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Resolving The Problem Of Student Disengagement: Flipped Instruction In A Community College Computer Science Course

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Dedication

This dissertation is dedicated to my family who has supported me throughout the long process of completing my postgraduate studies and research. Without their support, I could not have accomplished my dream. It is also dedicated to the many teachers I have had during my life, who have taught, encouraged, and assisted me. Being an educator can sometimes feel like a thankless career, but without many talented teachers in my life, I would not have had the confidence or underlying knowledge to pursue this degree.

Abstract

The mixed methods action research study described focused on the problem of student disengagement in an introductory computer science classroom at a community college. The problem of practice led to the development of the following research question: What is the impact of the flipped classroom on the academic performance and perceptions of community college students? A quasi-experimental design, using one group of students experiencing both a control and treatment, was implemented to investigate the research question. One half of a computer concept unit was taught using the transmission method of learning while the second half was taught using the flipped method of instruction. The transmission method incorporated instruction traditionally found in higher education, including lecture and passive learning techniques. The flipped learning method included video lessons viewed outside of class and active learning strategies employed during class time. The results of both pre-tests and post-tests were used to determine if the flipped environment affected student academic performance. In addition, a short survey and student journals were employed to determine students' overall perceptions of both teaching methodologies. On the whole, students saw more academic growth during the flipped half of the instructional unit, but their perceptions of the teaching method were not as favorable.

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Chapter One: Introduction

Background

On a stroll through the hallways of a contemporary college campus one will see students sitting in classes almost exactly as they have for decades: chairs or tables facing the front, notebooks out on the desk for note-taking, and a teacher standing at the front of the room lecturing. The lecture method is still one of the most widely used instructional methods in higher education (Bonwell & Eison, 1991; Eagan et al., 2014). With all the technological changes and the vast amount of research conducted on education techniques, one might wonder why the 21^{st}-century higher education learning environment continues to resemble scenes from the mid-20^{th} century classroom.

The transmission paradigm views the teacher as the primary source of knowledge who instructs passively listening students (Kivunja, 2014). Despite recommendations against this type of learning environment issued by Chickering and Gamson (1987) decades ago, researchers still find that many instructors in higher education regularly utilize passive learning techniques (Bonwell & Eison, 1991). This model of teaching and learning persists as higher educators seek to maintain tradition (Heyborne & Perrett, 2016) and alleviate their anxiety related to change (Bonwell & Eison, 1991). Many of the instructors in higher education were taught using passive teaching methodologies and, as a result, are most comfortable using them because they believe they can cover more material while maintaining control of the flow of information (Bonwell & Eison, 1991). Unfortunately, passive methodologies have been proven to cause students to tune out periodically while they listen to the professor (Bonwell & Eison, 1991). Freeman et al. (2014) conducted a metaanalysis of 225 studies and found that students in courses using active learning over lecture performed better. The researchers also found that students in traditional lecture courses were one and a half times more likely to fail the course. While the lecture method is prevalent, it does not garner the results many professors would like to see in terms of student learning. In fact, studies show that “the exclusive use of lecture in the classroom constrains students’ learning” (Bonwell & Eison, 1991, p. 24).

Schuster and Finkelstein (2006) stated, “in the near-millennium history of the academic profession, there has never been a time in which change is occurring so rapidly” (p. 51). Although change has occurred rapidly in society, Schuster and Finkelstein asserted that little has transformed in colleges and universities. Change in the classroom is necessary as higher education seeks to serve students from a diverse array of backgrounds and students from a new generation who have different traits than their predecessors.

According to Spring (2014), the population of the United States in 1830 was 81.9% White and 18.1% Black. Adams and Joshi (2013) stated that our national identity in the early 1800’s was rooted in our skin color and religion. The desire to keep America a White, Christian nation led to the United States government passing immigration policies during the 19th and 20th centuries designed to keep people of color and certain religions out of the country (Adams & Joshi, 2013). However policies shifted with the passage of the 1952 McCarran-Walter Act and the Immigration and Naturalization Act of 1965 as immigrants, previously not welcome, were given the opportunity to come to America (Adams & Joshi, 2013). As a result of this policy change, Spring (2014) stated that more immigrants began coming to the United States from Mexico, Central America, and Asia. Adams and Joshi (2013) reported that by 2000 there were 55 million immigrants and second-generation Americans in the U.S.

The U.S. Department of Education (2018) reported that by fall 2016, approximately 16.9 million students were pursuing an undergraduate education in the U.S.. Of that total reported by the U.S. Department of Education (2018), 53.8% were White, 18.9% were Hispanic, 13% were Black, 6.5% were Asian or Pacific Islander, and the remaining population was comprised of American Indians and Alaskan Natives. The U.S. Department of Education (2018) also reported that between 2000 and 2016 the postsecondary enrollment of Hispanics more than doubled, while the enrollment of Black students increased 73%. This is clear evidence that the postsecondary education population in the U.S. is dramatically changing and becoming more diverse.

With a more diverse student population, one might expect faculty in higher education to have become more diverse as a result. In fact, despite a more diverse population of students graduating with advanced degrees, higher education faculty has yet to reflect this increase (Kezar & Sam, 2010). While higher education faculty are slowly becoming more diverse, Kezar and Sam (2010) note that over 80% of faculty continue to be White. More recent statistics from the U.S. Department of Education (2018) also support this finding. During the fall of 2016 amongst full-time faculty at degree-granting institutions, 41% were White males, 35% were White females, 6% were Asian males, 6% were Asian females, 3% were Black males, 3% were Black females, 3% were Hispanic males, 2% were Hispanic females, and the remaining percentage were

Asian or Pacific Islander males and females combined (U.S. Department of Education, 2018).

Another factor creating this disjuncture between today's learners and higher education professors could be generational differences. The millennial generation of students, students born between 1982 and 2004, expect their instructors to engage them in the classroom and to utilize technology effectively to teach (O'Flaherty, Phillips, Karanicolas, Snelling, & Winning, 2015). Millennials are comfortable utilizing technological devices as learning tools (Espinoza, 2012; Worley, 2011) and are often dismayed when their college classrooms resemble something their parents and grandparents experienced in the previous century.

Millennials are a large generation who highly value education. Jaffe (2013) reported that college enrollment jumped 38% between 1999 and 2009. Moreover, the number of undergraduates is expected to rise to 17.4 million students by 2027 (U.S. Department of Education, 2018). If these statistics hold true, then the millennial generation and those coming after it are set to become the most educated generations in American history. According to Worley (2011), millennials are smarter than previous generations largely due to the quick access to information always available on technological devices as well as having an increased focus on academics during their formative years. This generation is confident (Hosek & Titsworth, 2016; McAllum, 2016; Worley, 2011), grade motivated (Bucker & Strawser, 2016; McAllum, 2016; Worley, 2011), great at multi-tasking (Worley, 2011), accepting of diversity (Worley, 2011), has strong ties to their parents (Hosek & Titsworth, 2016; Worley, 2011), and are exceptionally social (Worley, 2011).

Like all generations, they have challenges too. Millennials tend to have academic entitlement (Buckner & Strawser, 2016). This entitlement causes the generation to be highly motivated to succeed in college, but places most of the burden for that success in the laps of their teachers, not themselves (Buckner & Strawser, 2016; Goldman & Martin, 2016). Some of their entitlement issues spurn from high parent expectations (Worley, 2011). The generation is also described as facing choice paralysis because they tend to jump from idea to idea or job to job (Worley, 2011). Some of this lack of decisiveness is a result of deep-seated insecurity in their ability to succeed causing them to give up rather than take risks (McAllum, 2016). Connected to this is their struggle to manage open-ended tasks and make decisions (Buckner & Strawser, 2016). Worley (2011) points out that not all characteristics linked to a generation are representative of everyone within the generation. It is, therefore, important to note that not all millennials may have all these characteristics. However, understanding the generation one is teaching can be extremely beneficial and enable the instructor to enhance their learning experience (Worley, 2011).

Currently, more than 40% of higher education faculty are from the baby boomer generation (Worley, 2011). Worley (2011) states, “There is a significant difference in the life experiences, expectations, and technological expertise of many faculty and the students they are to teach” (p. 31). Hosek and Titsworth (2016) note that baby boomer professors teaching millennial students may feel vulnerable but encouraged them to take risks in the classroom to connect with millennials. In recent years, higher education has “been criticized for not adapting fast enough to the demands of a changing world and for not improving our pedagogical practices with the support of new technologies” (Granados-Bezi, 2015, p. 60). Worley (2011) points out that millennials are often easily bored with the traditional methods of teaching within higher education and encouraged teachers to shift the focus from teaching to learning.

While the lecture method worked for some students in the past, today's students, in particular community college students, require a variety of pedagogical experiences. A century ago, famed educator John Dewey (1938) proposed that educators must go further to deliver quality educational experiences for all students, not just for the few who may enjoy the traditional class lecture. Providing an engaging environment, rich with a variety of situations that allow the modern college student to transfer facts and apply them to real-world experiences, will avoid what Dewey describes as "mental truancy" (p. 46). This mental truancy thrives in passive learning environments where students are required to do little beyond exist in the classroom.

More active and cooperative learning may be the key to creating more engaging learning environments for today's college students. The National Research Council (2000) noted that a key characteristic of a quality-learning environment is a learner-centered classroom where learners are engaged in challenging collaborative activities. The National Research Council (2000) values the use of active and metacognitive learning strategies to help students recognize their own understanding of concepts and when they need additional help. Worley (2011) suggests that millennials be engaged in cooperative learning opportunities, which maximizes their social tendencies. In addition, Worley encourages professors to connect learning to real-world situations, infuse technology into the learning environment, keep students visually stimulated, provide constructive feedback, and incorporate inquiry-based learning. Instead, it seems that some higher educators are deep in the ruts of tradition, caught up in what worked when they went to college, rather than what is proven effective for students.

In addition, today's college educators must be reflective, rather than robotic. Exploring the effects of one's teaching methodologies is part of the reflective process of teaching and allows the educator to make classroom changes in a systematic way (Mertler, 2014). Reflective educators are those "who constantly and systematically reflect on their actions and the consequences of those actions" (Mertler, 2014, p. 23). Dewey (1938) states that it is easier to walk a path that is familiar and well worn. An effective classroom teacher never ceases to stop learning and continually explores new ways to connect with and engage all types of learners (Mertler, 2014). It is time instructors in higher education seek to be more efficient and transform into reflective educators striving for quality in the classroom (Granados-Bezi, 2015). To be more reflective and adaptive, higher educators must conduct more action research in their classrooms and experiment with different teaching methodologies. The entire process of identifying a problem, gathering data, making sense of data, and finally reacting to the results with an action plan allows an educator to participate actively in the ever-changing classroom environment and to grow professionally (Mertler, 2014).

This dissertation in practice (DP) sought to explore the ways in which a community college classroom could be structured so that reflective teaching practices are utilized to improve the educational experiences of a growing diverse body of students in a computer science classroom. Action research methods were used in the DP to determine the ways in which the pedagogical practices used in a computer science classroom at a community college could impact student scholarly activity to investigate the following research question: What is the impact of the flipped classroom on the academic performance and perceptions of community college students?

Statement of the Problem

The identified problem of practice (PoP) involved a flipped classroom and changes in pedagogy in a higher education introductory computer science course. The researcher was an instructor at a community college where pedagogical practice typically revolved around passive learning approaches. Over a four-year period, evidence showed that the millennial students the researcher followed were not responding to the lecture method of instruction. As a result, the investigator sought to implement flipped instruction to encourage cooperative learning and incorporate more active learning strategies in my pedagogy.

The flipped classroom is an innovative approach to teaching and learning popularized by and credited to two science teachers, Jon Bergmann and Aaron Sams, who were frustrated with students' lack of comprehension and inability to complete homework outside of class (Bergmann & Sams, 2012). They observed that their classrooms represented assembly lines from the Industrial Revolution presenting curriculum in an efficient way that produced students excellent at playing school but not actively engaging with the material (Bergmann & Sams, 2012). While the use of the flipped classroom has become popular in recent years, no single model or definition exists to define the concept (Bergmann & Sams, 2012; O'Flaherty et al., 2015). According to Bergmann and Sams (2012):

> There is no such thing as *the* flipped classroom. There is no specific methodology to be replicated, no checklist to follow that leads to guaranteed results. Flipping

the classroom is more about a mindset: Redirecting attention away from the teacher and putting attention on the learner and the learning. (p. 11)

As illustrated in Figure 1.1, the basic concept Bergmann and Sams (2012) popularized requires the teacher to swap what is normally done during class to the student's own time at home and move what is normally done at home back to the classroom. Flipped classrooms give time in class for students to dig deep into the material instead of spending the entire class listening to the instructor dictating facts and information (Heyborne & Perrett, 2016). Bergmann and Sams (2012) incorporated blended learning into their flipped classroom methodology with the use of video content and personal devices.

