" (Halpern, 2007, p. 6).

Lower-order thinking skills: the ability to know, comprehend, and apply knowledge. "Lower levels of cognitive work such as gaining knowledge and comprehension" (Westermann, 2014, p. 44).

Intrinsic motivation: "doing an activity for its inherent satisfactions rather than for some separable consequence" (Ryan & Deci, 2000, p. 56). "Motivation that originates from within the individual" and produces an "internal feeling of satisfaction" (Walker, Greene, & Mansell, 2006, p. 4).

Metacognition: "awareness of one's cognitive processes, cognitive strengths and weaknesses, and self-regulation" (Klassen, 2002, p. 91). "The knowledge a person has of his or her own cognitive processes . . . and the ability to self-regulate cognition" (Horvath & Forte, 2011, p. 11).

Motivation: "to be moved to do something, to be energized or activated toward an end" (Ryan & Deci, 2000, p. 54). "An inner drive, impulse, emotion or desire that moves" (Tuysuz, Yildiran, and Demirci, 2010, p. 1544). Biological processes that give behavior energy and direction and may include internal and external factors. "Students' energy and drive to engage, learn, work effectively, and achieve their potential" (Martin, 2012, p.240).

Traditional classroom: educators lecture to disperse information to students. "Educator driven lecture using PowerPoint to display content in a classroom setting" (Compton, 2014, p. 3). "Students passively receive information from their teacher" (Van den Bergh, Ros, & Beijaard, 2014, p. 773). "The teacher is the person in charge of transferring knowledge, with the student taking a passive role, mostly limited to listening and taking notes" (Canaleta, Vernet, Vicent, & Montero 2014, p. 651).

Summary

The purpose of this study is to assess the flipped classroom learning model. The researcher will contribute to the existing body of knowledge on flipped classrooms. Chapter 2 will provide an overview of the flipped classroom method, a theoretical framework, and studies that support as well as critique the FCIM. Chapter 3 will outline the quasi-experimental design to address the research questions: 1) Are students' critical thinking, metacognition, and motivation impacted in a flipped classroom model compared to a traditional classroom? and 2) What is the educator's opinion on the limitations/challenges of implementing a flipped classroom model in higher education? Chapter 4 will present quantitative data results to address research question one and qualitative findings to address research question two. Lastly, Chapter 5 will discuss the results and findings as well the limitations of the study and suggestions for further research to improve pedagogical efficiency of the flipped classroom instructional model.

CHAPTER II – REVIEW OF RELATED LITERATURE

Overview

In the past, there was far less need to worry about classroom boredom in higher education because technological devices (e.g., cell phones and other electronic devices) were not available or permitted in the classroom. Now, the millennial generation, born between 1982 and 2002, consider lecture-based instruction “boring” and have demonstrated a decreased tolerance for traditional lectures (Roehl, Reddy, & Shannon, 2013; See & Conry, 2014). Technological devices are a part of the day-to-day life of the “Google Generation,” and educators have struggled to capture and maintain the attention of today’s students as a result (Roehl, Reddy, & Shannon, 2013).

Thus, the millennial generation demands different pedagogies from lecture-based instruction. Although educational researchers have questioned the effectiveness of lecture-based instruction, lecture formats have had incredible staying power. Lectures are still the primary method of instruction for postsecondary lecturers who educate adult learners (Roehl, Reddy, & Shannon, 2013). Parker (2011) suggested millennials prefer collaboration, a learning environment that incorporates teamwork. In addition, millennials are more familiar with the process of active learning and participate more in their own learning than previous generations (Loeb, 2015). According to Baker (2009), millennials do not desire to be rote learners; they want to analyze and critique information.

Researchers suggest a possible solution for today’s students and educators is to introduce active learning strategies to increase student engagement in the classroom (Bergmann & Sams, 2012; Roehl, Reddy, & Shannon, 2013). Although students often increase their metacognitive knowledge by engaging in active learning techniques, researchers have reported that students give lower evaluation scores in courses with active learning despite evidence that reflects that they have learned more (Martin, 2012). Hence, more research is needed to determine whether FCIMs are the answer to actively engage millennial students or whether lower evaluation scores were given because students, despite their preference for active learning, expected traditional lectures, in which student effort is often minimal.

Active Learning

Active learning, per Roehl, Reddy, and Shannon (2013), results from pedagogies that focus on student activity and student engagement. According to Baepler, Walker, and Driessen (2014), these "pedagogies of engagement" are called POGIL (process-oriented, guided-inquire learning), peer learning, team-based learning (TBL), and cooperative learning. For Roehl, Reddy, and Shannon (2013), the goal was for educators to transcend surface learning and venture more deeply into learning from which understanding is obtained via active and constructive processes. Also, active and constructive processes necessitated a shift from a teacher-centered paradigm to a student-centered one. Some of these active learning processes and instructional approaches include individual activities, paired activities, informal small groups, and cooperative student projects (Roehl, Reddy, & Shannon, 2013). Examples of active learning activities are peer-to-peer collaboration, case studies, and group assignments. Others include conceptual mapping, brainstorming, collaborative writing, cooperative learning, role playing, simulation, project-based learning, and peer teaching (Roehl, Reddy, & Shannon, 2013; Wolff, Wagner, Poznanski, Schiller, & Santen, 2015). Active learning has often been described as the best method for students to utilize higher-order thinking skills such as synthesis, evaluation, and analyzing (Roehl, Reddy, & Shannon, 2013).

In a traditional lecture-based classroom where the instructor is the “sage on the stage” and is the giver of information (Hawks, 2014; Parslow, 2012), students are expected to receive the information and/or take notes. Therefore, active learning does not take place. Conversely, active learning activities allow educators to transition from being dispensers of facts to being architects of learning activities challenging students to become active learners rather than passive receptacles of information (Pierce & Fox, 2012). Hawks (2014) reported that when students work together, an increase in engagement, attention, and knowledge retention take place.

In fact, active learning strategies have been formalized in programs such as Robert Beichner’s Student-Centered Active Learning Environment for Undergraduate Programs or “SCALE UP” (Kustusch, Gaffney, & Beichner, 2009). SCALE UP is usually utilized in physics education, but it has been expanded to other sciences, engineering, and humanities classes. Students work in teams of three; faculty engage students in structured activities and problem-solving during class while mingling and engaging students in discussions (Martin, 2012). A similar approach was developed by Eric Mazur called “peer instruction,” in which students work in small groups to answer questions posed by the instructor (Martin, 2012; Miller, Schell, Lukoff, Mazur, & Ho, 2015).

Educators have previously implemented active learning techniques in the classroom, but a common reason given for not using them more is that there is insufficient time to cover the requisite material. This obstacle has led many educators to eliminate active learning techniques in the classroom as well as assigning group activities or assigning other active learning exercises to be completed outside the classroom. For instance, Bergmann and Sams (2012) faced a similar challenge of not having enough class time to implement active learning techniques. They determined that their students needed their assistance the most when they were trying to understand a difficult concept or problem, which often happened at home. To be with students while they are "actively" trying to learn the material, lectures would occur in smaller increments or watched at home by students, hence a flipped classroom (Bergmann & Sams, 2012).

Overview of the Flipped Classroom

The premise of a flipped class is work that was done in class is now completed at home and work that was completed at home is now completed in class (Kaufman, 2013). The instructor would then review material if needed and would continue to utilize active learning activities and assessments that provide students the opportunity to apply the information (see Table 1) (Bull, Ferster, & Kjellstrom, 2012; Hawks, 2014; Raths, 2013; Tucker, 2012).

Many consider the flipped classroom as a novel concept, but collaborative and process-oriented learning has been used in classrooms for over half a century. The terminology and technological advances, such as slide share and podcasts, are of course new, which give educators the resources to create videos and interactive lessons that can be accessed at home at the students' convenience (Marks, 2015). During class with the help of iClickers, Mastering Biology, and Learning Catalytics, educators can quickly identify the concepts students have and have not mastered, and this leads to flexible and purposeful grouping during collaborative learning (Marks, 2015).

The term “flipped” was introduced in 2007 by high school chemistry instructors Jonathan Bergman and Aaron Sams (Logan, 2015). Their goal was to accommodate student athletes who missed class due to athletic games. The instructors pre-recorded their lectures to give students the ability to watch the lectures at any time and to accommodate those students who missed class. The lectures were 10 to 15 minutes long and gave a general overview of the topic, including important definitions, why the topic was important, and how the content fit into the topic’s general overview. Once students were in class, they were given an assessment to determine their level of understanding. Assessments would consist of quizzes or homework assignments typically given in a traditional class.

Bull, Ferster, and Kjellstrom (2012) stated there are different degrees of adoption and many ways to “flip a class.” An instructor may flip one class, a few classes, or the entire course. For example, many educators do not require a textbook in a FCIM; in these cases, all required material is posted in a learning management system and/or the instructor’s website. According to Bergmann and Sams (2012), the best use of class time is to engage students in enriching activities and hands-on experiences. Despite various levels of a flipped classroom, the goal is to provide more time for interactions with students in the class (Bull, Ferster, & Kjellstrom, 2012).

Researchers suggest that the flipped classroom combines both behaviorist and constructivist learning pedagogies. According to Hawks, behaviorist pedagogy is utilized during the pre-recorded lectures, where students are given the information (Hawks, 2014). The basis for behaviorism teaching techniques include educational strategies such as transferring knowledge and teacher-centered instruction through lectures by breaking concepts into smaller more manageable pieces (Faretta, 2016). Constructivist pedagogy occurs in classrooms in which the faculty and students collaborate to help students understand the material (Hawks, 2014). Instructors can give attention to students one-on-one or in small groups and help them while they are trying to learn the material. Research has shown that some students have difficulty adjusting to the flipped classroom approach because they are expected to take responsibility for their own learning. Thus, teaching shifts from the instructor to the learner; more time and initiative is required as students are more accustomed and comfortable with the traditional classroom format (Fulton, 2012; Hawks, 2014; Talley & Scherer, 2013).

Table 1 *Differences Between Flipped and Traditional Classroom*

	Traditional Classroom	Flipped Classroom
Before Class	Students assigned readings from textbook, journals, articles, etc.	Students guided through learning module in a LMS that asks and collects questions such as the Cornell notes system, WSQ (watch, summarize, question), Google forms, etc.
	Educator prepares direct instruction or lecture	Instructor prepares “pedagogies of engagement”
Beginning of Class	Students have limited information about the direct instruction topic	Students have specific questions to answer after completing the learning module
	Educator makes assumptions about students’ level of understanding	Educator is aware of students’ level of understanding from submitted assignments in the LMS, iClickers, Learning Catalytics, etc.

Table 1 continued

	Traditional Classroom	Flipped Classroom
During Class	Students listen to direct instruction or lecture	Students engage in POGIL, TBL, etc.
	Educator delivers large amounts of information via direct instruction or lecture	Educator guides and facilitate students through active learning activities and provides feedback
After Class	Students complete homework	Students apply their knowledge from active learning activities and feedback given during class.
		Students extend their learning to more complex tasks or move to the LMS module
	Educator grades homework	Educator post additional explanations and resources based on gaps in students' knowledge during the previous class and grades high stakes assignments
Office Hours	Students ask what should I study?	Students know what they do not understand and ask "specific" questions
	Educator repeat information given during direct instruction or lecture.	Educator addresses questions and guide students toward a deeper understanding based on their "specific" questions and level of understanding

Note. Adapted from "How to Flip a Class" by S. Kopp, n.d., *University of Texas at Austin Faculty Innovation Center.*

Theoretical Framework

Bloom’s article *Innocence in Education* stated that teaching, not the teacher, is the key to the learning of students. Specifically, he stated that it is what teachers do when interacting with their students that determines what students learn and how students feel about the learning process (Bloom, 1972). There are a variety of conditions that can be used in the teaching-learning process to help teachers and students reach their goals. According to Bloom (1972), we all want education to be more than the inculcation of knowledge, but the challenge is to determine how to complete the process with 21st-century students. As stated by Lord & Baviskar (2007), challenging the way students think during class is a way to change the learning process. Furthermore, contemporary students want to be active in their assimilation of information (Lord & Baviskar, 2007). This study draws on Bloom’s Taxonomy of Educational Objectives and constructivism to explain the basis for the FCIM. In addition, metacognition and motivation will be discussed to further support this study theoretical framework.

Bloom’s Taxonomy

Bloom, Engelhart, Furst, Hill, and Krathwohl (1956) developed six major categories: knowledge, comprehension, application, analysis, synthesis, and evaluation, which increase in difficulty with each category creating a cumulative hierarchy, collectively known as Bloom’s Taxonomy of Educational Objectives (see Figure 1). The simplest category is knowledge-based, in which students are asked to recall memorized information. This category is also the easiest to assess and usually encompasses over 50% of the questions on college exams (Lord & Baviskar, 2007). The next category is comprehension, whereby students are asked to understand relationships and explain what they have learned. This category is more difficult to assess and encompasses 20% of the questions on a typical college exam (Lord & Baviskar, 2007). The third category is application; students are asked to apply rules or concepts to a problem. Application-based questions compose 12% to 15% of exam questions (Lord & Baviskar, 2007). According to Lord and Baviskar (2007), the remaining three categories—analysis, synthesis, and evaluation—are rarely used in test construction. Theoretically, students are asked both to break down and compare concepts at the analysis level. To demonstrate synthesis, students are required to produce something new from different concepts. Finally, at the evaluation level, students are required to evaluate and make judgments based on what they have learned (Lord & Baviskar, 2007).

Application, analysis, synthesis, and evaluation methods require critical thinking skills. Bloom's taxonomy will be used to support critical thinking, one of the constructs for this study (Bissell & Lemons, 2006). Critical thinking is more important than ever due to the plethora of invalid information to which students have access and is also desired by graduate and professional schools as well as employers (Gomboc-Turyan, 2012). Students often have difficulty thinking critically and the root of critical thinking is determining the validity and non-validity of information (Weiler, 2005). It has been suggested that if students are challenged daily during class, they will be prepared for upper-level questions in Bloom's taxonomy during exams (Lord & Baviskar, 2007).

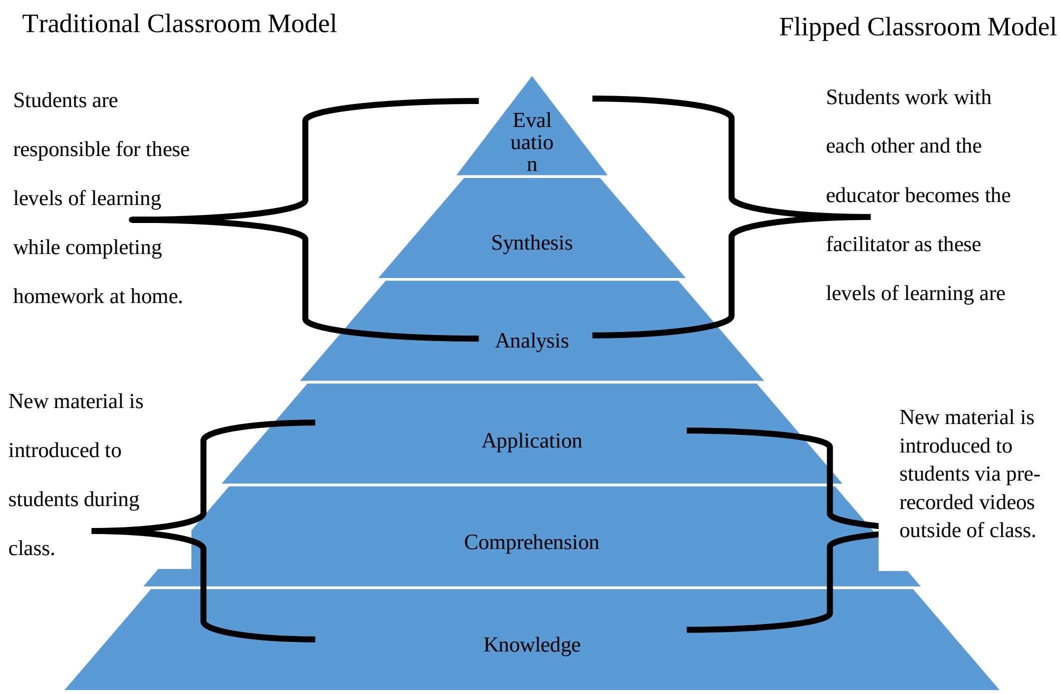

Figure 1. Bloom's Taxonomy in Flipped and Traditional Classroom Model

Bloom's Taxonomy in a traditional and flipped classroom format. Adapted from B. Williams, "How I Flipped My Classroom," NNNC Conference, 2013.

Constructivism

Constructivism is student-centered; its focus is on the process of learning. It provokes higher-order thinking and has been found to be a successful pedagogical practice (Reed, 2012). Constructivism focuses on students taking responsibility for their own learning and actively constructing their own version of knowledge, which requires learners to be active participants in the learning process and to find meaning in their experiences (Canaleta, Vernet, Vicent, & Montero 2014; Erdogan & Senemoglu, 2014;

Boghossian, 2006). Learning is not the replication of knowledge or merely working through someone else's thoughts; it is a process of making links and connections (Parker, 2011), which ultimately means that knowledge is constructed based on the learner's personal interpretation (Reed, 2012; Zhu, et al., 2009). For learning to take place from a constructivist's point of view, there must be meaningful interaction between the learner and the content (Zhu, et al., 2009). According to Marra, Jonassen, Palmer, and Luft (2014), constructivism can be described according to the following five tenets: 1) knowledge is constructed when a learner interacts with the environment; 2) each learner's reality (perception of the world) is unique; 3) a learner's understanding and thought process are influenced by their culture and community; 4) a learner's knowledge is anchored by relevant contexts; and 5) a learner's knowledge is constructed from a question, a need, or a desire to know. A unique aspect of constructivism is that each person's experience is just as valid as anyone else's, thus students develop or discover their own truth (Boghossian, 2006).

Application of Constructivism

Constructivism has been utilized in various disciplines, including counseling, music therapy, health education, and social work, but it is especially suited for scientific knowledge. Learners studying the scientific disciplines often construct sophisticated scientific concepts collaboratively, meaning students construct, monitor, and repair shared knowledge (Duane & Satre, 2014; Hunter & Krantz, 2010). Prince & Felder (2006) have defined constructivism as a class of teaching methods that include inquiry learning, case studies, and problem-based learning; the common factor is that these methods all require observations or experimental data to be interpreted. Several researchers have stated that constructivist teaching methods are superior to traditional lecturing, and traditional teaching methods are outdated (Bertacchini, Bilotta, Pantano, & Tavernise, 2012; Briggs, Long, & Owens, 2011). Also, research presents the limitations of didactic methods in developing students' critical thinking skills (Hrynchak & Batty, 2012). New teaching methods such as the flipped classroom are still being tested and may develop students' critical thinking skills more than traditional teaching methods (Bertacchini, Bilotta, Pantano, & Tavernise, 2012). However, per Hrynchak and Batty (2012), newer approaches with a foundation in constructivist principles are showing promise. Brown (2012) has stated that it is essential to create a learning environment in which students are active rather than passive and where constructing one's own interpretations is essential (Garcia & Pacheco, 2010; Mann, 2011).

Foundations of Constructivism

The foundations of constructivism include an authentic and active student-centered learning environment facilitated through social negotiation (Splan, Porr, & Broyles, 2011). The focus is on learning instead of teaching; students build their own body of knowledge and apply it to their own environment. Thus, there are multiple realities and perspectives that prove unique to each learner (Kala, Isaramalai, & Pohthong, 2010). Per Vogel-Walcutt, Gebrim, Bowers, Carper, and Nicholson (2011), when students develop their own models of information, learning is understood, applied, and stored more efficiently. Educators aid learners in constructing their own knowledge rather than providing the information to the learner (Vogel-Walcutt, Gebrim, Bowers, Carper, & Nicholson, 2011). When learning proves authentic or takes place in a real-world environment with real-world consequences, knowledge is retained longer and viable, and thus deep learning occurs which requires students to utilize higher-order thinking skills (Splan, Porr, & Broyles, 2011).

The constructivist approach requires the educator to: (1) create an environment where the learner is motivated to learn; (2) provide the learner with meaningful course materials; and (3) present relevant problems and questions while connecting the learner's previous knowledge (Brown, 2012). Hence, the main goal is for the educator to build upon the student's prior or existing knowledge (Livengood, Lewallen, Leatherman, & Maxwell, 2012). Furthermore, the constructivist approach focuses on the learner and their ability to actively create, interpret, and reorganize knowledge individually (Briggs, Long, & Owens, 2011; Brown, 2012). Also, students must be aware of their learning process, or metacognition, which provides the basis for self-directed learning (Hrynchak & Batty, 2012). Considering that constructivism is student-centered, educators are facilitators in the acquisition of knowledge and create an environment where students' learning and experience are encouraged (Asal & Kratoville, 2013; Duane & Satre, 2014; Garcia & Pacheco, 2010; Hunter, 2008). Constructivists, such as Piaget, Vygotsky, and Dewey, believe learning is an active process and learners construct and reconstruct information as a part of the learning process (Garcia & Pacheco, 2010; Hunter, 2008; Kala, Isaramalai, & Pohthong, 2010).

Piaget (1961) proposed that biological maturation and stages of cognitive development are necessary for learning, hence true learning occurs because of development. Piaget's principles of adaptation and organization are essential in cognitive development and are inextricably intertwined. Adaptation occurs when learners adjust to the demands of their environment to meet their goals, and organization occurs when observations are integrated into their current knowledge (Ginsburg & Opper, 1978). According to Ginsburg & Opper (1978), schemes, or organized patterns of behavior, are psychological structures or a group of meaningful actions or ideas that are the foundation of adaptation and organization. This means learners adapt schemes and schemes are systemized or organized into their cognitive development. Learners build schemes by adapting to their environment. In addition, Piaget suggested that learners should be "actively" involved in the learning process, meaning learners "actively" construct their own understanding through a self-regulatory process. Piaget did not emphasize the social impact of cognitive development like Vygotsky, who supported social contexts of learning in a collaborative environment.

Learners are responsible for their own construction of knowledge and learn by integrating (adaptation) and organizing new knowledge (organization) into their current knowledge base. Moreover, Piaget introduced assimilation, accommodation, and equilibration to explain intellectual growth, a process of adapting to the world. Furthermore, assimilation and accommodation are part of the adaptation and organization process where learners adapt to physical and mental stimuli (Ginsburg & Opper, 1978). Assimilation is defined as one's conceptualization of the environment "fits" into a scheme, a basic building block of thinking, cognitive structures, or enlarged into an existing structure to introduce new ideas (Simatwa, 2010; Swiderski, 2011). On the other hand, accommodation occurs when one modifies a scheme to fit the environment (Swiderski, 2011), make an existing structure more complex, or create a new structure (Splan, Porr, & Broyles, 2011). Equilibration, the stimulus for learning, is the need for accommodation when current experience cannot be assimilated in an existing schema

(Piaget, 1977), thus creating disequilibrium, a state when new information cannot fit into assimilation. This state forces the learner to restore balance by accommodation. Learning requires assimilation before accommodation; learners relate their experience to existing schemes before learning occurs, meaning assimilation and accommodation are complementary (Ginsburg & Opper, 1978; Splan, Porr, & Broyles, 2011). Nevertheless, assimilation and accommodation occur simultaneously.

Also, according to Simatwa (2010), real learning, a stable and permanent form, results from the equilibration process, which is the balance between assimilation and accommodation. It is the equilibration process where learners move from one level to a higher level of cognitive development (Simatwa, 2010). Piaget's schemes are built through active, self-directed interactions: when a problem or situation arises, schemes are applied to the new situation (Pagander & Read, 2014). According to Inhelder and Piaget (1958) assimilation and accommodation require learners to be active, as learning and aspects of learning must be discovered, not taught. Subsequently, von Glasersfeld (1993) stated knowledge occurs from constructivist activity and cannot be transferred to a passive receiver because knowledge must be actively built by everyone (Wink, 2014). More importantly, constructivism emphasizes a deeper learning or a deeper understanding of information; it is learning how to think, make decisions, and solve problems rather than using a straightforward method when introduced to challenging problems (Kala, Isaramalai, & Pohthong, 2010; Mann, 2011; Swiderski, 2011; Vogel-Walcutt, Gebrim, Bowers, Carper, & Nicholson, 2011). Ultimately, the goal is to teach students "how to learn" and "what to learn" if they are to develop into professionals that are competent, self-aware, able to self-monitor, and self-assess their learning to become lifelong learners (Mann, 2011).

Lev Vygotsky introduced an alternative approach to constructivism from Piaget's method. A new form of development is obtained when learners are assisted by their peers and eductors. Vygotsky's zone of proximal development is the difference between what a learner can achieve on their own and what they can achieve with the help of the instructor or scaffolding (Pagander & Read, 2014). He differentiates between two types of development: actual and proximal. Actual development are mental functions already acquired as a result of previous developmental cycles. For example, actual development would be a learner's prior knowledge. Whereas the zone of proximal development is the difference between actual development, independent thinking or prior knowledge, and potential development which are the cognitive abilities obtain with the colloboration of peers and/or assistance from an educator. Vygotsky described proximal development as "buds" or potential knowledge at the embronyic level that will maturate in the future with assistance (Vygotsky, 1978). According to Vygotsky (1978), for a learner to reach their full potential, learning and development requires meaningful and relevant tasks.

Vygotsky's zone of proximal development is often utilized in the FCIM. For instance, in a FCIM, students collaborate with their peers and receive help from their instructors during class, hence the zone of proximal development. On the other hand, theoretically,while completing homework assignments and/or an exam, the student would no longer require or have assistance from peers and/or instructors, a form of actual development, meaning the ability to think independently.

The main premises of constructivism build on the learner's prior knowledge as well as acknowledging multiple perspectives and realities, thus allowing the learner to construct knowledge with classmates and the educator (Hunter, 2008). From a constructivist point of view, learning is about understanding, applying, and constructing knowledge, not accumulating, memorizing, and repeating knowledge (Brown, 2012; Duane & Satre, 2014). Essentially, knowledge acquisition occurs when learners can articulate the information from their own perspective and construct meanings that make sense to them, meaning constructivism is subjective and unique to the learner (Brown, 2012; Splan, Porr, & Broyles, 2011).

Constructivism also concentrates on an individual's experience and their experience with others that influences how they formulates information (Asal & Kratoville, 2013). John Dewey, another contributor to constructivism, stated that students' experiences are unique and influenced by prior experience (Dewey, 1938). Dewey supported learner-centered or progressive education. He opposed lower-order thinking skills such as memorization. For Dewey (1938), the basis of education is "real experiences" even though all experiences are not educational. Dewey suggested learning should be grounded in authentic experiences and that students learn by engaging in inquiry-based learning, which is a fundamental of constructivism. Inquiry-based learning is the ability to work and think scientifically based on student motivation and prior knowledge. In addition, inquiry-based learning is a recommended active learning pedagogy by science and education leaders around the world; this method develops students' practical and transferrable skills, content knowledge, and scientific understanding (Madhuri, Kantamreddi, & Goteti, 2012). Dewey's teachings in inquiry, active participation, self-direction, and reflection (Ultanir, 2012). Dewey viewed education as a social process that integrated students' interests with social interests.

According to Dewey, reflection helps to create meaning between knowledge and experience. It also helps students to alleviate confusion (Dewey, 1910). Dewey viewed learning as a combination of imbalance and equilibrium, like Piaget (Hickman, Neubert, & Reich, 2009). Moreover, learners are active participants in the learning process and bring behaviors and experiences from past events. Over time, constructivism has developed into different philosophical, epistemological, and pedagogical approaches, including variants such as personal, social, radical, and pragmatic constructivism (Garcia & Pacheco, 2010; Wink, 2014).