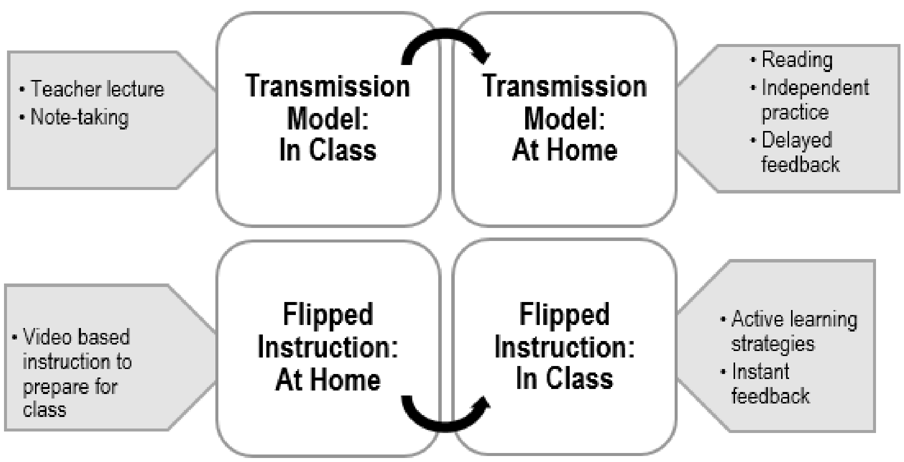

Figure 1.1 Comparison of Transmission Model to Flipped Instruction. With flipped instruction the focus of the classroom becomes student centered, rather than teacher centered.

Due to the reemergence of this model reinvigorated with a technological twist, some researchers have conducted studies examining the use of flipped classrooms, but "relatively few studies exist comparing flipped and nonflipped courses using an experimental or quasi-experimental approach" (Heyborne & Perrett, 2016, p. 31). While existing standards in higher education already require students to spend substantial time preparing for class through outside reading and writing assignments, the flipped classroom seeks to solve the issue of low student motivation by developing student competence, autonomy, and relatedness (Abeysekera & Dawson, 2015).

The benefits of this learning methodology include student ownership for learning, better student engagement during class, the ability for students to learn at their own pace with greater flexibility, and the use of class time for active learning (O'Flaherty et al., 2015). This teaching model "has the potential to enable teachers to cultivate critical and independent thought in their studies, building the capacity for lifelong learning and thus preparing future graduates for their workplace contexts" (O'Flaherty et al., 2015, p. 94). Some researchers have established a connection between the flipped model and higher academic achievement in the postsecondary setting (Crisafulli, 2015; Davies, Dean, & Ball, 2013; Peterson, 2016, Sahin, Cavlazoglu, & Zeytuncu, 2015; Trogden, 2015). Researchers have also found that students have better perceptions of the flipped model when compared to the traditional lecture setting (Brewley, Boindala, & Sinclair, 2015; Grimsley, 2015; Love, Hodge, Corritore, & Ernst, 2015; Peterson, 2016; Strayer, 2012).

Although many benefits have been associated with this instructional model, researchers conclude that the flipped method requires a significant time investment to create video content and in-class active learning activities (Gardner, 2015; Peterson, 2016). Another major hurdle to overcome when implementing this method are students who prefer passive learning strategies, such as a lecture (Gardner, 2015; Peterson, 2016). These students will resist instructional changes and must be educated on the first day of class by demonstrating how the flipped method can benefit them (Gardner, 2015).

Despite the challenges, “research demonstrates that the benefits outweigh the cost” (Crisafulli, 2015, p. 52).

Many of the community college students in the teacher practitioner’s classroom come from high-performing local high schools with skilled teachers who employ various teaching methodologies. When students arrive in a college classroom and discover that their instructor primarily seeks to talk to them for an hour, assign chapters out of a textbook to read, and give exams, it can cause quite a bit of frustration. The focus of the past has been on delivering quality instruction, but Worley (2011) stated, “The purpose of education is to produce learning, not deliver instruction” (p. 31). Technology can be harnessed to motivate students and promote inquiry and engagement (Crisafulli, 2015). Learning new technologies, just like learning new teaching methodologies, can be uncomfortable. Espinoza (2012) said “It is the people with the most responsibility who have to adapt first” (p. 30). With that in mind, the researcher sought to investigate new teaching methods incorporating technology to better engage her students. Specifically, the researcher incorporated flipped instruction into computer science courses to diversify instructional pedagogy and connect with millennials.

Purpose Statement

The overarching purpose of this research study was to investigate the effectiveness of flipped classrooms on the academic performance and perceptions of students enrolled in an introductory computer science course at the research site. While studies on the flipped classroom methodology have been conducted, few have conclusively proven that this method leads to greater academic achievement or improved skills such as critical thinking (O’Flaherty et al., 2015). The secondary purpose of this study was to infuse more technology into the researcher's classroom to better engage today's college learner. This is part of the modern flipped instructional approach.

Research Question

In an effort to deviate from the norm of the transmission model used in community college classrooms and to offer my students a more engaging classroom environment, I explored the impact of the flipped model of teaching on the achievement and perceptions of students in my computer science classroom. The following research question (RQ) guided the study: What is the impact of the flipped classroom on the academic performance and perceptions of community college students?

Assumptions, Limitations, and Delimitations

Assumptions. It was assumed, prior to the study, that the students would willingly participate. Students were able to drop out of the study at any time, although none chose to do so. It was further assumed that a diverse mix of participants from various backgrounds and with varying levels of technological skill would participate in the study. This is because students self-enroll in the course section without having any knowledge of the study. In addition, it was anticipated that students would put forth the same amount of effort, both in and out of class, as would normally be given had the study not taken place. During instruction in the classroom, it was supposed that when active learning activities were taking place, students would actively participate and stay engaged. It was also assumed that students would take ownership of their learning by watching the assigned videos during the flipped instruction treatment. Finally, it was assumed that all students had the capability to read test questions to take pretests and posttests. No students in the sample required testing assistance through the site's testing center.

Limitations. The present study was a quasi-experimental study, which according to Mertler (2014) means there is no random assignment used to select study participants. In addition, study participants were limited to the students attending a community college in the Midwest, which does not represent the student population across the United States. This is an obvious limitation of the study because results cannot be generalized to the larger student population enrolled in all higher education institutions (Mertler, 2014). Since the researcher intended to use the results of the study to make modifications to only her personal teaching methodology, the lack of generalizability is of no concern. Likewise, the researcher realized that the results of the study are applicable only in the context of the computer concepts unit within the researcher's computer concepts and applications course. Results may not be the same in other courses taught within other units.

There is the possibility of an implementation threat due to the researcher being the sole conductor of the research study (Fraenkel, Wallen, & Hyun, 2015). This can occur in the form of a personal bias toward the flipped instruction methodology. To reduce any potential bias, the researcher never stated any personal opinions of either learning approach in front of students as this could have influenced their own perceptions. If students made comments during the study about a particular method being used, the researcher avoided validating or discrediting their personal opinion with the researcher's in an effort to avoid influencing the personal opinions of the students regarding methods. Furthermore, the researcher collected notes in a teacher journal about the actions of students during class. The researcher avoided making conclusions about their behavior until the completion of the data analysis process.

Delimitations. The data collected in the present study are from one section of a computer concepts and applications course taught at a community college and, as a result, may not compare to other results in different higher education contexts. The study's participants were limited to freshmen and sophomores who self-enrolled in this required course for an associate's degree. It is the student's schedule preferences that heavily dictated which students enrolled in the section were selected for the study.

Theoretical Framework

According to Butin (2010), there are three key theoretical perspectives that shape the way educators view educational research. Post-positivism assumes that reality is objective and can be studied, measured, and explained (Butin, 2010). Butin states that this theory believes the right answer, best practice, or optimal outcome can be found through scientific study. Butin also describes interpretivism as a theory that holds the truth is socially constructed through the diverse cultural lens of society. Critical theory, according to Butin, is the most modern theory that seeks to examine the relationship between power and truth. The researcher's ideas mainly aligned with the post-positivist theory of education. This stance led the researcher to a study question that seeks to determine if a methodology affects student achievement and, therefore, could become a best practice in the researcher's own classroom.

Behaviorism. According to Ertmer and Newby (2013), the behaviorist view of learning is that "learning is accomplished when a proper response is demonstrated following the presentation of a specific environmental stimulus" (p. 48). This theory puts emphasis on environmental factors impacting student learning (Ertmer & Newby, 2013; Kivunja, 2014). One of the prominent theorists associated with behaviorism was B. F. Skinner who developed the operant conditioning theory. This theory explained the conditions needed for students to develop complex behaviors (as cited in Gredler, 2009, p. 102). Skinner believed that learning equated to behavioral change in a student and was related to the environment (as cited in Gredler, 2009, p. 136). Skinner can also be considered an innovator regarding the use of technology for instructional purposes. He advocated for the use of teaching machines to provide reinforcement as students were developing a skill (as cited in Gredler, 2009, p. 16). While these teaching machines did not last, Skinner viewed the use of computers as excellent sources of feedback to students as they developed a skill, but he warned teachers to avoid programs that only offer entertainment without a learning experience (as cited in Gredler, 2009, p. 125). While personal computers were still new and not widely available at the height of Skinner's research, he was able to foresee their educational value.

Another learning theorist associated with behaviorism is Robert Gagne who asserted that learning builds upon prior learning to develop complex skills (as cited in Gredler, 2009, p. 143). Gagne identified five types of learning: verbal information, intellectual skills, cognitive skills, motor skills, and attitudes (as cited in Gredler, 2009, p. 147). In addition, Gagne posited nine instructional events across three phases that described how to prepare students for learning, how to offer guidance to students during learning, and how to assess a student's ability to apply their learning (as cited in Gredler, 2009, p. 154). Gagne believed learning should be individualized for students to account for their readiness, differences, and motivation (as cited in Gredler, 2009, p. 174). In addition, planning effective classroom instruction was a major goal of Gagne’s theory, as he believed the classroom teacher should clearly state objectives, determine required prerequisite skills, and then select instructional activities for each objective (as cited in Gredler, 2009, p. 178). Gagne also originated the idea that curriculum should be designed from simple to complex while respecting the diversity of all learners (as cited in Gredler, 2009, p. 183).

Behaviorism still has an impact on modern educators as strategies from this theory can still be seen in the classroom today. According to Ertmer and Newby (2013), behaviorism resulted in the push for producing measurable outcomes in student achievement, the use of preassessment to determine what students already know, the sequencing of curriculum and instruction from easy to complex concepts, and the use of feedback and reinforcement to impact student performance. Behaviorists believe that the role of the teacher is to choose the best cues to produce the desired outcome in students and to furnish environmental conditions that allow students to receive practice with concepts and get reinforcement (Ertmer & Newby, 2013).

Cognitivism and constructivism. Hewitt (2006) identifies cognitive theories as a group of theories that include cognitivism and constructivism. According to Ertmer and Newby (2013), constructivism is a branch of cognitivism. Gredler (2009) contrasts the cognitive theories with prior theories, such as behaviorism, by stating, “cognitive-development perspectives do not address the acquisition of knowledge or specific skills. Instead, they focus on the formation of the highest levels of human thinking, describing the events and conditions necessary to attain these levels” (p. 269).

Ertmer and Newby (2013) explain that the cognitivist theory focuses more on what students know and how they come to know it. In addition, cognitivism views the learner as an active part of the learning process, rather than a passive recipient of information (Ertmer & Newby, 2013). According to Ertmer and Newby (2013), "the real focus of the cognitive approach is on changing the learner by encouraging him/her to use appropriate learning strategies" (p. 52). The goal is to make learning meaningful and enable learners to organize new concepts and information as they connect it to what they already know (Ertmer & Newby, 2013). Finally, cognitivism seeks to provide students with instructional activities where they can engage, apply, and analyze a concept (Kivunja, 2014).

Piaget is a leading theorist associated with the cognitive-development theory. Piaget's work is rooted in the belief that the "learner gains knowledge and constructs meaning from the interaction from his or her own experiences and ideas that he or she comes into contact with" (Kivunja, 2014, p. 83). Gredler points out that Piaget recommends teachers actively engage students by connecting learning to topics that interest students (as cited in Gredler, 2009, p. 285). Further pointed out by Gredler is that Piaget also changed the way we view children and adults, as he asserted that humans go through four stages in the development of reasoning (as cited in Gredler, 2009, p. 284). Also pointed out by Gredler were Piaget's noted shortcomings of directly teaching students the curriculum without engaging them as active participants in learning (as cited in Gredler, 2009, p. 300).

Cognitivism contributed to the modern classroom by highlighting the importance of connecting new concepts to the previously learned material, recognizing the value of metacognition, and the introduction of graphic organizers, outlines, etc. to sequence information for better memory processing (Ertmer & Newby, 2013). According to the cognitivist view presented by Ertmer and Newby, teachers should recognize the diversity of learners regarding their previous learning and experience and support learners with practice and feedback when learning new concepts.

The constructivist theory also recognizes the role of the environment and that learners play an active role in the learning process. Constructivism "assumes that learning occurs when the student is interacting with others (known as social constructivism) or is actively engaged with a task or course content or interacting with the environment" ("Learning Theories," 2014, p. 26). Ertmer and Newby (2013) explain that this theory asserts that what we know about our world is shaped by our interpretations of our own experiences and over time our understanding changes as new knowledge is constructed as it evolves from new situations. In this regard, Ertmer and Newby stated, "humans create meaning as opposed to acquiring it" (p. 55).

Vygotsky popularized the constructionist paradigm developed from the cognitivist theory as it was discovered that learning involves social aspects (as cited in Kivunja, 2014, p. 84). Furthermore, Vygotsky found cognitive development and learning to be influenced by interacting with others (as cited in Kivunja, 2014, p. 84). Gredler comments that Vygotsky also believed that culture affected learning and that "the key to the development of complex mental functions is mastering the signs and symbols of the culture as the means to master one's thinking" (Gredler, 2009, p. 341). Finally, Gredler highlights that Vygotsky is also famed for identifying the zone of proximal development as it relates to learning and for the use of scaffolding to promote student mastery (as cited in Gredler, 2009, p. 334).