Finally, the constructivist learning theory encompasses active learning, motivation, and personalized learning. The learner controls their own learning, and educators simply guide the learner. The flipped classroom instructional model naturally lends itself to the constructivist learning theory because it includes active learning techniques. According to Kala, Isaramalai, and Pohthong (2010), constructivism will be beneficial in a course that utilizes electronic learning (e-learning) because of the implementation of active learning techniqes. Some benefits of e-learning are convenience, consistency with the delivery of educational materials, enhanced recall and mastery learning, and increased student motivation and satisfaction (Kala, Isaramalai, & Pohthong, 2010). According to Smith (2008), the constructivist approach promotes collaborative and problem-based learning. Constructivism continues to expand as metacognition becomes more important and the definition of effective and contemporary teaching is becoming imperative.

Metacognition

Metacognition "is the act of thinking about your own thinking" (Hartle, Baviskar, & Smith, 2012, p. 33). Often metacognition is overlooked in traditional learning and instruction despite having positive effects on learning (Bissell & Lemons, 2006; Wang & Chen, 2014). An aspect of constructivism is active processing or cognition, either of which allows students to generate appropriate behavior for a given environment, hence generating knowledge that can be utilized in future situational contexts. Also, students are encouraged to become self-aware, self-mediated, and self-regulatory in a constructivism environment (Splan, Porr, & Broyles, 2011). Learners should be aware of their metacognitive abilities, meaning they should be aware of what they know, what they do not know, their learning style, and their strengths and weaknesses regarding course materials (Marra, Jonassen, Palmer, & Luft, 2014; Meyer, Abrami, Wade, Asian, & Deault, 2010; Wang & Chen, 2014).

Marra, Jonassen, Palmer, and Luft (2014) stated there are two components to metacognition: knowledge of cognition and self-regulation of cognition. Knowledge of cognition includes three types of knowledge: (1) metcognitive knowledge, or skills that are required for different tasks; (2) stategic knowledge, alternative learning strategies, and when to utilize those methods; and (3) self-knowledge, or one's own learning abilities. The other component of metcognition's self-regulation is the ability of the learner to monitor their own comprehension and to control their own learning activities. One example of self-regulation is planning, which requires the learner to begin with a variety of ways to approach a task, followed by setting clear goals and strategies for achieving the goals, while identifying potential obstacles. The second example is problem monitoring that requires the learner to be aware of the learning task and to anticipate what ought to be done next, followed by evaluation of the process (Dolmans, Grave, Wolfhagen, & Vleuten, 2005; Marra, Jonassen, Palmer, & Luft, 2014; Meyer, Abrami, Wade, Asian, & Deault, 2010; Wijnia, Loyens, & Derous, 2011). Also, the learner has to manage their time, regulate their physical and social environment, and control their effort and attention (Meyer, Abrami, Wade, Asian, & Deault, 2010). Similarly, Wang & Chen (2014) described metacognition as metacognitive awareness wherein the learner askes the what, how, why, and when questions of their learning process. The learner must also implement real-time self-management that includes planning, evaluating, and regulating of the cognitive task (Walker, Greene, & Mansell, 2006).

Reflection and motivation are important aspects of self-regulation (Dolmans, De Grave, Wolfhagen, & van der Vleuten, 2005; Liu, et al., 2014). Subsequently, active learning allows the learner to self-regulate the learning process, meaning the learner is metacognitively, motivationally, and behaviorally engaged in their own learning (Bakir, 2011; Van den Bergh, Ros, & Beijaard, 2014; Liu, et al., 2014; Meyer, Abrami, Wade, Asian, & Deault, 2010). In traditional classrooms, regulation of learning tasks are controlled by the educator, but in a flipped classroom students are responsible for self-regulation of their learning. Many students will not become self-regulated learners because they have not been taught how to learn and to consider alternative strategies to learning class material. The constructivist approach produces students that have the ability to self-regulate their own learning as they progress from postsecondary education to become lifelong learners (Reed, 2012).

Motivation

Motivation is critical to student learning and has been reported as essential for students' success in learning (Chen & Jang, 2010;Gomboc-Turyan, 2012; Jovanovic & Matejevic, 2014). Otherwise, the motivation of the student decreases and disinterest increases; hence, students will learn only when they are motivated (Pagander & Read, 2014; Weiler, 2005). Liu, et al. (2014) depicted motivation as a combination of "will" and "skill": the "will" is the learner's motivation, and the "skill" includes strategies used for effective learning. According to Tuysuz, Yildiran, and Demirci (2010), students' motivation is increased when they believe they have choices and some degree of control over what they learn and how they learn. The research of Zhu, et al. (2009) has indicated that motivated students are better at constructing their knowledge than students who are not motivated to achieve learning goals. Liu, Bridgeman, and Adler (2012) stated that motivated students outperform less motivated or unmotivated students.

The self-determination theory (SDT), a specific motivation theory, proves useful for this study. SDT has been used in physical education, politics, health care, and general education and has predicted learning outcomes such as performance, persistence, and course satisfaction (Chen & Jang, 2010). Ryan and Deci (2000) developed SDT to differeniate between intrinsic and extrinsic motivation. SDT addresses psychological needs while including multidimensional forms of motivation that can be used to understand cognitive and behaviorial processes (Motl, 2007).

In brief, SDT pinpoints the type of motivation (intrinsic and extrinsic) and the impact of the motivation on individual outcomes (Abeysekera & Dawson, 2015; Tuysuz, Yildiran, & Demirci, 2010). According to Wijnia, Loyens, and Derous (2011), SDT is the difference between an autonomous and controlled basis for performing coursework. Automony is the willingness to engage in an activity, whereas controlled behavior is a combination of internal and external pressures. Self-determing motivation results in greater psychological well-being and better performances academically (Wijnia, Loyens, and Derous, 2011). There are three psychological needs inherent in SDT. First, there is competence, or a sense of confidence; second, there is autonomy, the idea that one's actions originate from the self; and, finally, there is relatedness, which is rooted in a sense of community. Motivation is increased when each psychological need (competence, autonomy, and relatedness) is fulfilled (Chen & Jang, 2010; Liu, et al., 2014; Urdan & Schoenfelder, 2006).

The self-determination theory does not define motivation as a monolithic construct. Instead, motivation comprises three major categories: (1) intrinsic motivation—or doing something because it is enjoyable; (2) extrinsic motivation—doing something because it lends to a tangible outcome; and (3) amotiviation—lacking an intention to act. There are three components of intrinsic motivation, the highest level of behavioral regulation or most self-determined form: to know, to accomplish things, and to experience stimulation (Grodesky, Kosma, & Solmon, 2006; Motl, 2007). Research suggests that students in an autonomy-supportive environment are more instrinsically motivated, have higher self-esteem, and are more excited to learn (Tuysuz, Yildiran, & Demirci, 2010; Urdan & Schoenfelder, 2006). Above all, instructors are encouraged to be more nuturing and supportive as well as to provide opportunties for students to learn for themselves at their own pace (Urdan & Schoenfelder, 2006). According to Bertacchini, Bilotta, Pantano, and Tavernise (2012), factors of instrinsic motivation should be included in learning environments.

Comparatively, there are four components of extrinsic regulation ranging from external regulation (lowest form) to introjected regulation to identified regulation to integrated regulation (highest form) (Motl, 2007). External regulation reflects behaviors solely for some type of external reinforcement. The opposite of external reinforcement are behaviors that are performed for more autonomous reasons, an individual obtains integrated regulation, where the behavior becomes fully integrated and important to achieve a personal goal (Grodesky, Kosma, & Solmon, 2006; Keatley, Clarke, & Hagger, 2012). Lastly, amotivation is lacking intention to act. Some common causes of amotivation are when an individual feels the activity is unimportant, they are not competent to complete the activity, and/or the activity will not yield a desired outcome (Ryan & Deci, 2000).

Researchers have stated that motivation is associated with positive learning outcomes, but frequently motivation is not implemented in educational courses (Burguillo, 2010; Chen & Jang, 2010; Liu, Bridgeman, & Adler, 2012). Motivation has become an increasingly important component in the younger generation's literacy in science and a barrier to students' participation in science (Martin, Durksen, Williamson, Kiss, & Ginns, 2016). Additionally, it has been reported that the flipped classroom approach has a positive impact on student motivation (Amiri, Ahrari, Saffar, & Akre, 2013; Lage, Platt, & Treglia, 2000).

Flipped Classroom Research

Based on increased student satisfaction and engagement described in the literature, the flipped classroom is predominantly beneficial (Buxton, Buxton, & Jackson, 2016; Simpson & Richards, 2015; Tan, Brainard, & Larkin, 2015). In addition, students' summative assessment scores improved, and they reported that the course was more effective (Buxton, Buxton, & Jackson, 2016; Simpson & Richards, 2015; Tan, Brainard, & Larkin, 2015). However, the flipped classroom instructional model was also found to be ineffective in some regards. Several studies reported equivocal results or no statistically significant differences between a traditional and flipped model (Logan, 2015; Marks, 2015). In short, while research on flipped classroom research has largely understood the approach as beneficial to learning, some studies have yielded contradictory findings. The literature review that follows is divided into two categories: results that support flipped learning and results that do not.

Results Supporting Flipped Learning in Higher Education with Emphasis in Science Courses

Gross, Pietri, Anderson, Moyano-Camihort, and Graham (2015) found students improved their exam performance by nearly 12% in the flipped classroom format as compared to the non-flipped course. They also found the benefits of a flipped classroom were more pronounced for female students and students with a lower grade point average. The study was completed in an upper-level, lecture-based biochemistry course that was converted to an active flipped format. The difference between exam performance in the lecture-based course and the flipped was attributed to students in the flipped course attempting online homework questions more often and answering questions more accurately than students in the lecture-based course. Students completed a satisfaction survey instrument at the end of the course and reported the flipped format helped them to become more independent learners; conversely, students reported they did not learn more in the flipped format compared to a lecture-based course.

Butzler (2015) conducted a general chemistry course at an open-enrollment college and compared high school class rank and mathematics placement to overall course grades with data collected from a lecture, flipped, and stealth class in Fall 2012, Fall 2013, and Spring 2014. The content and final examinations were identical in each class. The lecture class used a traditional lecture approach, the flipped class viewed recordings of the lecture prior to class and completed homework during class, and the stealth class used the "tell, show, try, and assess" format which consisted of a 10–15 vodcast—a video viewed on the internet, readings, a demonstrated problem, independent problems, and a formative assessment. The results indicated that a students' mathematics levels explained 17.6% of the variance in the students' course grade. Nearly 21% of variance was contributed to students' class rank in high school, meaning students with a higher class rank in high school had a higher overall course grade. Butzler reported, due to the results of the study, less academically and mathematically prepared students would benefit more from a structured learning environment with continous feedback and pre-class activities, which are components of a FCIM. Overall, students in the upper- and middle-third of their high school class performed better in the flipped and stealth formats, but the stealth format was the most successful of the two formats. On the other hand, students in the bottom-third were more successful in the flipped format than the stealth format.

The Teaching and Learning Resource Centre at the Chinese University of Hong Kong developed materials using the FCIM to help students in the Department of Orthopedics and Traumatology interpret radiographs (Leung, Kumta, Jin, & Yung, 2014). Students could study materials according to their individual needs and were required to access the materials prior to class. Class time was dedicated to answering questions and activities to enhance topic familiarity. The method resulted in positive student feedback and improved student retention compared to previous semesters (Leung, Kumta, Jin, & Yung, 2014).

Geist, Larimore, Rawiszer, and Sager (2015) completed a quantitative pre-test-post-test control group quasi-experimental design to determine if there was a significant difference in knowledge between traditional and flipped classroom in a baccalureate nursing pharmacology course. Assessments for both groups included three unit tests and a final exam. Also, each group completed the Health Education Services, Inc. (HESI) exam to measure their aptitude before beginning the course. The sample size was 40 students in the control and 46 students in the treatment group. There were significant gains in the flipped classroom on the third unit test; however, there was not a significant difference in the means for the final exam (Geist, Larimore, Rawiszer, & Sager, 2015).

Results Supporting Flipped Learning in Higher Education with Emphasis in Non-science Courses

Galway, Corbett, Takaro, Tairyan, and Frank (2014) completed a small sample (N=11) study to examine learning experiences and opinions of the FCIM among masters-level public health students enrolled in an Environmental and Occupational Health course. Modules and quizzes were completed on the NextGenU's website prior to class and in-class sessions were held every other week. Class time was used to address challenging concepts and questions from students to clarify the assigned modules. This was followed by active learning activities, including students who worked in pairs on a toxicology problem set, small groups that worked on an occupational health case study, and all students were engaged in environmntal health decision making. Students reported an increase in knowledge; the mean examination scores for the flipped classroom instructional model students was 88.8% compared to 86.4% for traditional students. Also, students reported positive learning experiences and perceptions of the flipped classroom instructional model; the overall rating for the course was 4.7 out of 5.

Jacob Enfield implemented the FCIM in two sections of a web design course within the Cinema and Television Arts Department at California State University Northridge (Enfield, 2013). The instructor created 40 videos to provide instruction for students outside of the classroom. During class, a quiz was administered. Following the quiz, students were given in-class activities to discuss and practice what they learned. Most students reported the instructional videos helpful (62.2%) or somewhat helpful (37.8%), and found the instructional videos to be very engaging (37.8%) or somewhat engaging (56.8%). Students reported in-class activities increased engagement and stated it was very effective (51.4%), while others stated it was somewhat effective (37.1%).

Mortensen and Nicholson (2015) completed a flipped study at the University of Florida with 130 students enrolled in an equine course. Students took the Cornell Critical Thinking Test (CCTT) on the first and last days of class. Exams scores were significantly higher for the flipped course compared to scores from a traditional course taught during a previous semester. Furthermore, students' CCTT exam scores increased from the pre-test

(50.8) and the post-test (54.4), and students reported the flipped course provided more effective teaching than a traditional course.

Thompson and Ayers (2015) measured the impact of active learning on student engagment (professional relevance and peer interaction) in an undergraduate lower extremity orthopedic assessment course. Participants (N=17) completed a daily questionnaire and responded to five open-ended questions in a weekly journal. Primary findings for both professional relevance and peer interaction were high. Students described the content as professionally applicable and class activities as relevant. Active learning techniques were supported, and most students completed pre-class assignments and reported the value of completing pre-class assignments for full interaction with peers. The study supports the idea that active learning activities in a flipped classroom format can enhance student engagement.