According to Gredler (2009) the constructivist view sees the role of the teacher as presenting classroom activities that give students examples causing them to rethink their existing thinking and to question students to lead them to a new understanding of a concept. Gredler states that this theory recognizes a student's need to experiment, question, and investigate while learning. Teachers and students should collaborate to clarify and explain concepts (Gredler, 2009). In this model, the learner is working to gain individual understanding as he or she actively thinks about and participates in the lesson (Kivunja, 2014).

Many techniques used in today's classroom align with the constructivist view of education. Cooperative learning is a modern instructional tactic that emerged from this theory (Kivunja, 2014). Kivunja states that teachers who allow students to collaborate with peers and defend their views share in the constructivist view of learning. In addition, constructivism led to the modern push to connect curriculum to the real-world, to empower the learner to use what has been learned, to teach concepts in different ways and in different contexts, to develop problem-solving skills in learners, and for the use of assessments which challenge students to apply skills to a new problem or situation (Ertmer & Newby, 2013).

Experiential and active learning evolved from the constructivist learning model (Learning Theories, 2014). Active learning requires the learner to read, write, discuss, reflect, question, solve problems, and demonstrate skills (Bonwell & Eison, 1991). Less emphasis is placed on transmitting information to students and, instead, placed on activities allowing students to do and think (Bonwell & Eison, 1991). Another key component entails students being able to recognize when they have mastered the concepts and when they need more information or practice (National Research Council, 2000).

Connectivism. While there is debate regarding whether connectivism is an educational theory or a pedagogical view, it is a being presented in this DP because of its implications to the study. The theory of connectivism, which challenges the boundaries of earlier theories, is credited to George Siemens and Stephen Downes (Duke, Harper, & Johnston, 2013). Connectivism seeks to address how learning has been transformed by a new globalized society interconnected with technology. Siemens (2005) cites several reasons why connectivism is needed as a new learning theory including the fact that learners rarely stay in a single career field during their lifetime, formal education is no longer where most learning occurs, the way technology is rewiring our thinking processes, and the fact that knowing how to learn or what to learn is strongly supported by knowing where to find knowledge. Kivunja (2014) calls for a move towards the connectivist paradigm to prepare students for the 21st-century world, which requires critical thinking and problem-solving skills. Kivunja (2014) stated:

> Technological proficiency skills, as postulated in the connectivist orientation, empower our graduates to harness and exploit the enormous power of technology in helping them to think critically and to solve real-world problems as productive citizens in the 21st-century digital economy. (p. 89)

Duke et al. (2013) offer a simplistic definition of connectivism as “social learning that is networked” (p. 6). Connectivism connects to our global society as technology advancements have made the networking of ideas prominent (Duke et al., 2013). The theory was born from the belief that learning can occur because of a connection to outside knowledge, rather than from within an individual (Duke et al., 2013).

Behaviorism, cognitivism, and constructivism are all based on a foundation exploring how learning occurs. All three theories agree that learning occurs within an individual. However, Siemens (2005) challenges this idea stating, “learning is a process that occurs within nebulous environments of shifting core elements—not entirely under the control of the individual” (para. 23).

The theory of connectivism rests in the idea that learning is continual and shifts based upon a rapidly changing foundation of knowledge (Siemens, 2005). Siemens asserts that the ability to acquire knowledge is more important than what is already known or learned. Siemens views the maintenance of connections as an integral part of the continual cycle of learning. These connections are part of a cycle of knowledge in which the learner continually consults the network to acquire new perspectives and information to learn (Siemens, 2005). It is this continuous cycle of knowledge and collaboration of ideas that leads to continual learning (Duke et al., 2013). According to Siemens:

> Connectivism presents a model of learning that acknowledges the tectonic shifts in society where learning is no longer an internal, individualistic activity. How people work and function is altered when new tools are utilized. The field of education has been slow to recognize both the impact of new learning tools and the environmental changes in what it means to learn. Connectivism provides insight into learning skills and tasks needed for learners to flourish in a digital era. (para. 34)

Connectivism focuses on “actionable knowledge”, an emphasis on where to find knowledge (Duke et al., 2013, p. 7). Connectivism asserts that students gain knowledge by creating a personal network allowing them to acquire a point of view and opinion needed to make decisions (Duke et al., 2013). Duke et al. (2013) also state that connectivism empowers the learner to seek further knowledge to expedite research since no one knows all things or can experience all things.

Flipped learning and learning theory. The four main theories described above were used to develop this research study. Behaviorism values the use of reinforcement and feedback for learning. By using the flipped model, the researcher hoped to gain more time in class for practice, reinforcement, and feedback since the transmission of information is being moved outside of the classroom. In addition, the use of pre-assessment and the sequencing of instruction from easy to complex were also used in the unit. Both are common teaching tactics resulting from behaviorist theory.

While the behaviorist theory certainly is to be respected and was utilized, the cognitive theories were more closely aligned with the research conducted. According to Starr-Glass (2015), the flipped model of learning connects to the constructivist and progressivist theories in education made famous by Dewey (1938). Progressivists seek to “engage children in experiences that call for action, inquiry, experimentation, and collaboration” (Phillips, 2014, p. 664). The cognitive theories call for learners to be active and engaged. Flipped instruction allows students to learn the basics at home through video instruction and then attend class to apply what they have learned by engaging in activities at the higher levels of Bloom’s (1994) taxonomy while having teacher support. The flipped model is where “prior knowledge is actively recalled, cognitively compared, and then critically contrasted with new experiences and emerging understandings” (Starr-Glass, 2015, p. 78). This contrast, between what has already been learned and what currently is being learned, fits within the cognitive framework.

The focus of this study was to move away from the traditional passive techniques employed in higher education and move towards preparing students for the workplace. As Kivunja (2014) stated:

> For us to be effective teachers in the 21st-century requires that we make the pedagogical paradigm shift so that we change the way we teach to be able to prepare our students, not simply to memorize content and to follow instructions given by others, but to develop skills that are in demand in the 21st-century workplace; be able to think for themselves, solve problems, work in teams and lead others to success in the knowledge economy. (p. 89)

By flipping my classroom, the researcher not only created time in class for active learning activities, but also for experiences that developed problem-solving skills and created time for collaborative experiences (Starr-Glass, 2015).

Another way this study connects to the cognitive theories is through the connection of learning to the real world. As already explained, the flipped model offers more class time for activities. Gardner (2015) suggests connecting in-class activities to the real world within a flipped classroom as it promotes student buy-in of the model. The use of real-world applications will also force students to the higher levels of Bloom’s taxonomy (1994).

Although the primary theories forming the foundation for this study rest in the traditionally recognized theories of behaviorism and cognitive theory, connectivism adds a modern twist. This is relevant because of its emphasis on knowing where to find information for continual learning and growth. The computer concepts unit furnished students with knowledge useful in the contemporary world. Even though much of what the students learned from the researcher will change, students will have the skills to seek out information using valid sources in the digital age. The emphasis on knowledge seeking is an important skill for learners in the 21st century simply because there is such a vast amount of information available.

An ethical and responsible teacher attempts to prepare the best instructional environment for all students, but the reality is that it does not happen each day for each student. Ertmer and Newby (2013) stated that the world needs:

> Adaptive learners who are able to function well when optimal conditions do not exist, when situations are unpredictable and task demands change, when the problems are messy and ill-formed and the solutions depend on inventiveness, improvisation, discussion, and social negotiation. (p. 63)

It is not my goal to fill the brains of students with facts and information, but instead to help them become lifelong learners.

Action Research Design

Action research is a research methodology utilized in education that provides a practical way to improve teaching and learning (Mertler, 2014). In *Experience and Education* John Dewey (1938) advocates for the "systematic utilization of scientific method as the pattern and ideal of intelligent exploration" (p. 86). Dewey points toward the scientific method as the best way to authentically make sense of the world and thereby make sense of classrooms. According to Dewey, teachers must not simply react moment by moment to situations but use the scientific method to refine their professional toolbox to create better experiences for learners. I hope to address the problem of student disengagement by conducting action research.

Action research and traditional research are not identical. Action research is a "cyclical process of planning, acting, developing, and reflecting" (Mertler, 2014, p. 21). The goal of action research is to address a local concern experienced by a teacher (Dana & Yendol-Hoppey, 2014; Lederman & Lederman, 2015; Mertler, 2014). While traditional experimental research is useful, action research is more practical for educational professionals as they work to solve problems experienced in their unique classroom environments. Lederman and Lederman (2015) state that action research is just as rigorous as traditional research, but the primary difference between the two is that action research is not generalizable.

Mertler (2014) states that an adequate resolution to a problem might require repeated trips through the cycle to determine the best course of action for the situation at hand. Gilbert and Smith (2003) point out that "action research is intentional and systematically conducted; it does not rely on common trial-and-error strategies generally employed by teachers" (p. 81). The ultimate result of this type of research is to improve learning for students (Auger & Wideman, 2000).

Action research is a powerful professional development tool, allowing a teacher to improve their teaching practice (Dana & Yendol-Hoppey, 2014). Gilbert and Smith (2003) maintain that through action research, "teachers will see how the system can be changed through their research, creating new knowledge that empowers them and their learners as well" (p. 83). Gilbert and Smith indicate that this process of research and reform often becomes ingrained in a teacher's normal routine leading to a feeling of fulfillment. In addition, Auger and Wideman (2000) acknowledge that action research allows a teacher to contribute to the body of educational knowledge through the process of sharing their findings. The researcher sought to use action research for this study to be more purposeful in her teaching practice and to address issues experienced within her classroom.

Background and Role of Researcher

The first eight years of the researcher's career was spent teaching business education courses at a public suburban high school in a suburb of a large midwestern metropolitan area. For the past six years, the researcher has been an adjunct professor at a community college teaching introductory computer science courses. Four years ago the researcher also started teaching computer science as an adjunct at a private parochial institution. Both institutions are located in the same large midwestern metropolitan area.

According to Mertler (2014), action research practitioners differ from traditional researchers as they have a higher stake in the outcome of the research. Initially, the main motivation for conducting this research project was to resolve an educational problem within the researcher's teaching context. As the sole practitioner of the study, the researcher conducted the study, analyzed the data, and made conclusions.

Significance of the Study

While this study does not have the potential to generalize to all other higher education contexts, it does have significance within the researcher's teaching context. First, the results of this study were used to determine if the flipped method of instruction is worthwhile. If the flipped classroom does affect student academic achievement and perceptions positively within the scope this context, the researcher will be able to continue to refine the method and expand its use in other units and even in other courses taught. Second, others within the higher education community may be able to learn from the researcher's study to learn about this teaching methodology or to conduct future studies.

DP Overview

Chapter one introduces the present study, the problem of practice, purpose, research question, and theoretical framework. Chapter two contains a detailed literature review including the history of flipped learning, as well as detailed accounts of previous research and findings. Chapter three outlines the action research methods employed and includes information about the site, participants, and data analysis. Chapter four provides a detailed report of findings, discoveries, reflections, and analyses. Finally, chapter five consists of a summary, conclusion, and suggestions for future research related to flipped instruction.

Glossary

Action research: research conducted by educational stakeholders who wish to improve part of the teaching and learning process or environment within their own school context (Mertler, 2014)

Active learning: students actively construct meaning through engagement in the content at the higher levels of cognition, rather than passively receiving information through traditional lecture methods (Bonwell & Eison, 1991; King, 1993)

Blended learning: combining face-to-face instruction with online learning experiences completed outside of the classroom (Strayer, 2012; Zainuddin & Halili, 2016)

Flipped instruction: "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter" ("Flipped Learning Network," 2014, p. 1)

Flipped learning model: a model built on seven pillars of instruction, including a flexible environment, learning culture, intentional content, a professional educator ("Flipped Learning Network," 2014), progressive networking activities, engaging and effective learning experiences, and the use of a diversified and seamless learning platform (Chen, Wang, Kinshuk, & Chen, 2014)

Learning management system or learning platform: a web-based system assessable to students which is the backbone of the blended learning model as it allows students to receive structured content from instructors (examples—Blackboard or Canvas)

Student-Centered Instruction: a learning environment in which the student is at the center, engaging in activities, interacting with peers and the instructor, and put in control of their own learning

STEM: abbreviation for science, technology, engineering, and mathematics courses

Teacher-Centered Instruction: a learning environment in which the teacher is at the center, lecturing and imparting knowledge upon students

Teacher-Researcher: an educational professional conducing researcher in his/her teaching context to solve an educational problem

Transmission Model/Traditional Method of Instruction: a method of instruction that is teacher-centered and heavily relies on lecture and passive learning activities

Video Lectures: videos, containing information at the knowledge and understanding cognitive levels over one concept, watched by students outside of class prior to attending the next class session as a means to prepare for active learning activities

Chapter Two: Literature Review

Introduction

Today’s colleges and universities face many challenges as they strive to educate and prepare the next generation of workers. Colleges are tasked to create dynamic student learning environments (O’Flaherty et al., 2015). While smaller class sizes are known to promote learning, many times the budget requires larger class sizes to keep the doors open (Berrett, 2012). Today’s learners expect a technologically rich learning environment (O’Flaherty et al., 2015) as technology has infused every part of the millennial generation’s lives (Espinoza, 2012). Expectations for what education entails is high due to the rising cost of a college education. One change that can be made, often with little additional cost, is the nature of the higher education classroom. According to McCallum, Schultz, Selke, and Spartz (2015), the recognition that teaching and learning are of the highest importance to an institution may offer some solutions for colleges and universities struggling to engage the modern college student.