Hybrid Flipped Classrooms

A hybrid flipped classroom includes online and in-class lecture components whereas a flipped classroom includes pre-recorded lecture videos and active learning student engagement during class time (Karayaka & Adams, 2015). An undergraduate physiological psychology course used a hybrid flipped classroom to assess students knowledge of synaptic transmission (Talley & Scherer, 2013). In this study, some class time was used for review and practice testing instead of lecture. One in four sessions used the flipped format. Students enrolled in the course were primarily seniors and psychology majors. The learning techniques used were self-explanations, in which students created videos of themselves narrating the process of synaptic transmission, and practice techniques, in which students produced labeled cell drawings during class without aid on a blank sheet of paper. Researchers Talley and Scherer (2013) found an increase in the final grade for the course; the mean from a previous semester in a traditional course was 65.88 and for the hybrid flipped course the mean was 74.51. This difference was an entire letter grade and showed that the hybrid flipped classroom format along with the learning techniques of self-explanation and practice testing increased students' academic performance in the course.

Brunsell and Horejsi (2013) reported findings from a hyrid flipped physics course. Only one unit on magnetic fields was flipped, and the educator collected data using unit tests, surveys, interviews, and a teaching journal. The educator found or created 16 videos which doubled the amount of class time devoted to hands-on activities and small group problem solving. Nearly all of the students considered the video lectures helpful for building their understanding, and at least half liked being able to replay parts or all of the video until they were able to understand the concepts. Before the flipped unit was implemented, two-thirds of students stated they had enough time to get help; however, 96% of students reported during the flipped unit that they received the help necessary during class time. Students were also able to learn from their classmates; three-quarters stated they learned from their classmates during the class time devoted to problem solving. Also, students performed equal to, or better than, students in previous years on the magnetic field unit test.

Trogden's (2015) research supported the idea that the flipped classroom can be utilized to balance content and student engagement. She implemented a hybrid flipped class, where there were three class meetings each week. One of the three class meetings was a 50-minute video delivered online in order for students to work in small groups during class. This method increased class time which was used for problem solving. This study was completed during the same semester with the same instructor teaching a flipped treatment group and a non-flipped control group. Students in the flipped class had a lower failure rate and a higher course GPA; also, none of the students received a final grade of F.

Danker (2015) reported the use of two flipped classroom approaches (blended learning N=32 and guided inquiry approach N=33) in a performing arts course. Both approaches were utilized to stimulate deep learning. There was a slight increase in students' level of understanding to 4.1 with the guided inquiry approach as compared to 3.9 with the blended learning approach. Students successfully increased deep learning by connecting topics in an inquiry-based approach (90%) than in a blended learning approach (78%). The results support that idea that individualized learning and inquiry-based activities successfully engage students, increase curiosity, and promote the development of higher-order thinking skills.

Results Not Supporting Flipped Learning

Jones (2015) compared student engagement, student satisfaction, and student rentention of knowledge in traditonal and flipped versions of Introduction to Horse Production. A pre-test on equine equipment was utilized to determine students existing knowledge; the average score was 70% for 63 participants. The traditional group scored higher on the post-test (92%) compared to the flipped group (81%).

In another study, the flipped model was applied to emergency medicine clinical clerkship. The goal was to determine if performance would improve on a 40-question multiple choice exam between a traditional and flipped clerkship among 56 participants

(Heitz, Prusakowski, Willis, & Franck, 2015). There was not a significant difference between the traditional and flipped groups on the exam; however, students rated the flipped clerkship higher than they rated the traditional clerkship.

Whillier and Lystad (2015) evaluated the effectiveness of a flipped model by comparing a unit of a neuroanatomy course during the summer 2011 (N=33) and 2013 (N=23) terms. Students from the 2013 flipped course had slightly higher grades, but the difference was not statistically significant. Moreover, there were not significant differences in self-rated knowledge or satisfaction scores between the two groups. Whillier and Lystad have suggested these results may be due to students preferring to absorb information passively rather than actively teaching themselves the material.

McLaughlin, Roth, Glatt, Gharkholonarehe, Davidson, Griffin, Esserman, and Mumper (2014) flipped a pharmaceutics course at two satellite campuses (N=22) to determine potential improvement in student academic performance, engagement, and perception. Students preferred the flipped format and stated the flipped format enhanced their learning. There was a significant increase in preference; before completing the course 34.6% preferred the flipped format compared to 89.5% preferring the flipped format after completing the course. However, final exam scores did not differ significantly from the previous year when the course was taught using a traditional format.

A Prezi platform was implemented in flipped undergraduate analytical chemistry course. The sample size (N=13) was too small to yield statistically significant results and there was not a significant difference in written examinations and student GPAs. On the other hand, student evaluations were positive. Students described group work during class as helpful and reported enjoyment of the class format and Prezi presentations as well as a decreased need for outside help. Fitzgerald and Li (2015) reported Prezi was a convenient and attractive addition to a flipped format and popular among students. While there were not increases in academic performance, the instructor was encouraged by the results and will continue using Prezi in a flipped classroom format.

Overall, the most common difficulties with implementing the flipped classroom were students' lack of preparation for in-class activities, decreased student satisfaction, and students' difficulty in adapting to the new format. Moreover, students have stated there is a heavier work load in a FCIM and less effort is required in a traditonal classroom compared to a FCIM (Tawfik & Lilly, 2015).

Summary

This chapter has included an overview of Bloom's taxonomy, constructivism, metacognition, motivation, and research on the flipped classroom in higher education. Traditional lecture-based instruction continues to prevail in higher education, which can be problematic for higher education institutions that attempt to prepare students to be critical thinkers and mindful learners (Al-Zahrani, 2015). Scholars suggest a change is needed to prepare students to meet the demands of the 21st century (Al-Zahrani, 2015; Kong, 2014; McLaughlin, et al., 2014). Bergman and Sams (2012) have suggested the intervention that may revolutionize education and promote higher-order thinking skills is the flipped classroom (Al-Zahrani, 2015; Tawfik & Lilly, 2015).

Flipped learning has become increasingly popular within the last 10 years. Berrett (2012) stated the increased interest in flipped learning can be attributed to the explosion of technological resources available to educators and students (Kong, 2014). Despite the numerous studies and positive findings completed on flipped learning, much of the literature has focused on implementation and students' perspectives in flipped classrooms compared to traditional classrooms (Tawfik & Lilly, 2015). There is a paucity of studies that examine students' learning gains or losses in flipped classroom (Fitzgerald & Li, 2015; Milman 2012; Tune, Sturek, & Basile, 2013). Furthermore, there are still unanswered questions: whether students prefer a flipped classroom, whether college and university students learn more, and whether flipped learning works better in some disciplines than others (Jenkins, 2015). In addition, the mixed response to flipped learning among students and educators necessitates further research to assess the value of the flipped classroom in higher education (Westermann, 2014). This study will attempt to fill the gap by presenting quasi-experimental data to assess critical thinking, metacognition, and motivation in flipped learning and provide a foundation for further research and practice of flipped learning in scientific disciplines at higher education institutions.

The next chapter will present an explanation of this study's research methodology, which includes a quasi-experimental design using a survey questionnaire, interview, and an analysis of constructs to evaluate the effectiveness of flipped learning.

CHAPTER III – METHODOLOGY

Participants

The study sample will consist of teachers and their undergraduate students enrolled in science courses at any postsecondary institution taught by faculty members who are members of HAPS, which includes over 1,700 members in the United States, Canada, and throughout the world (Human Anatomy & Physiology Society, 2015). The researcher is a HAPS member and will use three methods to access HAPS educators: listserv, email, and recruitment at the annual conference. Two of the three methods are only available to HAPS members. HAPS-L is a discussion group in which HAPS members communicate with each other via email. Members must enroll in HAPS-L; hence, this list will be limited. The second method uses the HAPS member search, a database that includes all current members' contact information. Emails will be sent to HAPS members explaining the purpose of the study and benefits of participation. Lastly, the researcher will recruit participants during the annual HAPS Conference held in May. HAPS members will be asked which format they used for teaching their courses: traditional or flipped. Student participants from each format will be entered in a drawing for a $25 Amazon gift card upon completion of the pre-questionnaire and the post-questionnaire. Also, educators will be entered in a drawing for a $50 Amazon gift card.

Instrumentation

The MSLQ was developed by a team of researchers from the National Center for Research to Improve Postsecondary Teaching and Learning (NCRIPTAL) and the School of Education at the University of Michigan. The MSLQ was designed to assess college students' motivation and learning strategies (Pintrich, Smith, Garcia, & McKeachie, 1991).

The instrument for this study will consist of items to measure the dependent variables: critical thinking (see Appendix F items 15–19), metacognition (see Appendix F items 9–14 and 20–31), and motivation (see Appendix F items 1–8). There are five items to measure critical thinking, 18 items to measure metacognition, and eight items to measure motivation. The instrument will contain a Likert-type scale with a value range from 1-strongly disagree to 5-strongly agree. The intrinsic goal orientation component from MSLQ has an alpha (α) reliability of .74, and the extrinsic goal orientation component from MSLQ has an α reliability of .62. The elaborative cognitive and metacognitive scale from MSLQ include strategies such as paraphrasing, summarizing, and creating analogies that help the learner to connect new information with prior knowledge and has an α reliability of .76. The critical thinking component of the MSLQ measures the learner's ability to apply prior knowledge to new situations to solve problems and has an α reliability of .80. The metacognitive self-regulation component from MSLQ measures the learner's ability to plan, monitor, and regulate their learning and has an α reliability of .79. The MSLQ demonstrates Cronbach's alphas ranging from .62 to .80. All scales are above an acceptable Cronbach's alpha except extrinsic goal orientation. For extrinsic goal orientation, Cronbach's alpha is .62, which is below the recommended .7 and is indicative of low internal consistency (Soini, Liukkonen, Jaakkola, Watt, & Yli-Piipari, 2014). Due to low internal consistency, more error may be associated with extrinsic goal orientation.

The MSLQ instrument has been validated in several studies and demonstrates predictive validity from a study completed by developers Wilbert J. McKeachie and Paul R. Pintrich who sampled 37 classrooms (N=380) from various disciplines at a public, four-year university in the Midwest (Artino, 2005; Duncan & McKeachie, 2005; Pintrich, Smith, Garcia, & McKeachie, 1991). From the data gathered, 31 motivation items were tested to determine how well the items fit six theoretical latent correlated factors: intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs about learning, self-efficacy, and test anxiety. Only intrinsic and extrinsic goal orientation will be used in this study. There were 50 cognitive items tested to determine how well the items fit nine theoretical latent correlated factors: rehearsal, elaboration, organization, critical thinking, metacognitive, time and study environment management, effort regulation, peer learning, and help seeking; only elaboration, critical thinking, metacognitive, and effort regulation will be used in this study (Pintrich, Smith, Duncan, & McKeachie, 1993).

Confirmatory factor analyses (CFA) were completed to reveal factor validity for the motivation and cognitive items. CFA was used to specify which variables or items load onto which factors (motivation and cognitive). For example, four items were assumed to be indicators of intrinsic motivation and loaded on the intrinsic construct. Each item loaded only on one latent factor to yield the final MSLQ.

Structural equation modeling was employed to estimate parameters and test the models. The model was generated using maximum likelihood to determine the parameter estimates. Also, tests for goodness of fit were used to moderate how well correlations reproduced paired with the input set of correlations, hence the goodness of fit indices yielded six scales for the motivational components and nine scales for the cognitive components. Omnibus fit statistics such as chi square to degrees of freedom ratio, goodness of fit indices (GFI), adjusted goodness of fit indices (AGFI), and root mean residual (RMR) was used in the analyses. Per Pintrich, Smith, Duncan, and McKeachie (1993), a chi square to degrees of freedom less than five is a good fit between the observed and reproduced correlation matrices; a GFI and AGFI of .9 or greater is a good fit; and a RMR .05 or less is a good fit. The motivational model had a chi square to degrees of freedom of 3.49, a GFI of .77, an AGFI of .73, and a RMR of .07, and the cognitive model had a chi square to degrees of freedom of 2.26, a GFI of .78, an AGFI of .75, and a RMR of .08. The researchers found that all the subscales were positively correlated, except test anxiety which will not be used in this study, meaning the scales are valid to measure the motivation and cognitive constructs (Pintrich, Smith, Duncan, & McKeachie, 1993; Hamilton & Akhter, 2009).

The MSLQ subscales were correlated with students' final course grades to determine predictive validity (Artino, 2005). The motivation subscale had a significant correlation with students with high intrinsic motivation (average r=.29). Students that implemented higher-order thinking skills, such as critical thinking and metacognition, were more likely to have a higher final course grade (average r=.21). Multivariate analyses were completed as well; researchers found that among computer and natural sciences students the 15 subscales accounted for 39% of the variance in their final course grade (Pintrich, Smith, Duncan, & McKeachie, 1993).

Cook, Thompson, and Thomas (2011) conducted a validity study on the motivation section of the MSLQ that included reliability and factor analysis. Participants were internal and family medicine residents (N= 210) enrolled in a web-based ambulatory medicine course. Internal consistency reliability for all items on the MSLQ was $\alpha = 0.93$ and for each domain was $\alpha \geq 0.67$. Test-retest reliability from 95 participants, who completed the MSLQ one year later, had a range of 0.40–0.56. The test-retest reliability for the entire instrument was 0.46. In this study, only two constructs from the motivation section will be used and combined to measure motivation: intrinsic goal orientation and extrinsic goal orientation. Intrinsic goal orientation had an $\alpha = 0.79$ and a test-retest reliability of 0.49, and extrinsic goal orientation had an $\alpha = 0.78$ and a test-retest reliability of 0.36, which may result in more error. Confirmatory factor analysis yielded a borderline model fit, whereas an exploratory factor analysis yielded psychometric and predicative properties similar to the five factors (self-efficacy, intrinsic interest, test anxiety, extrinsic goals, and attribution) on the original scales. The data did not fit the model well. There was a statistically significant chi-squared test ($\chi^2 = 1106.7$; d.f. = 419, $p < 0.001$), but the standardized root mean square of 0.079 was acceptable. Both the root mean square error of approximation (0.089) and a Bentler's comparative fit index (0.82) were substandard. On the other hand, the GFI was 0.73 and RMR was 0.079, which were similar to the GFI and RMR in the original study.