College students are diverse in backgrounds, age groups, and experiences, where some are parents, working adults, military veterans, and spouses (DuBrowa, 2014). DuBrowa (2014) states that students expect learning to come alive, thus presenting a challenge to the traditional methods used in the postsecondary setting. Granados-Bezi (2015) asserts that instructors who utilize flipped instruction recognize the need to move away from traditional modes of learning to serve a diverse population of students. The move toward student-centered learning methods, such as those used during flipped instruction, need to be further investigated to assess whether they positively impact student performance (Crisafulli, 2015; González-Gómez, Jeong, Airado Rodríguez & Cañada-Cañada, 2016).

The use of constructivist or learner-centered strategies within the classroom is beginning to move through postsecondary education to promote active knowledge construction (Day & Foley, 2006; Heyborne & Perrett, 2016). If faculty can capitalize on the opportunity to transform in-class time from dull to engaging, they may see more student involvement in the learning process and greater student achievement (McCallum et al., 2015). Flipped instruction "places more of the burden upon the student to take the lead in the learning process" (Francl, 2014, p. 119) by moving the lecture out of the class as homework and replacing it with active learning activities (Bergmann & Sams, 2012; Heyborne & Perrett, 2016; Lage, Platt, & Treglia, 2000; Love et al., 2015; Peterson, 2016; Sparks, 2013; Sun & Wu, 2016; Zainuddin & Halili, 2016). Flipped instruction has roots in blended learning, which combines face-to-face instruction with online instruction (Peterson, 2016; Sahin et al., 2015; Starr-Glass, 2015; Strayer, 2012; Zainuddin & Halili, 2016). A general sequence of instruction occurring in most flipped classrooms includes the following:

- Traditional lecture material is given to students as homework, typically through video lectures, which should be viewed prior to attending the next class (Albert & Beatty, 2014; Barkley, 2015; Bergmann & Sams, 2012; Brewley et al., 2015; Davies et al., 2013; Francl, 2014; González-Gómez et al., 2016; Grimsley, 2015; Lage et al., 2000; Mason, Shuman, & Cook, 2013; McFarlin, 2008; O'Flaherty et al., 2015; Peterson, 2016; Pierce & Fox, 2012; Sparks, 2013; Touchton, 2015).

- Students are required to complete a learning activity or quiz prior to returning to class to determine their mastery of the video content (Albert & Beatty, 2014; Barkley, 2015; Francl, 2014; Gardner, 2015; Kim, Kim, Khera, & Getman, 2014; González-Gómez et al., 2016; Grimsley, 2015; Lage et al., 2000; McFarlin, 2008; Sparks, 2013; Starr-Glass, 2015).
- Questions and misconceptions about the video content are addressed at the beginning of class (typically for no more than 10-15 minutes) (Davies et al., 2013; Francl, 2014; Grimsley, 2015).
- During class time students are engaged in higher-order thinking by participating in active learning strategies (Albert & Beatty, 2014; Barkley, 2015; Bergmann & Sams, 2012; Francl, 2014; Mason et al., 2013; O'Flaherty et al., 2015; Pierce & Fox, 2012; Sparks, 2013; Strayer, 2012; Sun & Wu, 2016; Touchton, 2015).
- An assessment is given at the end of a unit to measure understanding (Barkley, 2015; Brewley et al., 2015; Francl, 2014, Mason et al., 2013; Pierce & Fox; 2012; Sparks, 2013; Strayer, 2012).

While flipped instruction is changing how the classroom operates, it is not the change in homework assignments that is bringing about the learning gains, but rather, what is happening in-class (DuBrowa, 2014). According to DuBrowa (2014), "providing in-class activities that focus on higher level cognitive activities that promote deeper learning, helps students build upon the basic knowledge that they gained outside of class . . . and become active components part of the actual learning process" (p. 97). The popularity of flipped instruction is rooted in the transition from a teacher-centered environment where students are "passive receptacles of information" to a student-centered approach where students are actively engaged in the learning process and where educators become "architects of learning activities" (Pierce & Fox, 2012, p. 1).

The Transmission Model of Learning

In the traditional college classroom, the professor typically presents information on a concept through a PowerPoint presentation, allows students to ask relevant questions related to the lecture, assigns homework, and administers assessments to determine what students learned (Francl, 2014). This method of learning, known as the transmission model of learning, places the burden on the educator, not the student (King, 1993). In 1987, Chickering and Gamson analyzed fifty years of research to define seven best practices for undergraduate education. Contact between faculty and students, cooperative learning techniques, active learning strategies, prompt feedback, an emphasis on time on task, high expectations, and the recognition of diverse learning styles were identified as proven research-based tactics to improve the quality of higher education (Chickering & Gamson, 1987). Despite the call for more engaging learning strategies in the classroom, the transmission model persists in college classrooms (Eagan et al., 2014; Starr-Glass, 2015), particularly in science, technology, engineering, and math (STEM) courses at the postsecondary level (Marcey & Brint, 2013; Weiman, 2014).

Eagan et al. (2014) conducted a survey involving over 16,000 full-time undergraduate professors at over 260 four-year colleges and universities to find that 50.6% rely on extensive lecturing as a primary means of teaching. This has changed little from the same survey conducted in the late 1980's. While more professors were using class discussions, cooperative learning, group projects, and peer evaluations, the use of extensive lecturing holds steady as the primary teaching methodology (Eagan et al., 2014). Weiman (2014) also views lecture as a substandard methodology and declared that any postsecondary institution using traditional lecture as the primary method of instruction in STEM courses “is providing an inferior education to its students” (p. 8320). Research has consistently shown that the transmission method remains a fixture in higher education because of tradition, few incentives for faculty to change, anxiety, and faculty self-perceptions that they should be disseminating information to students (Bonwell & Eison, 1991; Heyborne & Perrett, 2016).

The largest drawback with the transmission method of instruction is that it typically results in passive students (Bonwell & Eison, 1991). Bergmann and Sams (2012) asserted that when students sit in a lecture their brains fail to grow because they are not actively using the information. According to Chickering and Gamson (1987) “learning is not a spectator sport” (p. 5), but instead requires the active participation of the learners. In the end, professors need to talk less and require the students to do more active knowledge construction through hands-on learning and inquiry (Worley, 2011).

Another disadvantage with the traditional approach to instruction is that students in college today simply do not read their textbooks outside of class (Gardner, 2015; Starcher & Proffitt, 2011). Assigned reading outside of class is a common expectation in higher education. Starcher and Proffitt (2011) point out that the problem of students failing to read assigned textbook materials is widespread amongst all disciplines and at all levels of postsecondary education, even at the graduate level. After analyzing research data on the habits of college readers, they found that reading a college-level textbook requires considerable effort and that “students may simply view the cost of studying, in terms of opportunity costs, as too high” (Starcher & Proffitt, 2011, p. 397). The researchers identify many reasons why college students fail to read, such as the fact that the student lacks the ability to read well or that the reading does not seem directly connected to the class. However, Starcher and Proffitt note that contributing to the problem are instructors who spend class time giving lectures that summarize the assigned reading material, thus making the reading assignments unnecessary.

One final negative side effect of the transmission model of learning is, that as students sit passively, they often fail to interact with either the teacher or other students in the class. This isolation in the classroom often feels comfortable to students. Students in traditional classrooms often prefer not to interact with others (Strayer, 2012). Considering that collaboration skills are a valuable 21st century skill for learners today (Kivunja, 2014), this disengagement in the classroom is not serving the best interests of students.

The point, according to Day (2006), is that "although lectures and reading can be included in constructivist-inspired instruction, alone they typically do not provide adequate support for learners' knowledge construction" (p. 422). The transmission method employed in most college classrooms focuses on the lower levels of cognition while students are in the classroom and then asks students to attempt the higher-order thinking skills, typically unsupported, on their own (Starr-Glass, 2015). Furthermore, Touchton (2015) states that "harnessing theoretical concepts and applying them in practice is one of the greatest conceptual leaps students make in the course of their education and is therefore one of students' greatest challenges" (p. 28).

Wallace, Walker, Braseby, and Sweet (2014) compare the instructional paradigm, described above as the transmission model traditionally used in higher education, with the learning paradigm, which is more in line with the flipped instruction methodology involved in this study. According to Wallace et al. (2014), the flipped classroom may be the key to transitioning higher education away from the instructional paradigm and believes “a critical mass of dedicated instructors is needed throughout higher education to generate a paradigm shift to the learning paradigm” (p. 254).

Flipped Learning

History. While some educators experimented with providing video content outside of class as early as 2000 (Heyborne & Perrett, 2016), the popularity of flipped instruction is typically attributed to two high school science teachers, Jon Bergmann and Aaron Sams, who developed the concept after realizing that students were not able to complete their homework successfully on their own at home (2012). Bergmann and Sams discovered that their students needed support at home to master difficult concepts, especially when they were absent from school. The pair decided to *flip* their classrooms by moving the lectures out of the classroom and moving the homework into the classroom. The idea behind this concept was that the routine transmission of information was now made available to the students to do at home prior to class and during class students would be engaged in high-quality active learning experiences at the upper levels of cognition (Bergmann & Sams, 2012; Enfield, 2013). Bergmann and Sams began moving homework out of class by using video lectures that students could access at home. This resulted in significant changes in students’ attitudes and achievement. Bergmann and Sams soon found that many educators wanted to implement this new concept of flipped learning, particularly at the secondary level, which prompted them to create the Flipped Learning Network (FLN) as a way to connect educators with resources on this novel methodology.

Definition. There is not one model or definition that represents all flipped classrooms (Bergmann & Sams, 2012; Bishop & Verleger, 2013; Cresap, 2015). However, the one unifying concept that all flipped learning environments share is the desire to redirect attention from the teacher back on to the learners (Bergmann & Sams, 2012). Bergmann and Sams (2012) gave a simplistic definition of flipping learning as "that which is traditionally done in class is now done at home, and that which is traditionally done as homework is now completed in class" (p. 13). Since beginning the FLN (2014), the definition of flipped learning has taken on a more polished form and has been defined as:

> A pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter. ("Flipped Learning Network," 2014, p. 1)

Abeysekera and Dawson (2015) characterized flipped learning approaches by the change in how in-class and out-of-class time is utilized; the use of active learning, cooperative learning, and problem-solving activities to make in-class time engaging to students; and the incorporation of technology, particularly video lectures. According to Bishop and Verleger (2013), flipped learning "represents a unique combination of learning theories once thought to be incompatible—active, problem-based learning activities founded upon a constructivist ideology and instructional lectures derived from direct instruction methods founded upon behaviorist principles" (p. 2). This rearranging and blending of theories has been well embraced by secondary educators, but Prodoehl

(2015) emphasized the benefits of this learning methodology at the postsecondary level, particularly in introductory classes where students need to master the basics before moving on to an advanced course.

The pillars of flipped learning. The FLN (2014) established four pillars to guide flipped learning. According to the FLN, all truly flipped classrooms must meet the requirements of all four pillars. The first pillar is the flexible environment in which the educator sets up a physical environment ready for both individual and cooperative learning (FLN, 2014). Beyond the physical nature of the classroom, the flexible environment also describes the flexibility of the educator as to how quickly students are required to master concepts, how assessments are used, and how instruction proceeds (FLN, 2014). The second pillar is the learning culture of the flipped classroom, which moves away from the traditional teacher-centered approach to a student-centered approach. The student-centered approach affords ample class time for students to explore concepts on a deeper level in a way that learning can become meaningful to the students. Intentional content, the third pillar, describes the educator's intentional planning of what will be deeply explored during in-class sessions and what concepts will be presented to students during their own time outside of class. This pillar also centers on the intentional incorporation of active learning techniques during class time. The final pillar centers on the role of the professional educator in the flipped learning environment. According to the FLN, the professional educator has a more challenging job as they will continually assess students during class to not only supply feedback to them but to adjust future instruction. Furthermore, the professional educator is identified by the FLN as reflective and continually striving for improvement of their teaching practice.

Although the four pillars are most recognized in the domain of flipped learning, Chen et al. (2014) question whether these four pillars are enough to adequately define the flipped learning environment as it applies to the realm of higher education. Based on their research, they suggest that three additional pillars need to be added to truly describe an effective flipped learning environment so that the F-L-I-P™ method (“Flipped Learning Network,” 2014) would become F-L-I-P-P-E-D (Chen et al., 2014). The first addition by Chen et al. is progressive networking activities characterized as an emphasis on how learning occurs in the classroom. They criticize the original model for focusing too much on just the content, leaving out the importance of learning by doing emphasized in progressivism. The next addition is engaging and effective learning experiences as the researchers wanted to see more emphasis placed on the dialogue between students and teachers during in-class activities. Finally, the team of researchers added a final pillar called diversified and seamless learning platforms, arguing that video content and outside learning activities should be offered to post-secondary students at home. These learning platforms are very popular throughout higher education and should be included as an important component of the postsecondary model as they can offer learning materials in a convenient, easy-to-use way (Chen et al., 2014). In fact, González-Gómez et al. (2016) credit the increased availability of student learning platforms as one reason many professors are giving this instructional method a try.

For the present study, the researcher created a flipped learning environment incorporating all seven pillars of the F-L-I-P-P-E-D model outlined above by the FLN (2014) and Chen et al. (2014). The goal was to furnish students with a learning environment that holds as closely to the definition of a flipped classroom as possible and then to evaluate the effect on student learning and perceptions.

Criticisms and Misconceptions of Flipped Learning

Flipped learning is certainly a change in pedagogy for most educators in higher education as it is sharply different from the transmission model that has been in place for hundreds of years in universities across the United States. The biggest criticism among those who have used this learning technique is that it is labor intensive (Berrett, 2012; Cresap, 2015; Faulkner, 2015; Gardner, 2015; Jensen, Kummer, & Godoy, 2015; Love et al., 2015; Mason et al., 2013; O'Flaherty et al., 2015; Peterson, 2016; Touchton, 2015). In contrast, Enfield (2013) and Ferreri and O'Connor (2013) reported that the time required preparing for classes decreases with the flipped method, particularly during the second year of implementation. Some instructors have found that once video content has been made, the time it takes to prepare for class decreases, as they do not have to review information they would like to cover during a long lecture (Mason et al., 2013).

When using this classroom format, the educator must be prepared for some potential pitfalls. One misconception about flipped learning is that it creates a chaotic classroom environment (Bergmann & Sams, 2012), but that could be said about any classroom rooted in the learner-centered ideology (Schiro, 2013). When describing the learner-centered classroom, Schiro explains that students do not just do as they please but make choices of how to learn based on their interests. While not every flipped learning environment utilizes a full learner-centered approach, many utilize active and cooperative learning strategies that will appear a bit chaotic from outside observers. Since the classroom will be more active, Bergmann and Sams state that classroom management tactics will have to be altered as students will occasionally need redirection.

With a new emphasis being placed on the use of active and cooperative learning strategies, some instructors may not be prepared to deal with their new role as a facilitator (Kim et al., 2014). Francl (2014) concludes that the teacher's job becomes more challenging with the flipped classroom environment, because it requires more one-on-one interactions with students and deeper questioning of them. Since active learning techniques are typically used during class to replace lectures, the instructor will need more subject matter expertise than is required during a lecture (Weiman, 2014).

Another major issue causing some professors to stay away from flipped learning is the potential for students to review the instructor poorly on end-of-course evaluations (Berrett, 2012). Berrett discusses the case of students at Harvard University who rated professors using the flipped methodology lower than others using more traditional methods. One consideration prior to switching to this methodology would be to discuss the change with a department chair so that any slight changes in evaluations may be noted and monitored as semesters pass (Love et al., 2015). One way to combat this potential pitfall is to prepare for it ahead of time. On the first day of a course, instructors should explain to students the differences they will be experiencing in the flipped classroom and the reasons behind this change (Cresap, 2015; Crisafulli, 2015; Love et al., 2015; O'Flaherty et al., 2015). The explanation should be enthusiastic (Albert & Beatty, 2014) so that students are excited about the potential changes and how it will positively impact their learning. Yet it is important to note that even after an explanation, students may be hesitant at first until they get used to the new teaching style (Love et al., 2015).

Some researchers have found that students became frustrated with the introduction of the flipped classroom because they prefer to sit back and listen in a passive classroom environment as opposed to participating and interacting with classmates (Gardner, 2015; Mason et al., 2013; Sahin et al., 2015). Students generally recognize that the flipped approach puts more ownership of learning on them, which requires more self-discipline on their part (McCallum et al., 2015). Instructors will need to "explain the flipped pedagogy as a means for extending learning beyond gathering knowledge" (Cresap, 2015, p. 191). This goes against what most students have been trained to do in school. A final tip from Love et al. (2015) is to solicit feedback from students as the semester begins to give them ownership over the course, but the researchers caution instructors to seriously consider the suggestions requested.

Student buy-in is key to the success of this method (Brewley et al., 2015; Gardner, 2015; Heyborne & Perrett, 2016). Peterson (2016) states that convincing students to invest more of their own time on learning is challenging. In a traditional class, students can often skip the homework assignments and still function in-class without being confused, but students in a flipped classroom will struggle if they come to class unprepared (Van Sickle, 2016). The professor's ability to create meaningful learning experiences during class will be dependent on whether students prepared for class by watching the video lectures (Heyborne & Perrett, 2016). Grimsley (2015) conducted a study to analyze student use of video in a flipped environment and found that students failed to watch video lectures if there was not a motivation to do so. One suggestion to remedy this problem was to view a sample video lecture in-class with students and immediately follow it with an activity to demonstrate the importance of viewing the videos before class attendance (Faulkner, 2015; Grimsley, 2015).

Overall, many of the initial problems instructors face with the flipped learning approach can be easily resolved if the instructor is connected to a network of other teachers who can give assistance when problems arise (O'Flaherty et al., 2015). This was the primary reason for the formation of the FLN. Reflecting on the process and connecting with other educators who can offer support are keys to the successful implementation of this method (O'Flaherty et al., 2015). Starr-Glass (2015) states that "the acrobatics of flipping require confidence, conviction, agility, and a high degree of flexibility" (p. 87) to be successful. It is also important to note that instructors should slowly transition to this method, rather than jumping into it in all courses taught (Gardner, 2015). Overhauling a traditional lecture class to move towards a more learner-centered flipped instructional model "requires considerable thought and planning" on the part of the instructor (Wallace et al., 2014, p. 259).

Active Learning

According to King (1993), active learning requires learners to think about information by analyzing, synthesizing, and evaluating it, as opposed to just passively sitting and receiving it from the professor. Bonwell and Eison (1991) give a simplistic definition of active learning as the process of involving "students in doing things and thinking about the things they are doing" (p. 19). Active learning places less importance on transmitting information to students and more emphasis on building skills, engaging students through activities, and having students reflect on their own understanding (Bonwell & Eison, 1991). Students are asked to "make what they learn part of themselves" (Chickering & Gamson, 1987, p. 5). Furthermore, King (1993) asserts that active learning leads learners toward a deeper understanding of the content because they must make sense of the new information and not just regurgitate the lecture. Active learning is a powerful learning tool, particularly in STEM classes as it helps students "integrate basic concepts into conceptual frameworks, link prior learning to new knowledge, and develop reasoning and problem solving skills that allow the application of concepts to situations that are not explicitly memorized" (Marcey & Brint, 2013, p. 2). Furthermore, active learning allows millennial students to question and ask why, which according to Espinoza (2012) is a key way they construct knowledge.

Active learning has a proven track record of improving instruction and academic achievement, particularly in STEM courses (Freeman et al., 2014; Pierce & Fox, 2012; Weiman, 2014). In a meta-analysis of 225 studies examining the academic achievement and failure rates of undergraduate STEM students, Freeman et al. (2014) reveal that exam scores were six percent higher in courses that incorporated active learning strategies. Furthermore, they concluded that active learning was beneficial to students because it increased student participation across all STEM disciplines.

Although active learning is a proven strategy in the classroom (Love et al., 2015; Weiman, 2014), there can be obstacles. When using active learning, there is often less time to disseminate information to students, thus putting the burden on the student to learn information outside of the classroom on their own (Bonwell & Eison, 1991). Active learning strategies take time to prepare adequately and may be difficult to utilize in large class sizes (Bonwell & Eison, 1991; O'Flaherty et al., 2015). In addition, there is sometimes a fear that students will not engage, fail to learn the content adequately, or negatively review the professor at the end of the semester because of their unorthodox teaching methodology (Bonwell & Eison, 1991).

Research by Lumpkin, Achen, and Dodd (2015) offers a contemporary view of active learning in today's college classroom. Lumpkin et al. (2015) analyzed the perceptions of college students regarding active learning experiences in the college classroom to find that students valued active learning and felt it positively impacted their learning. The researchers used quantitative and qualitative evidence to determine that students believed their understanding of a concept was deepened when they were required to reflect on, write about, and discuss it. Students also valued the ability to work cooperatively with others and were able to easily find real-world applications of a concept (Lumpkin et al., 2015). Gardner (2015) also reveals that using activities that connect to the real world helps students have a more meaningful experience. This connection to the real world makes learning come alive for students. Kivunja (2014) solidifies this stance by stating "the value of what we teach is not in the pedagogical content knowledge but in the process of its application to real-life situations to solve problems" (p. 87).

A major factor in the success of flipped learning is the incorporation of active learning strategies that occur during instructional time. Ferreri and O'Connor (2013) redesigned a postgraduate level pharmacology course in which lecture was completely removed during class. Students were required to read their textbook materials prior to class and then to participate in cooperative and active learning strategies during class. The study analyzed the final grades of 449 students both before the course redesign and during the first and second years of the course redesign to determine if academic achievement had improved (Ferreri & O’Connor, 2013). Ferreri and O’Connor found that with the traditional method of instruction 59.5% of students received A’s and B’s in the course, compared with 62.5% of students in the first year of course redesign and 63.5% of students during the second year of course redesign. The study demonstrates the power of active learning strategies and the effect on academic achievement.

King (1993) recommends practical active learning strategies as a professor makes the transition from a transmission approach to a constructivist one. While the use of active learning during in-class activities is prominent among the research associated with flipped learning, the specific strategies being utilized varies greatly by discipline (Bishop & Verleger, 2013). Instructors should choose activities that fit their teaching style and classroom situation (Love et al, 2015). After analyzing numerous flipped research studies, Bishop and Verleger noted that many flipped classrooms use some form of small group activity during class to explore content more deeply. Regardless of the activities chosen, the instructor should be prepared to facilitate and guide students, while maintaining a strong collaborative learning culture (Kim et al., 2014).

The Role of the Instructor

King (1993) discusses the differences between the transmission model and the constructivist model in the classroom. In a typical college classroom the professor is “the ‘sage on the stage,’ the one who has the knowledge and transmits that knowledge to the students, who simply memorize the information and later reproduce it on an exam—often without even thinking about it” (King, 1993, p. 30). This model results in passive learners and is not relevant in a society where students will be expected to think for themselves, resolve problems, and generate new knowledge (King, 1993). In contrast to this traditional teacher-centered approach is the constructivist or learner-centered approach, which King states places the learner at the center of the learning process, rather than the professor. A constructivist approach requires students to reflect on their prior knowledge and experience, create relationships between ideas, and manipulate the new information (King, 1993; Starr-Glass, 2015). This model of instruction replaces the “sage on the stage” with the “guide on the side” (King, 1993, p. 30). This shift in pedagogy places the control of learning with the students and makes learning the center of the classroom (Bergmann & Sams, 2012, Francl, 2014). Francl (2014) calls for the educational community to abandon the term *teacher* and replace it with *facilitator* (p. 119) as “the instructor’s workload is changed from a ‘slide reader or explainer’ to a ‘responsive knowledge provider’” (p. 122).

One key factor to the success of flipped instruction is the creation of an environment allowing learners to develop with appropriate support from peers and the instructor (Starr-Glass, 2015). The learning environment needs to be built on trust where students feel open to share and learn (Cresap, 2015). Faulkner (2015) advocates for the blending of the flipped method with peer instruction strategies to create a class environment that involves students in the learning process, allows for discussions, corrects student misconceptions, develops student confidence, and increases learning. According to Van Sickle (2016), some students are more willing to be vulnerable in front of their peers than others. In addition, providing clear feedback as students work during class is critical to the success of active learning in the flipped environment (Kim et al., 2014). This new role of facilitator could be challenging for some instructors who have never been trained to effectively facilitate discussions, redirect students, promote a safe environment for group learning, or ask deep questions (Love et al., 2015). One challenge may be the unpredictable nature of what students may ask during in-class activities since their questions may put the instructor on the spot (Bergmann & Sams, 2012; Berrett, 2012; Starr-Glass, 2015). This uncertainty is nothing to fear, as Bergmann and Sams (2012) suggest that instructors get used to the idea of admitting when they do not have the answer and suggest collaborating with students to discover the answer.

A final change for instructors will be the increased need for organization in the classroom. When planning instruction in a flipped classroom, teachers should remember to connect what students are doing outside of class on their own to what happens during class (Kim et al., 2014; O'Flaherty et al., 2015; Starr-Glass, 2015). Advanced planning is required in order to make these connections. Failure to do so could cause students to become confused or frustrated enough to stop participating in both the outside and in-class activities.

Benefits of Flipped Learning

Flipped instruction offers many research-based benefits to students at various levels of their educational journey. It allows teachers to free up class time to include more active and problem-based learning experiences (Mason et al., 2013; McCallum et al., 2015; O'Flaherty et al., 2015; Starr-Glass, 2015). By completing activities in-class requiring higher-order thinking skills, students can receive support during the learning process and correct any misconceptions they may have of the material (Gardner, 2015; McCallum et al., 2015; Touchton, 2015). Activities at the application, analysis, synthesis, or evaluation levels are at the higher levels of cognition (Green & Johnson, 2010), which is where all active learning activities taking place in the flipped classroom should reside (Albert & Beatty, 2014).