Alkharusi, et al. (2012) examined the psychometric properties of the motivational and learning scales on the MSLQ at Sultan Qaboos University (N=952). The confirmatory factor analysis indicated a reduced form (71 items) was a better fit than the original form (81 items). Items were deleted one at a time until an acceptable model was obtained, resulting in three items deleted from the motivational model and seven items from the learning model. Most of the motivational factors (intrinsic goal orientation, task value, control beliefs of learning, and self-efficacy) were positively correlated with one another and had a range of .42 to .68. All items on the learning model were positively correlated with one another and had a range of .37 to .77 except for peer regulation (.17), not used for this study. Internal consistency reliabilities for extrinsic goal orientation (α = .62), elaboration (α = .77), self-regulation (α = .82) were comparable to the original study. Feiz, Hooman, and kooshki (2013) assessed construct validity and reliability of the MSLQ among high school students (N=504).

An exploratory factor analysis was completed on the cognitive and metacognitive items. Based on the eigenvalues and the scree plot a six-factorial solution was substantiated. The internal consistency was α=.957. Rotgans and Schmidt (2010) assessed MSLQ at the general curriculum level (N=1,166). CFA was used to determine construct and predictive validity and correlating the subscales of MSLQ to final semester grades. All subscales were incorporated except text anxiety and task value. The motivation section chi-squared test ($\chi^2 = 3.86$; $p < 0.001$), RMSEA = .05 and CFI = .94). The learning section chi-squared test ($\chi^2 = 3.26$; $p < 0.001$), RMSEA = .04 and CFI = .86). Both demonstrate the data fit the models well. The GFI =.95, AGFI =.93 and RMR = .03 for the motivation section and the GFI = .88, AGFI = .86, and RMR =.03 for learning section were better than in the original study.

Reliability was assessed using coefficient *H.* The values ranged from .52 to .86 and an average of .68. According to Rotgans and Schmidt, the values indicate a moderate to good internal consistency. Lastly, the researchers assessed the modified MSLQ predictive validity by computing Pearson's correlation coefficients between the MSLQ subscales and final course grade which proved moderate to weak but statistically significant except for control of learning beliefs. There were stronger correlations for intrinsic goal orientation (.16), elaboration strategies (.14), and metacognitive self-regulation (.17).

Despite the lackluster validity evidence, MSLQ has been widely used in various disciplines and in hundreds of studies. Each instrument has advantages and disadvantages and the validity of self-report questionnaires such as the MSLQ has been questioned (Kivinen, 2003). MSLQ is a reasonable measure that combines the researcher's three constructs: critical thinking, metacognition, and motivation and will be implemented because it was developed assess college student's motivation and learning strategies. Furthermore, MSLQ was designed to be used in any subject and various learning activities. Each item is worded so that students can address motivation and learning that at are specific to a course or subject (Davenport, 1999; Smith & Chen, 2015). Several researchers have supported the factor structure and the 15 subscales of the MSLQ (Feiz, Hooman, & kooshki, 2013; Pintrich, Smith, Duncan, & McKeachie, 1993).

The overall internal consistency reliability .78 for motivation scales and .71 for learning scales are not stellar but adequate, comparable with other Likert scales (Davenport, 1999; Stoffa, Kush, & Heo, 2011). MSLQ can be used in its entirely or its subscales only. Most of the subscales with inadequate performance from the original instrument, except for extrinsic goal orientation, will be removed for this study. Researchers have suggested a simplified model is a better fit, which the researcher will implement (Cook, Thompson, & Thomas, 2011). Cook, Thompson, and Thomas (2011) produced a five-factor model (self-efficacy, intrinsic interest, test anxiety, extrinsic goals, and attribution) after a follow-up exploratory factor analysis, which included extrinsic goal orientation. Also, MSLQ has been found to retain its original psychometric properties when converted to a five-point Likert scale (Davenport, 1999).

Design

The design of the study will be mixed methods and include a quasi-experimental, pre-test/post-test non-equivalent control group design and a phenomenology design. Participants in this study will be students from pre-professional science courses in the United States who enrolled in classes during Fall 2017, Summer 2018, or Fall 2018 terms. The researcher is a HAPS member and recruited educators at the 2017 and 2018 Annual HAPS Conference and emailed educators from the HAPS-L list and the HAPS membership directory, which includes all of the organization's members. The researcher will identify educators that use a traditional format in their classrooms (control group) and educators that use a flipped format in their classrooms (experimental group). The researcher cannot be entirely certain the control classroom and experimental classroom are comparable; thus, the two groups will be non-equivalent. Class time will be used to categorize a traditional and flipped format. Participants will complete the educator classroom format questionnaire (see Appendix C). A pilot study will be completed with two to three educators not in the HAPS organization to test the accuracy of the educator classroom format questionnaire and to determine the criteria to differentiate between a traditional and flipped classroom. If class time is teacher-centered where educators spend 75% or more of class time dispersing information to students via PowerPoints and/or whiteboards and homework assignments are completed at home, then the format will be traditional. If over 75% of class time is student-centered and spent actively engaging students by putting students into groups, problem solving, completing homework, hands-on activities, or other active learning techniques as well as all lectures are posted in a learning management system to be view at home and before class sessions then the format will be flipped. Class time with the flipped format will be modified based on students' needs. The educator will provide assessments to students at the beginning of class to address any questions students may have about the pre-recorded lecture watched at home, hence class time will vary based on assessment results.

Educators and their students will not be randomly assigned to conditions; hence, the researcher will rely on a pre-test to statistically control for group in-equivalence. The instructors' participation will be voluntary, and students will select the courses without knowledge of the format or their instructors participating in the study. Instructors will be asked to announce and provide the questionnaire after the first major course assignment, between the fourth and sixth week of the semester. At this time, students will be aware of the format, know the expectations of the instructor, and the add/drop date will have passed. The post-test will be administered during the last two weeks of the semester. A typical semester is 16 weeks, and the goal is to have a minimum of 10 weeks between the pre-test and post-test.

Prior to data collection, an application package will be submitted to the University of Southern Mississippi Institutional Review Board (IRB) for approval. The survey link will be emailed to instructors within two weeks of the semester start date and within three weeks of the last day of class. Participants will be asked when the semester begins and ends at their institution upon consent of participating in the study. Weekly reminders will be sent during the pre-test/post-test administration period. Students will then be asked by their instructors via class announcements and learning management systems such as

Blackboard, Canvas, Moodle, etc. to complete the questionnaire. Educators that used the flipped format will be asked to complete a semi-structured interview at the end of the term to determine their opinion on the limitations and challenges of implementing a flipped format. The following research questions will be addressed during the study:

Research Questions

Research Question 1:

Are students' critical thinking, metacognition, and motivation impacted in a flipped classroom model compared to a traditional classroom?

Research Question 2:

What are the educators' opinion on the limitations/challenges of implementing a flipped classroom model in higher education?

Procedure

All HAPS members that have access to HAPS-L discussion and are in the HAPS member search will be emailed a recruitment form, which includes the purpose of the study and expectations of the participants, upon IRB approval (see Appendix A and B). HAPS members that agree to participate will be emailed the educator classroom format questionnaire (see Appendix D). After the educator classroom format questionnaire is complete, the researcher will select participants based on format (traditional or flipped) and class size. The goal is to have equal sample sizes for the traditional and flipped formats and a large sample size. Also, participants from the same educational institution will be selected to decrease the number of IRB approvals for the study. Upon selection to participate in the study, educators will be given access to the educator and student consent forms and the survey instrument (see Appendixes C, E and F). The researcher will email the pre-test questionnaire link to educators three weeks after the first day of class. A reminder email will be sent each week until the sixth week of the educators' semester. Students will access the survey instrument via Qualtrics between the fourth and sixth week of the semester. The researcher will send the post-test questionnaire link to educators three weeks before final exams and a reminder email will be sent each week until the last day of class. The post-survey instrument will contain the same items as the pre-survey instrument.

FCIM educators will be sent an email to schedule their semi-structured interview four weeks before the last day of class. Educators who utilized a flipped format will complete an interview via Skype at the end of the semester to give feedback on the implementation and challenges of their course format as well as discuss active learning techniques used in the course. Completed surveys and interviews will be downloaded to a backup computer jump drive and secured in a locked file cabinet at the researcher's office for a period of five years. Only the researcher and researchers assisting in data analysis will have access to the data. After the quantitative and qualitative data has been collected, the researcher will complete analyses.

Analyses

Data will be collected and transferred from Qualtrics then analyzed using Statistical Package for the Social Sciences (SPSS). The researcher will utilize a mixed factorial multivariate analysis of variance (MANOVA) to estimate the relationships between classroom format (flipped and traditional) and outcomes (critical thinking, metacognition, and motivation). Students taught by the same instructor will be relatively similar to each other than to those taught by another instructor. In order to eliminate this problem of non-independent observations, interclass correlation (ICC) will be used to estimate the dependency between scores (Field, 2013).

The responses to instructors' semi-structured interview (see Appendix G) will be reported using qualitative measures. All participants will be asked about their experience with a flipped classroom and given the opportunity to discuss aspects of a flipped classroom that are not included in the interview questions.

Content analysis will include reading the transcript and making notes of relevant and interesting themes, followed by the researcher making a list of the different types of themes. Next, the list will be categorized based on brief descriptions of the data. The categories will then be linked together if possible and listed into major and minor themes. Lastly, the major and minor themes will be compared. This process will be completed for each interview. The major and minor themes will be used to explain the educators' opinions about the FCIM.

Summary

The chapter described the participants, instrumentation, design, procedure, and analyses to investigate: 1) students' critical thinking, metacognition, and motivation in a flipped classroom model compared to a traditional classroom and 2) educators' opinion on the limitations and/or challenges of implementing a flipped classroom model in higher education. The researcher collected and analyzed quantitative data from students enrolled in flipped and traditional classrooms throughout the United States to address research question one. Qualitative data were collected and analyzed from flipped classroom educators to address research question two. Chapter 4 will present quantitative results from the experimental group-flipped classrooms and control group-traditional classrooms and qualitative results from flipped classroom educators.

CHAPTER IV – RESULTS

Introduction

The purpose of this study was to determine the pedagogical efficiency of the flipped classroom model by providing more quantitative data on flipped classroom models and to examine critical thinking, metacognition, and motivation in traditional and flipped classrooms. It further examined the challenges and limitations for instructors when implementing a flipped classroom. Multivariate statistics were chosen because there is one predictor variable classroom (traditional or flipped) and three outcome variables (critical thinking, metacognition, and motivation). Using a quantitative approach, the study attempted to answer research question one: Are students' critical thinking, metacognition, and motivation impacted in a flipped classroom model compared to a traditional classroom. Qualitative methods were used to address research question two: What are science educators' opinions on the limitations/challenges of implementing a flipped classroom model in higher education. This chapter will present the descriptive, quantitative, and qualitative analyses from the study.

Pilot Study

A pilot study was conducted to determine the criteria for classroom format. There were no changes suggested from the three participants that completed the pilot study. The researcher categorized classroom format on the amount of time spent lecturing versus active learning techniques. If 75% or more time during class was spent lecturing, then the classroom format was traditional, and if 75% or more time during class was spent completing active learning techniques, then the classroom format was categorized as flipped.

Demographics

There was a total of 14 educator participants recruited to post the survey questionnaire link in their courses. Ten out of the 14 educator participants had students complete the questionnaire. Only four of the 10 educator participants implemented a flipped classroom format. Student participants were enrolled in two- and four-year colleges and universities in Arkansas, Illinois, Michigan, Missouri, Mississippi, California, and Texas. The flipped classroom educators had large classes with over 100 students enrolled in each class compared to the traditional classroom educators with an average of 30 students per class. Most of the student participants were female, Caucasian, and freshman or sophomore class level (see Table 2).

Table 2 *Flipped and Traditional Classroom Demographics*

	Flipped		Traditional	
	N		N	%
		Gender		
Male	45		24	16.1
Female	208		152	83.9
Total	253		176	100
		Ethnicity		
African American or Black	20		42	14.5
Asian	8		16	5.6
Caucasian or White (non-Hispanic)	196		56	58.7
Hispanic or Latino	21		24	10.5
Other	8		38	10.8
Total	253		176	100
		Class Level		
Freshman	40		54	22.1
Sophomore	116		41	36.9
Junior	43		34	18.1
Senior	25		13	8.9
5th year Senior	7		12	4.5
Other	22		19	9.6
Total	253		173	100

Research Question One

The MSLQ was administered with a five-point Likert scale: 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree. The means for each construct (critical thinking, metacognition, and motivation) are in Table 3, Table 4, and Table 5.