Flipping the classroom also allows the teacher to spend more time interacting with and helping struggling students during class (Barkley, 2015; Bergmann & Sams, 2012; Love et al., 2015; Brewley et al., 2015). Rather than spending the entire class lecturing, which leaves little time for interaction directly with students, the teacher can listen to the students' thinking, hear them discuss concepts, watch them solve problems, and provide ample feedback both when they are on the right track or when things have steered off course. The millennial generation enjoys being given verbal feedback to reaffirm expectations because praise and extra help allow them to know when and if they are meeting expectations (Espinoza, 2012). This level of feedback is possible in the flipped classroom as the instructor can move around the room observing and interacting with students. According to Espinoza (2012), "rigor and relationship are not antithetical" but can happen in the flipped classroom (p. 30). The increased time teachers and students interact can also positively impact how students view of the course overall (Van Sickle, 2016).

Not only are teachers interacting with students more, but also students are interacting with each other more as a means of learning (Bergmann & Sams, 2012; McCallum et al., 2015; Zainuddin & Halili, 2016). Students are not just socializing but learning together and assisting each other with the understanding of the concepts. Starr-Glass (2015) makes note of Vygotsky's suggestion that students use language to organize their learning, which is possible in the flipped classroom as there is more time for social interactions and engagement (as cited in Starr-Glass, 2015, p. 78). Sun and Wu (2016) conclude that the flipped classroom creates a rich environment for students as they were internalizing knowledge. They also find that both student-to-student and teacher-to-student interactions have a positive impact on a student's achievement in the classroom. Strayer's (2012) study also notes that students value cooperation in a group learning approach as students in a flipped classroom were more willing to work together and engage during class than those in the traditional setting.

Since more time is available during class, activities can be diversified to meet the needs of all learners (Mason et al., 2013). Crisafulli (2015) states that flipped learning "has the potential to promote, rather than hinder, student learning by appealing to different learning styles in a wide variety of subjects" (p. 45). Abeysekera and Dawson (2015) second this notion as it allows instructors to tailor instruction to the student's level of readiness. Bergmann and Sams (2012) began their journey into the flipped classroom by simply moving the lecture out but ended up transforming their classroom into a flipped-mastery classroom. According to Bergmann and Sams, this flipped-mastery classroom allows for remediation and differentiated instruction.

Another highly cited benefit of the flipped classroom is that it encourages students to be self-motivated and take control of their own learning (Granados-Bezi, 2015; Grimsley, 2015; Mason et al., 2013). Prodoehl (2015) states that flipped instruction will "put ownership of education squarely in the hands of students" (p. 3). Wallace et al. (2014) note that flipped instruction gives more time for students to apply their knowledge. They also state that it forces students to be "cognitive apprentices who are expected to take ownership of their learning, become active members of the community of learners within the course, and practice thinking like an expert" (Wallace et al., 2014,

p. 260). Placing more responsibility for learning on students could address the growing discontent amongst students in postsecondary education (Granados-Bezi, 2015).

One reason college faculty are leery of trying flipped instruction is the fear that they will have to reduce the amount of content they are able to cover in a semester (Bonwell & Eison, 1991). However, another benefit of flipped instruction is that more content can be covered than in a traditional lecture-based course (Grimsley, 2015; González-Gómez et al., 2016; Mason et al., 2013). This is often a surprising benefit to the method. Flipped instruction not only allows for a wider coverage of content but a more in-depth exploration of the content.

After analyzing the downsides and benefits of flipped instruction, one can see that many of the benefits directly impact students while the negative aspects affect the instructor. The method requires the instructor to adapt and change. Change is difficult; however, change that brings about better learning experiences for students is worth the cost in terms of time and effort. Teaching is a personal growth opportunity (Espinoza, 2012) and part of growing is adapting to the ever-changing needs of students.

Technology Use in Flipped Learning

The technology-infused version of the flipped classroom is made possible by the technological advancements of the late 20th century (Berrett, 2012; Heyborne & Perrett, 2016). The Internet's surge of popularity and usefulness to the average American in the late 1990's (Adams, 2015) has transformed education in numerous ways. According to Adams, modern educators have numerous ways of using technology both in the classroom and through homework assignments accessed online at home. Many teachers today do not simply attempt to integrate technology but to infuse it into their classroom in a variety of ways (Adams, 2015). Granados-Bezi (2015) declares “the future of education remains in the hands of those instructors interested in improving their teaching results by using technology more effectively and by creating new venues for independent learning” (p. 60). Video, although not revolutionary to today’s students, is a highly attractive way to engage students (Bergmann & Sams, 2012). It is important to remember that “it is not the presence of technology that motivates students; it is how effectively that technology is used to promote student inquiry and engagement” (Crisafulli, 2015, p. 53).

It is important to note that today’s millennial learners view technology differently than past generations. They no longer rely on the all-knowing professor to educate them as they can simply use technology to find answers on their own (Espinoza, 2012). In addition, millennial learners do not compartmentalize their lives but are always connected to their school, work, and social lives (Espinoza, 2012). This generation of learners expects to use technology as a learning tool and is plugged in nearly all the time.

The benefits of video. Video is a powerful tool in the flipped classroom as it offers numerous benefits to students as they prepare for in-class activities. Not only has video been shown to improve learning (Zhang, Zhou, Briggs, & Nunamaker, 2006), but video is the vehicle by which students control the pace of their learning in the flipped classroom (Cresap, 2015; Love et al, 2015; Marcey & Brint, 2013; O’Flaherty et al., 2015; Zainuddin & Halili, 2016). Videos can help busy students work ahead or absent students catch up (Bergmann & Sams, 2012). A pause button is a powerful tool on a video as it allows a student to slow down the pace of the content, giving him or her time to process the information (Bergmann & Sams, 2012; Enfield, 2013). Grimsley (2015) finds that when students use video content 93% used the pause button, 93% appreciated being able to go at their own pace, and 86% appreciated the opportunity to rewind the video. His survey also revealed that English language learners watched videos numerous times to help with their comprehension. In addition, students can easily review video content, when broken up into small chunks if a concept is forgotten or as they review for an exam (González-Gómez et al., 2016; Marcey & Brint, 2013)

Although some researchers have found that students will treat video content just like the reading assignments they loathe (Day & Foley, 2006), others have shown that students react positively to video content and even watch it when it is not assigned (Bishop & Verleger, 2013). Sahin et al. (2015) implemented flipped instruction in undergraduate calculus courses and found that students preferred watching videos when preparing for class to reading a traditional textbook.

Effective video content. Trogden (2015) states that “the modern educator must structure educational activities to be worthwhile or the student will avoid completing them” (p. 120). Certainly, this sentiment applies to the creation of video in the flipped classroom. The best video is one created to maximize student learning by concisely and clearly presenting information in an organized manner. Video content should never be made unless there is an educational benefit to students (Bergmann & Sams, 2012). Before creating video content, instructors should plan the content by deciding the objective for the video and determine what information is essential (Bergmann & Sams, 2012). Part of the planning process may include writing a script to guide your video lecture so that it is as succinct as possible (Crisafulli, 2015). It is also important to consider that the video content is going to prepare students for the next class, which means that the content of the video should be focused on the lower levels of cognition. If the video content is too difficult for students, they will get frustrated and give up.

It is critical that videos be short, no more than fifteen minutes, and focused on one topic (Albert & Beatty, 2014; Bergmann & Sams, 2012; Cresap, 2015; Crisafulli, 2015). While some educators have used longer videos in the flipped classroom, many students begin to tune out if the video is too lengthy. By breaking up the videos into smaller chunks, students can watch them in small doses and more easily view them later if they need a focused review on one concept. This is not to say that students should only be assigned one short video prior to a class, but breaking up the videos, makes them easier for students to manage.

Another tip for creating quality videos is to use voice inflection (Bergmann & Sams, 2012) so that the video does not appear bland to the students who will potentially be hearing your voice many times during a course. Try to use a conversational style, just as you would in the classroom, add a bit of humor, and edit the final product to improve video quality (Bergmann & Sams, 2012). It is also vital that teachers adhere to all copyright laws when creating video content (Bergmann & Sams, 2012). Once videos are ready, place them on a learning platform that is easily accessed by students as it greatly increases the chances that they will watch them (Bergmann & Sams, 2012; Francl, 2014; Kim et al., 2014). If videos are not easy to access and available anytime, anywhere, students will not watch them (Francl, 2014). It should also be very clear to students which videos need to be watched prior to coming to each class (Mason et al., 2013).

Although instructors will want their video lectures to be of the utmost quality, they must remember that the more important thing to focus on is the quality of in-class activities (O'Flaherty et al., 2015). Video content is important but will not impress students if the in-class activities are mediocre and not beneficial to the students' deeper understanding of the content. As an instructor experiments with video production, he or she will get more knowledgeable about what works and what does not.

The downside of video content. Grimsley (2015) notes a lack of Internet access as one reason students may not watch video content to prepare for class. The role of the digital divide must be considered when implementing a flipped classroom (Carpenter, Sweet, Blythe, Winter, & Bunnell, 2015; Jensen et al., 2015). The digital divide is the gap between those who have access to technology and those who do not (Carpenter et al., 2015). Most college campuses have ample technology resources available to students while on campus, but students traveling home to rural areas may experience slow Internet connection speeds or may simply just not get service (Carpenter et al., 2015). Furthermore, an instructor must also consider the technology savviness of their students. Grimsley recommends providing technical assistance with systematic instructions that students can use to resolve common video playback problems. Providing this help through an online learning management system puts the help at the fingertips of all students day and night.

While some instructors have found creating video content time consuming (Jensen et al., 2015; Love et al., 2015; Sahin et al., 2015), others have found the process to be relatively quick (Day, 2006). The wide difference in opinions is likely attributed to the level of technological savvy of the instructors and the type of equipment they have available. Regardless, it will take some expertise to create video content for the flipped classroom (Jensen et al., 2015). One way to assist instructors with the magnitude of the amount of video content needed for a full-length semester course is to work with other instructors in their department to create the content (Enfield, 2013). Enfield found that by collaboratively creating video content with all professors teaching the same course, students were taught the basic information in the class consistently, regardless of the semester or instructor. Since videos can be reused in most content areas more than once without major changes, the time investment needed to create the videos will not reoccur each semester (Love et al., 2015).

Modern college students expect technology use in the classroom. McFarlin (2008) states that “the effective use of instructional technology provides a means to provide students with immediate, on-demand access to course content” (p. 90), which is exactly the point of providing video lectures to students in the flipped classroom approach. Students take over the pace and ownership of learning from the instructor.

Previous Research on Flipped Instruction

One of the challenges currently facing the flipped model is the lack of solid evidence proving it increases the academic performance of students in the college classroom (Abeysekera & Dawson, 2015; Crisafulli, 2015; DeLozier & Rhodes, 2016; Grimsley, 2015; Heybourne & Perrett, 2016; O’Flaherty et al., 2015). Many researchers who have either implemented the method or analyzed it have called for more experimental or quasiexperimental studies on its effectiveness (Heyborne & Perrett, 2016). One limiting factor in most studies is that “potential causative mechanisms are being changed between treatments (e.g., shifting to active learning, including additional technology, using additional teaching materials, implementing peer instruction) that it is difficult, if not impossible, to disaggregate them” (Jensen et al., 2015, p. 2).

Another obstacle is the various definitions of what a flipped classroom truly is, which results in some research studies using a partial flip or a full flip and great differences in what occurs during class time (DeLozier & Rhodes, 2016). In addition, "the results claimed in non-peer reviewed articles are suspicious because the research data is undocumented and only descriptive statistics were reported" (Sparks, 2013, p. 65). This issue affects some of the research studies reviewed in this literature review, as many studies were not using statistical measures to determine if flipped instruction improved student performance. Despite the issues addressing the variability within flipped classrooms, many researchers have concluded that the method increases student achievement and their overall perception of learning. Most also agree that the change to the flipped classroom was worth the extra time and effort required for implementation.

Student perceptions. Numerous research studies have been conducted analyzing the effect flipped instruction has on student perceptions of learning. Most of these studies used either an instructor created survey using a Likert scale or a standard end-of-course evaluation to measure student perceptions. Most of the studies reveal that students have positive perceptions of the flipped classroom. Some studies analyzed in this review also measured student achievement in the flipped classroom. These results are mentioned in this section. Studies with more conclusive evidence regarding achievement will be discussed in the next section of the literature review.

Studies revealing positive student perceptions. Bishop and Verleger (2013) analyzed 22 studies on the student perceptions of flipped instruction. Studies used in the analysis had to meet the pair's definition of a flipped classroom by incorporating both video content and engaging in-class activities. Although various types of research studies were analyzed, student perceptions of flipped instruction were found to be positive overall. Bishop and Verleger (2013) did report that some students did not react favorably to the instructional method, but the number of students in this category was low.

In another study, Sparks (2013) flipped an introductory marketing class to determine the impact on student learning and student perceptions. Sparks compared pretest and posttest scores to reveal that 14.8% of students showed significant improvement in their content mastery, 81.5% of students showed no significant growth, and one student showed a significant decrease in performance. During the study, Sparks observed his classroom during active learning activities. Sparks noted that students were better prepared to participate in-class, were able to dig deeper into concepts during group activities, and that groups were able to make better presentations and defenses of their position. In addition, Sparks surveyed students to identify their perceptions to find that 88% of students viewed flipped instruction as a more effective. Students also stated that they were more interested in learning.

A study conducted by Kim et al. (2014) of three undergraduate courses from different disciplines also sought to analyze student perceptions. After experiencing flipped instruction, three classes were asked to take a survey. The researchers discovered that students were satisfied with the flipped classroom, it was helpful to their understanding of course concepts, and it assisted them in regulate their own learning. Additionally, students felt that the environment was more student-centered with more interaction between students and the instructor.