Table 3 *Pre-test and Post-test Means*

Construct	Pre-Flipped	Pre-Traditional	Post-Flipped	Post-Traditional
Critical Thinking				
Question 15	3.13	3.49	3.11	3.54
Question 16	3.50	3.58	3.32	3.48
Question 17	3.27	3.46	3.47	3.61
Question 18	3.57	3.66	3.11	3.38
Question 19	3.23	3.41	3.15	3.44
Metacognition				
Question 9	4.34	4.10	4.24	4.10
Question 10	4.08	3.98	4.16	4.03
Question 11	4.29	4.26	4.16	4.17
Question 12	3.38	3.27	3.12	3.30
Question 13	4.17	4.09	4.06	4.05
Question 14	4.12	3.85	4.04	3.89
Question 20	3.45	3.33	3.25	3.11
Question 21	2.99	3.02	3.12	3.18
Question 22	4.22	4.22	4.14	4.11
Question 23	3.70	3.64	3.79	3.75
Question 24	3.43	3.51	3.54	3.65
Question 25	3.73	3.80	3.73	3.78
Question 26	3.91	3.62	3.86	3.67
Question 27	3.08	3.07	3.04	2.92
Question 28	3.60	3.58	3.65	3.64
Question 29	4.18	4.09	4.17	3.93
Question 30	3.94	3.88	3.94	3.82
Question 31	3.88	3.99	3.83	3.90
Motivation				
Question 1	3.79	3.70	3.84	3.62
Question 2	4.19	4.19	4.18	4.04
Question 3	4.24	4.18	4.07	4.12
Question 4	3.22	3.34	3.33	3.39
Question 5	4.40	4.44	4.26	4.35
Question 6	4.00	4.18	4.05	4.23
Question 7	4.13	4.06	3.99	3.88
Question 8	4.02	3.93	3.97	3.98

Table 4 *Pre-flipped and Post-flipped Mean Differences*

	Pre-flipped	Post-flipped	Difference
Critical Thinking			
Question 15	3.13	3.11	-0.02
Question 16	3.50	3.32	-0.18
Question 17	3.27	3.47	0.20
Question 18	3.57	3.11	-0.46
Question 19	3.23	3.15	-0.08
Metacognition			
Question 9	4.34	4.24	-0.10
Question 10	4.08	4.16	0.08
Question 11	4.29	4.16	-0.13
Question 12	3.38	3.12	-0.26
Question 13	4.17	4.06	-0.11
Question 14	4.12	4.04	-0.08
Question 20	3.45	3.25	-0.20
Question 21	2.99	3.12	0.13
Question 22	4.22	4.14	-0.08
Question 23	3.70	3.79	0.09
Question 24	3.43	3.54	0.11
Question 25	3.73	3.73	0.00
Question 26	3.91	3.86	-0.05
Question 27	3.08	3.04	-0.04
Question 28	3.60	3.65	0.05
Question 29	4.18	4.17	-0.01
Question 30	3.94	3.94	0.00
Question 31	3.88	3.83	-0.05
Motivation			
Question 1	3.79	3.84	0.05
Question 2	4.19	4.18	-0.01
Question 3	4.24	4.07	-0.17
Question 4	3.22	3.33	0.11
Question 5	4.40	4.26	-0.14
Question 6	4.00	4.05	0.05
Question 7	4.13	3.99	-0.14
Question 8	4.02	3.97	-0.05

Table 5 *Pre-traditional and Post-traditional Means Differences*

	Pre-traditional	Post-traditional	Difference
Critical Thinking			
Question 15	3.49	3.54	0.05
Question 16	3.58	3.48	-0.10
Question 17	3.46	3.61	0.15
Question 18	3.66	3.38	-0.28
Question 19	3.41	3.44	0.03
Metacognition			
Question 9	4.10	4.10	0.00
Question 10	3.98	4.03	0.05
Question 11	4.26	4.17	-0.09
Question 12	3.27	3.30	0.03
Question 13	4.09	4.05	-0.04
Question 14	3.85	3.89	0.04
Question 20	3.33	3.11	-0.22
Question 21	3.02	3.18	0.16
Question 22	4.22	4.11	-0.11
Question 23	3.64	3.75	0.11
Question 24	3.51	3.65	0.14
Question 25	3.80	3.78	-0.02
Question 26	3.62	3.67	0.05
Question 27	3.07	2.92	-0.15
Question 28	3.58	3.64	0.06
Question 29	4.09	3.93	-0.16
Question 30	3.88	3.82	-0.06
Question 31	3.99	3.90	-0.09
Motivation			
Question 1	3.70	3.62	-0.08
Question 2	4.19	4.04	-0.15
Question 3	4.18	4.12	-0.06
Question 4	3.34	3.39	0.05
Question 5	4.44	4.35	-0.09
Question 6	4.18	4.23	0.05
Question 7	4.06	3.88	-0.18
Question 8	3.93	3.98	0.05

A MANOVA was used to determine if there was a significant difference in critical thinking, metacognition, and motivation in traditional and flipped classrooms. This statistical test supports research question one because there are three outcome variables: critical thinking, metacognition, and motivation and one predictor variable: classroom format. Prior to the MANOVA, the data was screened, missing data was deleted because the number of missing cases was less than <5%, and there were no outliers.

MANOVA results revealed there was not a statistically significant difference in critical thinking, metacognition, and motivation based on classroom format, F (3,425) =1.353, p=0.257; Wilk's Λ = .991, partial $\eta 2$ = .009. Classroom format does not influence critical thinking, metacognition, and motivation. No follow-up test was completed due to the nonsignificant MANOVA results.

Intraclass correlation was used to estimate inter-rater reliability. Each construct for pre-test and post-test had moderate (between 0.5–0.75) reliability or overall a good (between 0.75–0.90) reliability (Koo & Li, 2016). Intraclass correlation (ICC) estimates and their 95% confident intervals were calculated using SPSS version 25 and were based on a mean rating (k=10), absolute agreement, two-way mixed effects model. A multilevel model was completed but do not yield different results. No follow-up test was completed because the ICC and multilevel model were the same (see Table 6–9).

Table 6 *Intraclass Correlation Critical Thinking Pre-test and Post-test*

	Intraclass Correlation	95% Confidence Interval		F Test With True Value 0			
		Lower Bound	Upper Bound	Value	*df1*	df2	Sig
Average measures	.612	.531	.679	2.580	428	42	<.001

Table 7 *Intraclass Correlation Metacognition Pre-test and Post-test*

	Intraclass Correlation	95% Confidence Interval		F Test With True Value 0			
		Lower Bound	Upper Bound	Value	*df1*	df2	Sig
Average measures	.721	.663	.769	3.587	428	428	<.001

Table 8 *Intraclass Correlation Motivation Pre-test and Post-test*

	Intraclass Correlation	95% Confidence Interval		F Test With True Value 0			
		Lower Bound	Upper Bound	Value	*df1*	df2	Sig
Average measures	.621	.542	.687	2.639	428	428	<.001

Table 9 *Intraclass Correlation Overall Pre-test and Post-test*

	Intraclass Correlation	95% Confidence Interval		F Test With True Value 0			
		Lower Bound	Upper Bound	Value	*df1*	df2	Sig
Average measures	.860	.831	.884	7.158	428	428	<.001

Research Question Two

The four flipped classroom instructors completed a semi-structured interview at the end of the semester. Below are the themes for questions three through nine of the semi-structured interviews (see Appendix G).

Table 10 *Themes for Limitations/Challenges of FCIM*

Themes	Number of Participant Responses
Teacher preparation	4
Student preparation	3
Student groups	2

Table 11 *Themes for Advantages of FCIM*

Themes	Number of Participant Responses
Flexibility	4
Fun	3
In-depth learning	4

Table 12 *Themes for Disadvantages of FCIM*

Themes	Number of Participant Responses
Teacher preparation	4
Student participation	3

Table 13 *Themes for Comparing Teaching in FCIM and Traditional Classroom*

Themes	Number of Participant Responses
Fun	3
Student/teacher interaction	2

Table 14 *Themes for Higher-Order Thinking in FCIM*

Theme	Number of Participant Responses
Improvement	4

Table 15 *Themes for Motivation in FCIM*

Theme	Number of Participant Responses
Improvement	2

Table 16 *Themes for Advice in FCIM*

Theme	Number of Participant Responses
Planning	4

The four summaries below provide flipped classroom educators' challenges and limitations of implementing a flipped classroom instructional model. No codes or categories were included due to the small sample size and the educator participants directly addressed research question two.

Educator A Interview Summary

Educator A is a biology instructor that has been implementing the flipped classroom instructional model for five and half years and has “flipped” Human Anatomy, Human Physiology, and General Biology. The instructor stated the limitations and challenges of implementing a flipped classroom as:

> There are two complete PREPS required for each class. You have to develop THINGS (worksheets, videos, readings, questions, quizzes, etc.) for students to DO so they GET THE INFORMATION in the first place. That is one entire prep and can be extremely time consuming to do it well. THEN you have to develop meaningful, challenging, and engaging THINGS to do during class time. This is another entire prep.

Educator A listed three advantages to “flipping”:

1. I can spend valuable class time (the only time students have access to ME) to target the misconceptions specific to the students in the class RIGHT NOW.
2. Students have the opportunity to really master valuable independent LEARNING strategies, and I have time to teach students strategies and skills for HOW TO LEARN. I can give more pep talks, which keep them GOING.
3. It is FUN. I feel like my time in my classroom is really valuable- and there is a very engaging and game-like environment.”

Educator A listed three disadvantages to “flipping”:

1. It is incredibly time intensive.

2. I have been flipping for almost 6 years and have yet to see it get “easier.” There is a constant pressure to update videos and activities, which means you don't ever really reach the mythical ‘easier’ stage, when you've got everything developed and now you can rest. At least I've not yet reached that stage.
3. It is really hard to ADJUST the course content. I use video lectures, so to change the course sequence (or fix errors) literally often will require a re-record of an entire set of videos, which is ridiculously time intensive. You get totally locked into your plan, which sort of sucks sometimes.

Educator B Interview Summary

Educator B is a biology instructor that has been implementing the flipped classroom instructional model for three years and has “flipped” Human Anatomy and Physiology II. The instructor stated, “overcoming student preconceptions about how a class should be run designing or finding good materials, both lecture materials for the students to view at home and activities for in class” as the limitation and/or challenges of implementing a flipped course. Advantages are “more effective practice for mastery of concepts, more time to spend on complex activities that develop high-level thinking and engages students in class.” For educator B, the disadvantage of “flipping” a course is, “It takes more work on the part of the instructor.”

Educator C Interview Summary

Educator C is a biology instructor that has been implementing the flipped classroom instructional model for three semesters and has “flipped” Human Anatomy and

Physiology I and II. The instructor stated the limitations and challenges of implementing a flipped classroom are:

> The large classroom size, the lecture-style stadium seating (difficult for group members to talk to each other sometimes), student expectations of the teacher lecturing/spoon-feeding them the material, if students don't come to class prepared, they may struggle greatly in the activity.

The three advantages are: “Students building bonds, friends, and study groups with other students (especially important since I teach a class with mostly freshmen), higher grades on exams, students learning how to learn.” The three disadvantages are: “Complaining from students, amount of preparation for instructor to finding/creating the perfect activity to promote learning and not waste time, placing responsibility for learning on students can be very difficult to do.”

Educator D Interview Summary

Educator D is a biology instructor that has been implementing the flipped classroom instructional model for three years and has “flipped” Human Anatomy and Physiology Lecture and Laboratory. The instructor stated the limitations and challenges of implementing a flipped classroom are: “It is extremely time-consuming at first. You have to precisely plan assignments and syllabi and record/edit hours of lecture material or interactive materials. Excellent video editing or lecture writing software is a must.” Three advantages are: “1) Flexibility 2) In-depth application of material to clinical scenarios 3) More fun during F2F class (not as dry as traditional anatomy lecture).” Three disadvantages are: “1) Making connections with students that I don't see three times a week. 2) Proving to some students that this is a great way to learn and might be more effective than a traditional lecture. 3) Reliance on online materials/websites that crash!"

Summary

This chapter covered a priority mixed method design, where quantitative data was prioritized. The quantitative data was collected using a non-random quasi-experimental design. Insignificant results were revealed from a MANOVA. The qualitative findings revealed the limitations/challenges of "flipping" a course are overcoming student misconceptions and preparation. The next chapter will include discussions and recommendations on the flipped classroom instructional model in higher education.

CHAPTER V – DISCUSSION

Introduction

In this chapter there will be a brief summary of the previous four chapters and a review of the purpose of study, the literature review, and statistical methodology. Key findings of this study will be presented and discussed according to current literature as well as the importance and significance of the key findings. Also, this chapter includes limitations of the study and recommendations and suggestions for further research.

Purpose of the Study

The purpose of this dissertation study is to examine and compare students' critical thinking, metacognition, and motivation in both a flipped classroom instructional model and a traditional classroom. Also, this study explored flipped classroom instructional model educators' opinions on limitations and challenges of implementing a flipped classroom instructional model in higher education. This area of research is important for the science field because it can expand knowledge about critical thinking, metacognition, and motivation in flipped and traditional classrooms as well as flipped pedagogies. In addition, this study is beneficial for educators interested in implementing a flipped classroom instructional model.

Summary of Literature Review

Many millennial students demonstrate a lower tolerance for traditional pedagogies, which they often view as boring and unentertaining. The challenge in higher education is how to keep students engaged and interested in the content. One possible solution is flipped learning, a term introduced in 2007 by Jonathan Bergman and Aaron Sams. In this format, lecture material is conveyed through short (10 minutes or less) videos, which are viewed by students outside of class. In class, students' complete "homework" assignments (Logan 2015).

Flipped learning is student-centered and supported by a constructivist approach, which is the foundation of the theoretical framework for this study. FCIM is the direct opposite of the "sage on the stage" or traditional lecture-based format. Flipped models focus on the four pillars of F-L-I-P which are F for flexible environments, L for learning culture, I for intentional content, and P for professional educators, each component of F-L-I-P will be explained below (The Four Pillars of F-L-I-P, 2014).

Firstly, flexibility is essential to any FCIM. Students are given the option to choose when and where they learn by having access to instructional videos that can be viewed at their convenience. They also have multiple ways to learn the content and demonstrate their level of mastery. Secondly, learning culture refers to creating an environment where the educator is not central, but the learner is. A FCIM class is dedicated to the learner having the time to construct their knowledge as they interact with the educator, peers, and the course content. Thirdly, intentional content is any method or material the educator uses during class to strengthen students' higher-order thinking skills. Commonly, intentional content is student-centered activities and active learning techniques. Fourthly, professional educators continuously observe, fills the gaps for students, and provides constructive feedback during class. FCIM professional educators alter intentional content based on students' mastery levels and can assess students' learning in real time.

The researcher draws on Piaget's theory of constructivism and Vygotsky's zone of proximal development; both are correlated with student-centered learning. Piaget's constructivism states learners must assimilate and accommodate to create new learning (Piaget, 1977). Learners assimilate by fitting information into a scheme while simultaneously accommodating the scheme to fit their experience. Typically, assimilation and accommodation are not isolated processes; however, in traditional lecture-based classrooms assimilation occurs in class and accommodation occurs while completing homework. On the other hand, in flipped learning assimilation occurs prior to class via 10-minute lecture videos or virtual interactive assignments, and accommodation occurs during class using active learning techniques.

Vygotsky's zone of proximal development differentiates what learners can learn on their own versus what they can learn with the help of instructors or peers (Vygotsky, 1978). Commonly, this process is called scaffolding or "filling the learner's gap." In a FCIM, scaffolding is completed during class when the educator and the students' peers are readily accessible to help the student learn what they cannot learn on their own. Whereas, in a traditional lecture-based format, students commonly do not have access to educators or peers unless the student visits the lecturer during office hours or arranges a study group with their peers.

Both theories require the learner to construct and actively engage in the learning process, which is the premise of flipped learning (Leo, 2017). Students construct knowledge and actively engage with material in the classroom while peers and instructors are available to assist. The focus of this study was to determine if flipped classroom instructional models are more effective than traditional classroom instruction.

Effectiveness was measured using three constructs: critical thinking, metacognition, and motivation. Two of the constructs (critical thinking and metacognition) are often described as higher-order thinking skills. Therefore, Bloom's taxonomy, a six-level hierarchical pyramid ranging from lower-order (remembering, understanding, and applying) to higher-order (analyzing, evaluating, and creating) thinking skills, supports this study's theoretical framework.

In a FCIM class time is used to help students reach higher levels of cognitive development. Lower-order thinking skills-knowledge and understanding are completed individually and outside of class. On the other hand, higher-order thinking skills such as critical thinking and problem solving are completed with the help of the educator and peers during class. Students that complete intentional content or in-class assignments at a high cognitive level, such as critical thinking and metacognition, in a FCIM are more successful than students that do not exhibit high cognitive levels (Rajprasath, Dinesh, & Gunasegaran, 2018).

Furthermore, for the FCIM to be effective, students should be motivated to actively engage in class. The self-determination theory (SDT) supports the researcher's theoretical framework. There are three dimensions to the SDT: competence, autonomy, and relatedness (Sergis, Sampson, & Pelliccione, 2018). All three dimensions are essential in flipped learning for students to excel because successful students are often self-determined and take responsibility for their own learning.

Firstly, competence is the student's ability to believe they can complete a task. FCIM is designed so that students' competence level is increased before they complete in-class assignments. For example, educators increase students' competence level by introducing course content via lecture videos before class, and students can develop their lower-order cognitive levels outside of class. The information is not new to the student when they arrive to class, hence they have already assimilated the course content and are ready to accommodate during the next class session. During class, the educator builds on the knowledge and understanding introduced in the lecture videos.

Secondly, autonomy is the student's ability to engage with the course material with independence. Both the instructor and the student contribute to autonomy in flipped learning. The instructor contributes by offering a flexible environment, a learning culture, and intentional content, three of the four pillars of F-L-I-P. Each pillar supports the student in the learning environment and enhances their ability to take responsibility and own their learning. The student contributes by engaging with tasks that are preferable to their learning preferences and style.

Thirdly, relatedness is the student's ability to collaborate and communicate with his/her instructor and peers. In a FCIM, collaboration and communication are the cornerstones of class time. During class the goal is to collaborate with the instructor and peers to complete active learning activities using higher cognitive levels.

In sum, flipped learning uses a constructivist approach, higher cognitive levels, and motivation. The focus of this study was to examine critical thinking, metacognition, and motivation, and to provide scientific research to promote educational pedagogies to enhance higher-order thinking and motivation in a student-centered environment.

Summary of Methodology

This study employed a quasi-experimental pre-test/post-test design using the Motivated Strategies for Learning Questionnaire (MSLQ) to determine the effectiveness of flipped classroom instructional models. In addition, a semi-structured flipped educator interview was used to determine the challenges and limitations of implanting a FCIM.

HAPS is a large organization of human anatomy and physiology science educators that teach a variety of science courses at the secondary and post-secondary levels. The researcher only recruited post-secondary science educators that teach 100- and 200-level science courses at colleges and universities within the United States. This study has two participant groups: educators, members of HAPS, and students, who are enrolled in a HAPS member's science course. The HAPS educators were provided instructions to inform their students of the pre-MSLQ and the post-MSLQ. Only flipped HAPS educators completed the semi-structured interview.

HAPS members were recruited at the annual HAPS Conference held annually in May at a different HAPS members' educational institution. Also, HAPS members were recruited via email. The researcher has contact information for each HAPS member from the membership database and an email chat used by HAPS members known as ListServ.

HAPS members were contacted via email two weeks before the semester began. Science educators that agreed to participate in this study were sent a Qualtrics link to complete the educator participant consent form and the classroom format questionnaire. The classroom format questionnaire was used by the researcher to determine if the educator used a traditional lecture-based format or a FCIM. Classroom format was classified based on usage of class time; if more than 75% of the class time was used for lecturing then the class format was traditional lecture-based, and if more than 75% of class time was used for active learning activities and techniques then the class format was flipped.

After the educator participant consent form and classroom format questionnaire were completed, the researcher sent each educator participant a flipped or traditional pre-

MSLQ questionnaire link for students to be posted in a Learning Management System (LMS) (e.g., Blackboard, Moodle, Canvas) during the first week of class. The researcher emailed each educator a flipped or traditional post- MSLQ questionnaire link eight weeks later for participants in the summer term or 12 weeks later for participants in the fall term. The email included instructions for the educator participant to post the questionnaire link two weeks before the end of the term in the educators' LMS. FCIM educators were contacted at the end of the term to complete a semi-structured interview to give their limitations and opinions on implementing a FCIM.

The two research questions for this study are (1) Are students' critical thinking, metacognition, and motivation impacted in a flipped classroom model compared to a traditional classroom and (2) What are educators' opinions on the limitations/challenges of implementing a flipped classroom model in higher education?

Summary of Major Findings

Respondents' Demographic Characteristics

This study was completed during Fall 2017, Summer 2018, and Fall 2018 semesters and members of HAPS were solicited to participate during each semester. A total of 14 educators agreed to participate in the study. The 14 educator participants were solicited to post the survey instrument link in their LMS at the beginning and end of the semester, and 10 of the 14 educator participants had students that completed the MSLQ. The MSLQ used a five-point Likert scale to measure the three dependent variables: critical thinking, metacognition, and motivation.

Over 600 student participants completed the pre-test or post-test; however, only 426 completed both the pre-test and post-test. The sample population was primarily female (84%), Caucasian (59%), and first or second year (59%) college students. Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics was used to describe the sample population, and MANOVA was used to analyze the independent variable-classroom format and dependent variables: critical thinking, metacognition, and motivation.

There were four flipped educators that completed an interview to discuss the limitations and challenges of implementing a flipped classroom instructional model. No content analysis was completed for the open-ended qualitative survey questions because the flipped instructors directly stated their challenges and limitations of implementing a flipped classroom.

Research Question One

There was not a statistically significant difference between the flipped and traditional classroom format hence students' critical thinking, metacognition, and motivation was not impacted by classroom format. An explanation for this result could be due to threats of validity.

Firstly, this study used a self-reported questionnaire. Social desirability may have been a factor. Students could have selected responses that they thought were the best answers without comparing the statement to their actual experience. Another factor may have been that students were informed that their responses were anonymous and confidential in the student participant consent form, however, they may have still thought their instructor would have access to their responses. Therefore, students may have not responded accurately.

Secondly, the researcher used intact groups, meaning the student participants were not randomly assigned by educational institution, educator, or classroom format. When participants are not randomly assigned there is a selection threat because the student participants are different such as educational institution and educational background.

Finally, mortality could explain the statistically insignificant results. As previously noted, there was high dropout rate between the pre-test and post-test for both the flipped and traditional classrooms.

The average for the critical thinking construct was lower when compared to metacognition and motivation. A possible explanation for the lower critical thinking average could be because there were four questions from the MSLQ used to measure critical thinking whereas there were 18 questions to measure metacognition and eight questions to measure motivation.

Prior research suggested that students' higher-order thinking skills, such as critical thinking and metacognition, improved in a FCIM (Winquist & Carlson, 2014). However, in this study there were only small differences in the pre-test and post-test means for critical thinking, metacognition, and motivation. These findings are supported by research completed in an animal physiology class. There was no effect on final exam questions after a flipped method was used compared to traditional lecturing (Judd, Orlando, & Balcom, 2017). On the other hand, when students from the animal physiology class were separated into treatment groups based on attendance, there was a higher exam performance for students that attended all of classes that utilized the flipped method. This suggests that if students are present to actively engage with the material during class then exam performance is better. Furthermore, this leads the researcher to believe more research on the FCIM is needed to make an informed decision on the effectiveness of flipped learning.

Research Question Two

Educators were asked to comment on the challenges and limitations of implementing a FCIM. The most common challenges were preparation time and overcoming student preconceptions about learning in higher education.

Flipping a class is very time consuming because educators must create and edit lecture videos as well as create active learning exercises to be completed during class. An educator stated that it takes three hours to complete a 15-minute lecture video compared to eight hours when she first started flipping her class. In addition, the type of room the class is held in can be a challenge. One educator stated, “lecture-style stadium seating” can be difficult for group members to talk to each other. Other challenges are students coming to class unprepared, getting students to interact with each other during class time, and group members that do not work well together. These challenges have been reported in prior research studies (Jaster, 2017).

According to the educator participants, students’ preconceptions about flipped learning must be overcome before flipped learning can be successful. Many students are comfortable with the traditional classroom format and expect all classes to be lecture based. These attitudes are similar to feedback given in prior research on students’ and teachers’ perceptions of flipped learning (Willis, 2014; Van Sickle, 2015). One educator stated, “On the first day of class I now take time to explain the benefits and the drawbacks (and how to lessen them!) of a flipped class. I seem to have more buy in from students after I started doing this."

Despite the challenges and limitations, these instructors prefer the FCIM over the traditional classroom format. One instructor reported:

> I can spend valuable class time (the only time students have access to me) to target the misconceptions specific to the students in the class right now. Students have the opportunity to really master valuable independent learning strategies and I have time to teach students strategies and skills for how to learn. I can give more pep talks, which keep them going. It is fun. I feel like my time in my classroom is really valuable and there is a very engaging and game-like environment."

Another instructor stated, "More effective practice for mastery of concepts, more time to spend on complex activities that develop high-level thinking" as reasons for implementing a flipped classroom. Other reasons from instructors include students building bonds, friends, and study groups with other students. Additionally, there were "higher grades on exams, students learning how to learn, flexibility, in-depth application of material to clinical scenarios; and more fun during face-to-face class". Also, there are more reasons for implementing a flipped classroom such as, "more time to address complex concepts in class since the basics were covered by videos viewed at home, more practice with critical thinking and skills addressed on the assessments, and the ability of students to review lecture material as many times as they like since they can pause and replay videos." Lastly, educators have stated that flipped learning is fun for both the lecturer and students and more relevant, interactive, and engaging. Flipped learning requires students to be more independent and increases their enthusiasm for learning.

One of the benefits of implementing a FCIM is to improve higher-order thinking skills. The flipped instructors' responses support Bloom's theory that instructors' interactions with students determine what students learn and how students feel about learning (Bloom, 1972). Instructors' also reported improved critical thinking and metacognition in the FCIM, which further supports the constructivism theory. One flipped instructor compared critical thinking test questions in her flipped and traditional classes and reported, "more correct answers were given from the flipped classroom students".

The fathers of constructivism (Dewey, Piaget, and Vygotsky) described learning as an active process where learners construct and reconstruct information to learn new concepts. All of the flipped instructors reported that the active learning activities completed during class improved student learning. Furthermore, these findings confirm the current literature that claims most educators adopt flipped learning in higher education to enhance their students' engagement and active learning (Chellapan, van der Meer, Pratt, & Wass, 2018).

As reported in chapter 2, several researchers studies do not report a significant difference between flipped and traditional students' exam scores (Fitzgerald & Li, 2015; Heitz, Prusakowski, Willis, & Franck, 2015; McLaughlin et al, 2014; Whillier & Lystad, 2015). Some of the common difficulties from previous studies such as student preparation and student complaints about the flipped format were similar to the disadvantages reported from the flipped classroom educators in this study. Despite the insignificant results as well as the limitations and challenges of implementing the FCIM, the flipped educators' support the FCIM. Lastly, the results from this study suggest that FCIM is not better but potentially as effective as traditional classroom formats.

Importance and Significance of Study

Previous studies primarily examined students' perceptions of flipped classroom instructional models and flipped learning in secondary environments. However, this study was one of the first to combine quantitative and qualitative measures to investigate the flipped classroom instructional model while comparing the flipped classroom instructional model and traditional classroom in higher education. This study also contributed to the existing literature related to FCIM.

The findings of this study suggest there are no significant differences in critical thinking, metacognition, and motivation in a FCIM and traditional classroom. This study may impact pedagogical decisions of undergraduate science courses. Results from this study are important for educators when designing college-level science courses and deciding between traditional or flipped pedagogy. Therefore, administrators and educators in higher education will be keen to accept both formats in the higher education learning environment.

Limitations of Study

The limitations of this study include convenience sampling, low number of participants, and measurement. Convenience sampling from HAPS membership database can be generalized to other science educators; however, it may not be generalized to other disciplines or all populations. HAPS members are a small number of educators when compared to the total number of educators in the United States. The convenience sample resulted in a threat to population validity, a type of external validity. The lack of population validity means the study is not entirely generalizable.

The second limitation of the study is the low number of educator and student participants in comparison to the large number of HAPS members. Only 14 HAPS members out of ~1,700 participated in the study, which resulted in a smaller educator and student participant sample size. The small sample size of educator and student participants is yet another threat to external validity.

The third limitation of the study is the number of measurements. The findings of my study are limited to the MSLQ, the only instrument used, to measure critical thinking, metacognition, and motivation in this study. As previously stated, critical thinking was lower than metacognition and motivation. Therefore, another instrument to measure the constructs, particularly critical thinking, would strengthen this study. Furthermore, the MSLQ may not be the best instrument to measure specific course content. The MSLQ was used to measure critical thinking, metacognition, and motivation on all course material, whereas it may be better to measure students' critical thinking, metacognition, and motivation by chapters or units. Other measurements such as unit test, midterm exam, and final exam scores plus the MSLQ would be useful and provide more evidence to determine the effectiveness of the FCIM.