Another study sought to analyze the perceptions of students in a college algebra course (Love et al., 2015). Students were asked to prepare for class each week through textbook readings, slides containing notes, and/or videos (Love et al., 2015). At the end of the course, students were surveyed to determine how they liked the flipped method (Love et al., 2015). Twenty-seven out of 40 students took the survey and 76% of them stated that they enjoyed the flipped format. In addition, 72% stated that learning was more fun in the flipped classroom. The researchers asked students why they preferred this model. Student responses revealed that it allowed them to work at their own pace, work with others, be more focused during class, and become more aware of how they learn. Only four students responded that they preferred the lecture method to the flipped method.

Starr-Glass (2015) flipped his introductory accounting classes to see the impact it would have on students' attitudes and behaviors. Starr-Glass found that students felt burdened by having to learn on ones own, which reduced their self-efficacy at the beginning of the semester, but it increased again once they were used to the instructional model. Furthermore, he found that students felt they were more engaged, enjoyed the use of cooperative learning strategies, and felt they had developed improved problem-solving skills. Finally, he found that students felt they had moved away from surface learning in the course, as deep learning was required to master the content.

Touchton (2015) investigated the flipped method in advanced statistics classes at Boise State University in a study involving 83 students. Touchton used two groups, much like other researchers, and considered various factors, such as gender and GPA, in the analysis of student achievement. Touchton found that students in his flipped classes outperformed students in the traditional classes, but the differences were minimal and not significant. However, when students were asked to evaluate their classroom learning environment, Touchton found statistically significant results in the way students in the flipped section rated the course. Fifty-eight percent of students stated they would like to take another statistics course using the methodology, whereas only 26% of students in the traditional class had an interest in taking another statistics class.

Sahin et al. (2015) conducted a study to find out what students were doing to prepare for a flipped class, their perceptions about the model, and how their achievement compared to a traditional method of teaching. Three classes of undergraduate calculus, with a total of 96 students, were flipped. An analysis of the survey data revealed that students preferred to prepare for class by watching the video lectures over other options, such as reading the textbook, reading other materials, or watching other video materials available online. The survey did reveal that a percentage of students never did anything to prepare for class since it was not required. The researchers also found that 83% of students preferred a class using video lectures over one that did not. The research team also analyzed the quiz data from the flipped classes using t-tests revealing that the average scores from the flipped classes were significantly higher than students in the same course being taught primarily through lecture.

Qualitative research on student perceptions. Strayer (2012) conducted qualitative research within introductory statistics classes on the perceptions of flipped instruction. Strayer's (2012) study is highly cited within the existing research. He used the College and University Classroom Environment Inventory to examine student perceptions in a flipped classroom with 23 students and a traditional classroom setting of 26 students. After analysis of the qualitative data obtained by focus groups and field notes, Strayer concluded that flipped instruction could cause students to feel more uncomfortable as they are forced to work with others and tolerate the unexpected, whereas students typically know what to expect in a traditional classroom. However, he found that as time passed in the flipped classroom, students were more willing to work with others, ask questions, and engage in the classroom.

A study by McCallum et al. (2015) used focus groups to reveal student attitudes towards flipped instruction. The researchers interviewed 60 students with the use of a third party to get unbiased reviews of the method. After analyzing the qualitative evidence, the researchers concluded that student perceptions indicated that flipped instruction aided in their academic success. Students stated that videos allowed them to take better notes, prepare for class, feel engaged, permitted them to have control of their learning and the pace at which they learned, feel more connected to their peers, allowed them to get to know their instructor, and feel more comfortable contacting their instructor outside of class. Students did reveal one downside not previously identified with flipped instruction in that some students struggled to have self-discipline when preparing for class.

Another study using qualitative data studied 50 students in pre-calculus courses through an open-ended survey (Brewley et al., 2015). The team wanted to know how pre-class activities impacted student perceptions of learning. It was revealed that students were able to build confidence by solving simple problems before class, while knowing that they would tackle harder ones in-class with support. In addition, researchers wanted to find out how students felt about in-class activities. They found that students enjoyed engaging in work with other students and appreciated the fact that class was never mundane. They also discovered that students had realized the value of preparing for class as a tool to recognize areas where they needed help with their understanding and that during class their attentiveness was required to learn effectively.

Impact on attendance and withdrawal rates. Stone (2012) conducted a study of the flipped method within two general science courses. Stone found that exam scores in one course improved from an average of 78.5% in the control group to 86.2% in the flipped group on one exam, and from an average of 77.5% in the control group to a 90% in the flipped group on the other exam. Similar results were seen in another course, but the differences were not quite as extreme. When surveying students about their experiences, Stone found overwhelming support for the flipped method. Stone also analyzed attendance data to compare class turnout in the control and flipped groups. The data revealed that students in the flipped classes attended class more regularly. Furthermore, she saw a dramatic reduction in the number of students withdrawing from her general biology course taught using the flipped method.

Impact on different genders. A highly cited study by Lage et al. (2000) also analyzed the perceptions of students. Even though flipped instruction did not officially become a movement until later, Lage et al. technically flipped their classroom. The study surveyed five sections of undergraduate economics students in flipped classrooms with about 40 students per section. The survey asked students to rate their experience in the class on a Likert scale. Results showed that students preferred the flipped class to other classes they had taken in the traditional format and would prefer to take future classes in the flipped format. What makes this study unique is that the researchers analyzed the results of the females and males separately to see if there were any differences in their experiences. The researchers did find that females rated the flipped classroom method higher than their male peers.

Student perceptions of video lectures. Video is a major component of the flipped method, making a study conducted by Kay and Kletskin (2012) relevant to this discussion because it deals directly with the use of video by college students. Kay and Kletskin studied how college students use video during the learning process in an introductory calculus course. The researchers provided students with nearly 60 instructional videos on various topics that walked students through sample problems from start to finish and which ranged from two and a half to 14 ½ minutes each. The videos were not required, but they were made available the first three weeks of class to give students a tool to prepare for a diagnostic exam. The researchers wanted to analyze how the videos were used, when they were watched, and how often they were watched. Kay and Kletskin (2012) discovered that just over two-thirds of their calculus students watched the videos to prepare for the diagnostic exam even though they received no points for doing so. There were 4,675 visits to the website containing the videos made by 190 students with an average of 233 videos being watched per day. The researchers continued to make the videos available to the students after the diagnostic test was taken and found that students continued to access the videos since they were relevant to the content taught during the remainder of the semester. A survey was given to find out why students either watched the video content or failed to use it. The survey revealed that 87% of the students who accessed the videos found them to be useful or very useful to their learning of the material. Kay and Kletskin (2012) found that students watched the videos to help themselves remember the content, review the content, solve problems more effectively, visualize solving problems, and control the pace of their own learning. Furthermore, they found that students liked the interactivity of the video content and the quality of the explanations given. Kay and Kletskin saw improved performance in their class throughout the semester and indirectly connected this increase in performance to the use of the video content offered to students.

Enfield (2013) also conducted a study analyzing student's perceptions of the video lectures used during a flip in an undergraduate multimedia course. When asked if the video content aided student learning, 62.2% of all students responded that the video lectures were very helpful and 37.8% found them somewhat helpful. Students in the course were given quizzes during class, which proved to be an excellent motivator for students to watch the assigned video lectures. Over 80% of students responded that they were more likely to watch the video knowing there would be a quiz on the content. Enfield further reported that students preferred videos that were 20 minutes or less in length and that technological issues only negatively affected students' ability to watch videos in some instances.

One final study conducted by Crisafulli (2015) analyzed how students used videos in a flipped classroom involving 179 students in her freshman composition course over five semesters. Crisafulli did not require the videos be watched, but wanted to see their impact on students. She found that 87% of students had watched at least three-fourths of the video content available by the end of the semester, 61% had watched all video content available, and that many students reported stopping, restarting, and pausing the videos. She did not analyze their grades using a statistical method, but she saw scores on writing projects rise when compared to the scores from previous classes where video content was not available to the students.

Student achievement. While many studies have explored student perceptions with this new pedagogical strategy, fewer studies explore its effect on student academic achievement. Currently, the research on the effectiveness of flipped instruction is mixed. Adding to the mixed reviews is the fact that conducting true experimental research in the classroom setting is difficult. Although most of the studies reviewed come from STEM disciplines, studies from various disciplines were also analyzed to give a well-rounded portrait of this learning strategy.

Studies without conclusive evidence. Some studies on the academic achievement of students in a flipped classroom have resulted without conclusive evidence that the flipped classroom significantly affected academic achievement. Barkley (2015) conducted one such study in an introductory undergraduate agricultural economics course. Like other studies, Barkley compared student test scores from students enrolled in her flipped class with those who had taken her course previously in a traditional lecture format. Student data was used from nine different sections over eight different semesters taught using the lecture method. Barkley had a small sample size in her flipped section with only 35 students, but had over 1,500 students in her previously taught traditional courses with which to compare them. The data revealed that students in the flipped classroom received more A’s and B’s than those in the traditional format, with only one student receiving a C and none receiving D’s or F’s. Barkley’s study resulted in suggestive data, but not anything of statistical significance. Even though Barkley claims that all students in all her sections received the same content, it is hard to imagine that zero changes to the content of the course were made over the multiple years student data was collected. Further complicating this study is the fact that so few students were in the flipped class, making it hard to tell whether their higher achievement was due to the flipped method or simply a smaller class size and more teacher attention.

Day and Foley (2006) conducted a similar study in an introductory computer science course. The pair used an experimental group that received video lectures to watch outside of class, and a control group that received traditional lecture during class. This study was unique in that it attempted to control for the time spent in lectures by using the same in-class activities, homework, exams, instructor, and content for each class. They allowed the experimental group to skip seven class periods to account for the time spent viewing video lectures. The researchers compared student average grades on homework, projects, exams, and in the overall course for both groups to find no statistically significant differences between groups, even though the experimental group did have higher scores in all of the categories than the control group.

Heyborne and Perrett (2016) conducted another study in an introductory general biology course that resulted in mixed results. The quasiexperimental study design involved two sections with a total of 139 students taught concurrently with the same instructor. The researchers gave a pretest, posttest, four exams, and the final exam to analyze student achievement. Heyborne and Perrett found that on one of their unit exams, students in the flipped classroom did obtain scores statistically significant from the lecture class.

One set of researchers set out to prove that the flipped method is not effective, but that active learning is the cause of the achievement gains seen in research results. Jensen et al. (2015) studied two sections of a general biology course with approximately 60 students each at a private university. The researchers did not use video lectures but heavily relied on active learning both in and outside of class. The researchers did evaluate the control and experimental groups to determine that they were equivalent and then analyzed pretest scores, unit test scores, and a common final exam. The researchers did not find any statistically significant results and concluded “the flipped classroom does not result in higher learning gains or better attitudes over the nonflipped classroom when both utilize an active-learning, constructivist approach” (Jensen et al., 2015, p. 9). Even though the researchers did not find evidence that flipped instruction aids in student learning, they did state that they do not believe they have discredited flipped instruction because if active learning strategies are not being used, they can be implemented using a flipped classroom to improve learning.

Zainuddin and Halili (2016) conducted an analysis of current research into flipped instruction involving twenty research studies published in peer-reviewed journals between 2013 and 2015. Their analysis concluded that most flipped studies involve mixed-methods approaches to study the impact on academic achievement and student perceptions. Zainuddin and Halili had the same discoveries as one might make after reviewing the studies in this literature review, which is that flipped studies sometimes show gains in academic achievement, but the results of such studies do not always show statistically significant gains.

Positive impacts on student achievement. Davies et al. (2013) conducted a highly cited study investigating the effect of flipped learning on student academic achievement and perceptions in a pretest-posttest quasiexperimental study involving around 190 undergrads in an introductory statistics course. What made this study unique was the use of three groups to compare the traditional lecture setting, a flipped classroom setting, and a simulation-based instructional setting. The simulation-based setting involved students completing homework in a simulated environment with support from video demonstrations of concepts. The videos used were the same videos utilized by the flipped class. Davies et al. found that there were statistically significant differences between the scores of the three groups. The researchers found that the students in the flipped classroom outperformed the students in the traditional classrooms and the students in the traditional classroom outperforming those in the simulations-based setting.

Albert and Beatty (2014) analyzed the effect of the flipped classroom on the academic achievement of students in an undergraduate management course at a large, urban university with an ethnically diverse population. The quasiexperimental design used nonequivalent groups comparing one section of students taught using the traditional lecture format to a group the following fall semester using the flipped instructional model. Albert and Beatty used the same textbook, syllabus, exams, and teaching objectives for both groups, as well as the same instructor. Students in the two classes were given three exams throughout the class and the results were analyzed using descriptive and inferential statistics. They found that the class receiving flipped instruction had higher average exam grades on all three exams, leading them to the conclusion that the flipped classroom has potential to increase student performance.

Another researcher, Van Sickle (2016), implemented flipped instruction in college algebra courses at a small, private university. Van Sickle compared 54 student final exam scores from traditional classes to 58 student final exam scores from flipped sections of college algebra to reveal statistically significant differences between the two groups. Students in the traditional classes had a mean score of 70.5, while students in the flipped classes had a mean score of 77.2. Like other researchers, Van Sickle found student perceptions of the flipped methodology to contradict their achievement gains. Students in the flipped sections rated the course lower on several major sections of their course evaluation. The differences in the course evaluations were found to be statistically significant.