Recommendations and Suggestions for Further Research

Recommendations and suggestions for further research are to (1) recruit educators that teach both formats (flipped and traditional); (2) identify the type of active learning exercises used in FCIM; (3) measure student preparation in FCIM; and (4) use uniform assessments in FCIM and traditional lecture-based formats.

Ideally, recruiting educators that teach classes in both FCIM and traditional classroom formats in the same term would increase reliability and validity. Threats to reliability and validity at the educator level were not explored during this study and would be useful for future studies. For example, one threat of reliability is educator error because there were 10 educator participants in this study who had students to complete the pre-test and post-test. Each educator has differences and their own interpretation of the researcher's instructions as well as their own definition of what a FCIM is and how they choose to implement the four pillars of F-L-I-P (flexibility, learning culture, intentional content, and professional educator). Another example of a threat to validity is a type of internal validity, experimental mortality. Many student participants did not complete both the pre-test and post-test. Some educator participants were better than others at convincing their students to complete both; if there is one educator teaching both formats there could be more control over experimental mortality.

Further research should investigate what type of active learning activities are used in the FCIM. In this study the researcher did not investigate active learning techniques used in the FCIM or traditional classroom. Different types of active learning techniques such as group discussion or peer instruction may improve critical thinking, metacognition, and motivation more than another type. Exploring active learning techniques in FCIM may be beneficial to supporting the effectiveness of flipped learning.

Student preparation is an imperative component of student success in FCIM. Unfortunately, if students do not complete lower-order cognitive levels before coming to class, they are not ready to delve into or accommodate higher-order cognition during class. Moreover, educators and peers are not able to assist with scaffolding if the student does not have knowledge or understanding of the content. A future study could have pre-quiz or pre-assessment for students to complete before coming to class to engage with active techniques. The benefits of a pre-quiz or pre-assessment are two-fold: it allows the educator to offer intentional content based on the students' mastery and it allows the educator to have a frequency or number of students that are ready for higher cognitive level activities. A FCIM can only be effective if students are utilizing class time to efficiently and actively engage with the course content.

Another suggestion is to implement the same assessments in both the FCIM and traditional classroom. The assessment can be implemented by using units or tests. Adding pre-assessments to create a baseline and post-assessments to units in a science course can improve this study. More information can be deemed from multiple assessments to support or not support the effectiveness of the FCIM.

Conclusion

This mixed method dissertation study examined undergraduate students' critical thinking, metacognition, and motivation in science courses using flipped and traditional instruction. The results yielded critical thinking, metacognition, and motivation were not statistically different based on the classroom format. A convenience sample was used, and students were not randomly assigned to classroom format.

This study contributes to the literature by examining quantitative and qualitative measures to assess the FCIM. There was a lack of mixed method studies and studies that reported the instructors' opinions on the FCIM. This study was distinctive because of the use of the MSLQ, large sample size, and participants from multiple states in the US. The results from this study are confirmed by results from similar researchers' findings such as increased engagement, performance, student satisfaction, and educator satisfaction. However, the previous findings did not report a change in exam scores or statistically significant results (Heitz, Prusakowski, Willis, & Franck, 2015; Jones, 2015; McLaughlin et al, 2014; Whillier & Lystad, 2015). Moreover, this study is a potential solution for millennial students and supports constructivism.

Future studies could randomly assign students to classroom format and have an educator teach both a flipped and traditional format to obtain valid results on students' critical thinking, metacognition, and motivation. Overall, because the results were similar for both formats, it is worthwhile to continue to investigate the effectiveness of flipped classroom instructional models.

APPENDIX A – Recruitment Form

Date: August 3, 2017

Dear Hapsters,

As a graduate student in the Department of Education Studies and Research at the University of Southern Mississippi, I am conducting research as part of the requirements for a Doctoral Degree in Education, and I am writing to invite you to participate in my study.

If you choose to participate, you will be asked to identify the format of your courses (traditional or flipped) and to provide a questionnaire link for a pre-test and post-test to your students. The pre-test link should be posted in your learning management system (Blackboard, Canvas, Moodle, etc.) during the 4th week of class and the post-test should be posted 2 weeks before the final exam. Educators that implement a flipped classroom will be asked to complete a 10–15-minute semi-structured interview at the end of the semester. Your participation will be confidential, and no personal, identifying information will be required.

To participate, please response to this email or email me at phyllis.brown@usm.edu so that I can note your approval to participate in this study. An informed consent document is attached to this email. The informed consent document contains additional information about my research. Please sign the informed consent document, scan, and return it to me at phyllis.brown@usm.edu to indicate that you have read it and would like to take part in the study.

Phyllis Brown MS, MPH

APPENDIX B – IRB Approval Letter

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 17071001
PROJECT TITLE: Assessing Critical Thinking, Metacognition, and Motivation in a Flipped Classroom Instructional Model
PROJECT TYPE: New Project
RESEARCHER(S): Phyllis Brown
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Educational Research and Administration
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 07/17/2017 to 07/16/2018
Lawrence A. Hosman, Ph.D.
Institutional Review Board

APPENDIX C – Educator Consent Form

"Assessing Critical Thinking, Metacognition, and Motivation in a Flipped Classroom Instructional Model"

Phyllis Brown, Principal Investigator

University of Southern Mississippi

College of Education

This study is being conducted by Phyllis Brown, a student in the Department of Educational Studies and Research.

Background information:

The purpose of this study is to assess critical thinking, metacognition, and motivation in a traditional classroom and a flipped classroom. The study will be a non-equivalent pre/post-test design that will take approximately eight to ten weeks. Data will be collected 4–6 weeks after the start (pre-test) of the semester and 2 weeks before the final exam (post-test).

Procedures:

Flipped educators will spend class time actively engaging students by completing homework, group discussions, and/or guided inquiry learning activities. Students will complete activities with the educator and their peers. Any activity is acceptable that will encourage higher-order thinking skills. Flipped educators will provide pre-recorded lectures for students on their learning management system that will be accessed before class. Traditional educators will spend class time lecturing and all homework assignments will be completed outside of class. In a traditional classroom, students will listen lectures and other guided instruction from the educator and take notes.

Risks and benefits of being in the study:

There are minimal risks associated with this study. The risks are no more than the participants would encounter in everyday life. There are no direct benefits to participation in this study.

Compensation:

Educators will be entered in a drawing for a $50 Amazon gift card. There will be two drawings for students: one for the pre-test and one for the post-test. Student participants will be eligible to win a $25 Amazon gift card for each drawing.

Confidentiality:

The records of this study will be kept private. In any sort of report, I might publish, I will not include any information that will make it possible to identify a participant. Research records will be stored securely in the researcher's office for a period of five years.

Voluntary nature of the study:

Please be aware that this is a voluntary study and you may withdraw at any time.

Contacts and questions:

The researcher conducting this study is Phyllis Brown. You may ask questions at any time by email phyllis.brown@usm.edu or phone 601.467.8002.

If you have any questions or concerns regarding this study and would like to speak with someone other than the researcher, you are encouraged to contact the Institutional Review Board 118 College Drive #5417, Hattiesburg, MS 39406–0001or email at irb@usm.edu.

Please sign your consent with full knowledge of the nature and purpose of the procedures. Please save a copy of this consent form for your records.

Statement of Consent:

I have read and understood the above information. The researcher has addressed any questions that I have, and I consent to participate in the study.

Signature of Participant: ________________________________

Signature of Investigator: _______________________________

Phyllis Brown MS MPH, Researcher

Researcher Contact Information: Phyllis Brown

Phyllis.brown@usm.edu

601.467.8002

The University of Southern Mississippi Contact Information: Institutional Review Board

118 College Drive #5417

Hattiesburg, MS 39406–0001

Email: irb@usm.edu

APPENDIX D – Educator Classroom Format Questionnaire

The following items address how educators spend class time. Please write a percentage for class time (0–100%) and circle the best answer (a.-d.) where indicated. Please note class time does not have to add up to a 100% and class time represents one term or semester of a course.

1. During class, how much time is spent on direct instruction or lecturing?				
2. During class, how much time is spent directly interacting with students such as facilitating peer instruction, group work, and/or active learning activities?				
3. During class, how much time are students allowed to engage in meaningful activities during class without you being central?				
4. During class, how much time is spent on guided practice such as reflection, discussions, discovery differentiated learning, research and/or application activities?				
5. During class, how much time is spent providing student feedback?				
6. During class, how much time is spent working with students individually?				
7. During class, how much time do students spend working together in groups?				
8. During class, how much time do students spend on POGIL (process guided inquiry learning), PBL (problem-based learning), and/or team-based learning?				
9. Which flipped model do you use for your courses?	a. “Traditional”	b. Mastery Learning	c. Neither	d. Other

10. Where do students' complete homework assignments?	a. Home	b. Class	c. Both	d. Other
11. Are short videos provided for students to watch at home to replace direct instruction?	a. Yes	b. No		
12. If you answered yes to question 11, which of the following are students required to complete while viewing short videos at home?	a. Cornell Notes System	b. WSQ (watch, sum-marize, & question) technique	c. Goo-gle Forms	d. Other
13. If you answered yes to question 11, are students required to bring questions to class after viewing the short video at home?	a. Yes	b. No		
14. If you answered yes to question 11, are short videos viewed at home discussed during the next class meeting?	a. Yes	b. No		
15. If you answered yes to question 14, during class, how much time do you allow students to engage in active learning activities related to the short video viewed at home?				

Thank you for your participation!

APPENDIX E – Student Consent Form

"Assessing Critical Thinking, Metacognition, and Motivation in a Flipped Classroom Instructional Model"

Phyllis Brown, Principal Investigator

University of Southern Mississippi

College of Education

Your instructor is participating in a study about college teaching and learning. I, Phyllis Brown, a doctoral student, studying at the University of Southern Mississippi would like to ask for your participation in the study. As part of the study, over the course of the semester you will be asked to fill out two questionnaires related to your motivation and learning in this class. If you participate, you will eligible to win a $25 Amazon gift card. YOUR PARTICIPATION IS VOLUNTARY AND NOT RELATED IN ANY WAY TO YOUR GRADE IN THIS CLASS. You may decide to participate now, but you can withdraw from the study at any time during the semester with no penalty. All your responses are strictly confidential and only members of the research team will see your individual responses. Your instructors will not have access to your responses.

The attached questionnaire asks you about your motivation and learning skills for work in this course. THERE ARE NO RIGHT OR WRONG ANSWERS TO THIS QUESTIONNAIRE. THIS IS NOT A TEST. I want you to respond to the questionnaire as accurately as possible, reflecting your own attitudes and behaviors in this course. Questions concerning this study should be directed to me at phyllis.brown@usm.edu.

Please sign below if you would like to be involved in this study. Thank you for your cooperation.

Name (Print) ____

Signature____

Instructor's Name____

Today's Date____

APPENDIX F – Student Instrument

Pre-test/Post-test

Demographic Information					
a. Gender (circle one)	Male	Female			
b. Class Level (circle one)	Freshman	Sophomore	Junior	Senior	5th yr. Senior
c. Ethnic Background (circle one)	African American or Black	Asian	Caucas-ian	Hispanic	Other
d. Major					
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. In a class like this, I prefer course material that really challenges me, so I can learn new things.					
2. In a class like this, I prefer course material that arouses my curiosity, even if it is difficult to learn.					
3. The most satisfying thing for me in this course is trying to understand the content as thoroughly as possible.					

4. When I have the opportunity in this class, I choose course assignments that I can learn from even if they do not guarantee a good grade.					
5. Getting a good grade in this class is the most satisfying thing for me right now.					
6. The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.					
7. If I can, I want to get better grades in this class than most of the other students.					
8. I want to do well in this class because it is important to show my ability to my family, friends, employer, or others.					

9. When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.					
10. I try to relate ideas in this subject to those in other courses whenever possible.					
11. When reading for this class, I try to relate the materials to what I already know.					
12. When I study for this course, I write brief summaries of the main ideas from the readings and the concepts from the lectures.					
13. I try to understand the materials in this class by making connections between the readings and the concepts from the lectures.					
14. I try to apply ideas from course readings in other class activities such as lecture and discussion.					

15. I often find myself questioning things I hear or read in this course to decide if I find them convincing.					
16. When a theory, interpretation, or conclusion is presented in class or in the readings, I try to decide if there is good supporting evidence.					
17. I treat the course material as a starting point and try to develop my own ideas about it.					
18. I try to play around with ideas of my own related to what I am learning in this course.					
19. Whenever I read or hear an assertion or conclusion in this class, I think about possible alternatives.					
20. During class time I often miss important points because I am thinking of other things.					
21. When reading for this course, I make up questions to help focus my reading.					

22. When I become confused about something I am reading for this class, I go back and try to figure it out.					
23. If course materials are difficult to understand, I change the way I read the material.					
24. Before I study new course materials thoroughly, I often skim it to see how it is organized.					
25. I ask myself questions to make sure I understand the material I have been studying in this class.					
26. I try to change the way I study to fit the course requirements and instructor's teaching style.					
27. I often find that I have been reading for class but do not know what it was all about.					
28. I try to think through a topic and decide what I am supposed to learn					

from it rather than just reading it over when studying.					
29. When studying for this course I try to determine which concepts I do not understand well.					
30. When I study for this class, I set goals for myself to direct my activities in each study period.					
31. If I get confused taking notes in class, I make sure I sort it out afterwards.					

APPENDIX G – Educator Open-Ended Interview Questions

1. How long have you been flipping your class(es)?
2. What courses have you flipped?
3. What are the limitations/challenges of implementing a flipped course?
4. What are three advantages of flipping a course?
5. What are three disadvantages of flipping a course?
6. How would you compare teaching in a flipped classroom to teaching in a traditional classroom?
7. What are your thoughts on student’s higher-order thinking skills (critical thinking and meta cognition) in a flipped vs. a traditional classroom
8. What are student’s motivation level in a flipped classroom compared to a traditional classroom?
9. What advice would you give educators interested in flipping a course?
10. Is there anything else you would like to add about learning and/or challenges in a flipped classroom?

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