Peterson (2016) implemented a class flip within an undergraduate introductory statistics course involving one class of 19 students receiving lecture and one class of 24 students receiving flipped instruction. Flipped classes were given 45-minute video lectures to watch prior to class and then were engaged in problem-solving activities in groups during class. Final exam scores from both groups were compared to reveal that the flipped class had a mean a full letter grade higher than the traditional class even though both groups had comparable GPA's. Peterson also surveyed students to find that four criteria were statistically significant between groups: the responses regarding the ability of the instructor to answer questions, the quality of feedback given by the instructor, the overall quality of the course, and the effectiveness of the lecture.

Pierce and Fox (2012) saw similar results to Peterson (2016) when they implemented a flipped model in an undergraduate pharmacology course involving a pretest-posttest group comparison study. Pierce and Fox implemented flipped instruction into one eight-week unit on renal pharmacotherapy, requiring students to watch video lectures prior to class and then engage in a group analysis of case studies during class. The researchers compared 71 student exam scores to previous scores obtained by students learning through the traditional lecture method. The researchers found statistically significant differences in student performance on both the renal unit exam and on the portion of the final related to renal pharmacotherapy. In addition, the researchers gave students in the flipped classroom a survey to determine their overall experience in the course. Overall Pierce and Fox received positive feedback regarding flipped instruction. Ninety-six percent of students indicated that viewing the lecture videos prior to class was important, 96% stated that the instructor connected the video lecture to in-class learning in a meaningful way, and 80% felt that their self-efficacy had improved during the class.

Another pair of researchers, Marcey and Brint (2013), implemented a flipped classroom model for an undergraduate biology course. This study involved 32 students in a lecture section and only 16 in a flipped section. One flaw in the study was that the researchers learned that video lectures, intended to only be used by the flipped section, was being used by the lecture section as well. This discovery was made about two-thirds of the way into the class and the differences in test scores were not quite as dramatic after that point, but the flipped class continued to outperform the lecture section on exams. The researchers found that on two exams the differences between scores in the flipped and lecture classes were statistically significant. Marcey and Brint also analyzed student perceptions to find that students in the flipped classroom rated their overall class experience higher than their peers in a lecture section. The results of the survey revealed statistically significant results on the following categories: the quality of explanations regarding the content by the instructor, the effectiveness of teaching methods in the course, the value of homework assignments to learning, the ability for the course to promote active participation, and the quality of in-class activities.

An effort was made during the research process to analyze all of the most recent studies on flipped instruction to glean as much information possible on previous study methods. While the evidence certainly suggests that the flipped classroom has resulted in higher achievement for students at the postsecondary level, no studies were found involving community college students and only one involved students in an introductory computer science course.

Conclusion

According to Starr-Glass (2015), flipped instruction "is not simply the rearrangement of learning activities and instructional dynamics; rather, it is about seeing those elements in different ways, employing them in more effective ways, and appreciating new ways of using the changed learning space" (p. 75). The flipped method moves students away from "surface-level learning that leads students to cramming as much information into their brains in hope of doing a successful 'data dump' on the exam" (Walker et al., 2014, p. 259) to motivated, engaged, and confident learners (Zainuddin & Halili, 2016). It is a move away from "declarative knowledge (where instructors authoritatively presented 'what is') to procedural knowledge (where learners are required to independently discover 'why it is')" (Starr-Glass, 2015, p. 79).

Based on the research investigated in this literature review, flipped instruction appears to have the potential to increase student engagement and improve academic achievement. The present study experimented with flipped instruction within the researcher's classroom to determine its impact on the students learning who have enrolled in the course. The study is also an effort to improve the researcher's pedagogical practice.

Furthermore, the researcher will continue to reflect upon current teaching practices as well as ever-evolving teaching philosophies and ideologies.

Chapter Three: Methodology

Introduction

The purpose of this action research study is to determine the impact of the flipped classroom on the academic achievement and perceptions of students in an undergraduate computer science class at a community college. The identified research question is: What is the impact of the flipped classroom on the academic performance and perceptions of community college students? The independent variable for the present study was the method of instruction, which was flipped learning. The dependent variable was student academic performance and perceptions during the course. The results of this study will allow the researcher to either continue refining the model for future use in classes or to try a different instructional strategy to resolve the issue of student disengagement. The action research methodology was selected since it is the most appropriate for addressing a local concern in a teacher's classroom (Ivankova, 2015).

Action Research Design

Action research is a powerful way for teachers to learn about their school environment, their teaching methodologies, and their students (Mertler, 2014). Action research aims to solve the everyday problems teachers encounter in the classroom (Fraenkel et al., 2015). By engaging in teacher inquiry, teachers are making "the normal, everyday work of teaching less happenstance and more visible, heightening the opportunity for teachers to improve conditions in their classrooms on a regular basis" (Dana & Yendol-Hoppey, 2014, p. 149).

Action research has several benefits to the classroom teacher. First, action research is a practical way to investigate local issues affecting a given context (Ivankova, 2015), thus allowing the teacher inquirer to delve into a problem occurring in their classroom to develop knowledge "generated from research grounded in the realities of educational practice" (Dana & Yendol-Hoppey, 2014, p. 8). The teacher can shift teaching practice toward effective methods, rather than sticking with methodologies that may not be the most effective. As Auger and Wideman (2000) state, action research offers solutions to the problems encountered in the classroom and allows a teacher to improve instruction for all students.

Action research allows teachers to steer their own professional development to discover what works best for their classroom. Teachers can improve their own teaching practice by becoming more competent and confident (Fraenkel et al., 2015; Ivankova, 2015). Dana and Yendol-Hoppey (2014) state that a final benefit of action research is that inquiring teachers are more likely to make changes based on the information gained from their research because of their large stake in the process. Action research places control for change in the teacher's hands resulting in empowering them (Ivankova, 2015; Mertler, 2014).

Although action research has numerous benefits to the classroom teacher, there are differences separating it from formal research. One of the biggest misconceptions about action research is that it lacks the quality and rigor of traditional experimental research (Mertler, 2014). Mertler states that rigor is "the quality, validity, accuracy, and credibility of action research and its findings" (p. 27). Lederman and Lederman (2015) express that action research is just as impactful as traditional research and should be conducted with as much rigor. When evaluating the rigor of a study, Mertler suggests that the researcher consider the audience for the study. It is critical to note that action research studies cannot be generalized to a population (Fraenkel et al., 2015). Even though this study will not be generalizable, the study's author plans to proceed to resolve a problem in the researcher's classroom. Another difference between action research and formal research pertains to the type of sample used in the study. A random sample is used in in formal research, but in action research it is more likely that a purposive or convenience sample will be used (Fraenkel et al., 2015).

Design of the Study

Numerous variations of the action research process exist; however, the study's examiner chose to use the process recognized by Mertler (2014). Mertler suggests four steps for conducting action research: planning, acting, developing, and reflecting.

Planning. The first step of the process is planning. Mertler (2014) considered this stage one of the most important. The researcher must identify a topic to explore, which may lead the researcher to investigate the effectiveness of a new teaching method, research a problem within their context, or delve into a topic of interest relevant to education (Mertler, 2014). One critical component in this phase is to develop a project that will be manageable and avoids complex topics (Fraenkel et al., 2015). As the planning stage unfolds, Mertler indicates that the researcher should identify a problem, investigate the topic by researching and reviewing the related literature, and then develop a plan for research.

Identifying the problem. The identified research problem was conceived after a common theme of student disengagement was observed in the classroom. The researcher not only found that students were not engaged during lecture, but that little class time was being used for active and cooperative learning activities. The study's author was finding ones own own classroom dull and recognized a need for change.

In the introductory computer science course taught by the researcher, students were expected to learn computer concept objectives relevant to the workplace in a short unit, typically three weeks long, at the beginning of the semester. The textbook for the course contains no information on these concepts so the teacher must generate all learning resources. From past experience in the course, the researcher/teacher observed that students often do not complete outside reading assignments, do not stay attentive during lectures and discussion, and then typically do poorly on the computer concepts assessments. Students simply were disengaged during the unit, which led the teacher to consider a new teaching methodology, flipped learning.

Exploring relevant research. The instructor then moved to the next phase of planning by exploring relevant research related to the flipped classroom methodology. Through relevant research on this methodology (see chapter two) the teacher learned that the flipped classroom model encourages students to take ownership of their learning while providing students with the flexibility to use technology resources to learn at their own pace (Love et al., 2015; O'Flaherty et al., 2015). In addition, research pointed out that the flipped method freed up class time typically used for lecture (Love et al., 2015; O'Flaherty et al., 2015; Peterson, 2016). The teacher then decided that flipped instruction would work well in the computer science classroom since it may allow more time to actively engaging students during class. The research question was developed after considering current research on flipped classrooms. The study explored the impact of the flipped instructional method on the academic performance and perceptions of the researcher’s computer science students. To align the research with a post-positivist position, a research question was sought that would search for a best practice useful in the classroom context.

Development of the research plan. A research plan was developed during the next phase. Action research studies can collect quantitative data, qualitative data, or a combination of both (Fraenkel et al., 2015; Mertler, 2014). Many researchers end up collecting both types of data in a mixed-methods study (Ivankova, 2015; Mertler, 2014). Using both types of data “provides a more complete understanding of research problems than does the use of either approach alone” (Fraenkel et al., 2015, p. 555) and gives the researcher a richer picture of the problem (Dana & Yendol-Hoppey, 2014). When it comes to collecting both types of data, Mertler (2014) considers limited time to be a disadvantage as gathering two types of data requires the researcher to invest time creating and/or implementing two instruments and then ensuring that both types of data collected are valid and reliable. Since the unit involved in the study would be relatively short, the researcher decided to employ a mixed methods action research study using the concurrent quanitative plus qualitative (quan + qual) study design described by Ivankova (2015). Ivankova explains that this design involves two strands where both quantitative and qualitative data are collected concurrently and then separately analyzed. Ivankova states that this design can “compare quantitative and qualitative results to obtain complementary evidence in different types of data and produce well-validated conclusions” (p. 128). This research method allowed the researcher to save time (Ivankova, 2015), which is important given the time restraints within action research.

Ivankova also states that the use of this method allows a researcher better insight into the effectiveness of an intervention. Finally, this method allowed the researcher to triangulate data sources to add credibility to interpretations (Ivankova, 2015). Figure 3.1 shows an overview of the concurrent quan + qual mixed methods study design that was employed in the present study.

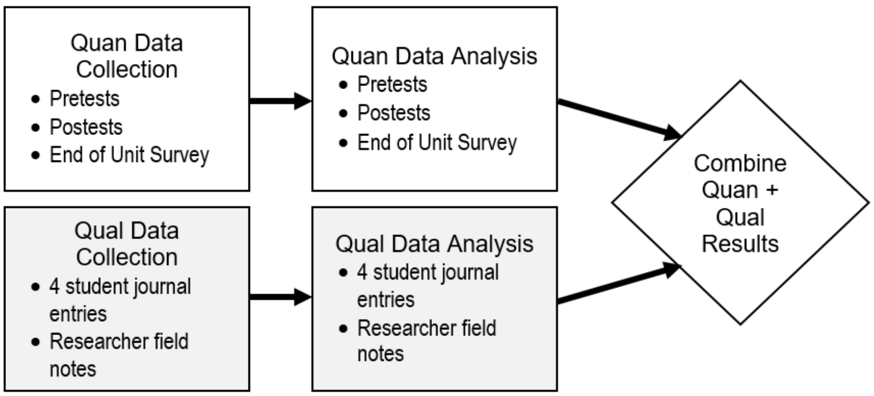

Figure 3.1 Overview of Concurrent Quan + Qual Mixed Methods Study Design. The study involved four different types of data gathered throughout the study. The data was not looked at or analyzed until the conclusion of the study.

Methodology. The present study involved both quantitative and qualitative data collected concurrently during a short computer concepts unit. The use of mixed methods was used to gain additional insight from students regarding their actual learning experiences in the classroom. A quasi-experimental design was employed since it is nearest to a true experiment (Mertler, 2014). Butin (2010) states that quasi-experimental studies are best for determining if an intervention, such as flipped instruction, is successful. The researcher used the designs of previous studies, such as Davies et al. (2013) and Petersen (2016), as guides even though those studies used two separate groups of students.

The study used one group of students in one section of an introductory computer science course. The unit was facilitated solely by the researcher of this study. A pretest-posttest design with one group of students who experienced both the control (the lecture method) and the treatment (flipped instruction) during a two-part computer concepts unit was used to gather data on student achievement. By allowing students to experience both the control and the treatment, Mertler (2014) states that a researcher is better able to compare the effectiveness of the treatment condition to ensure the treatment had an effect and that it was not due to chance or outside factors. While most of the studies analyzed in the literature review used two separate groups to compare the control to the treatment, the use of one group was selected to make the research more manageable as an action research study. The use of one group also eliminated the need to do matching between groups, which is typically needed in quasi-experimental studies (Mertler, 2014). While this study is not meant to be generalized to a greater population, the researcher wanted to make sure that the treatment improved the academic performance of the class' students so that it could be used in future sections of the researcher's course and within other computer science courses taught by the author of this study. Figure 3.2 shows the cycle that was used for the pretests and posttests in the present study.

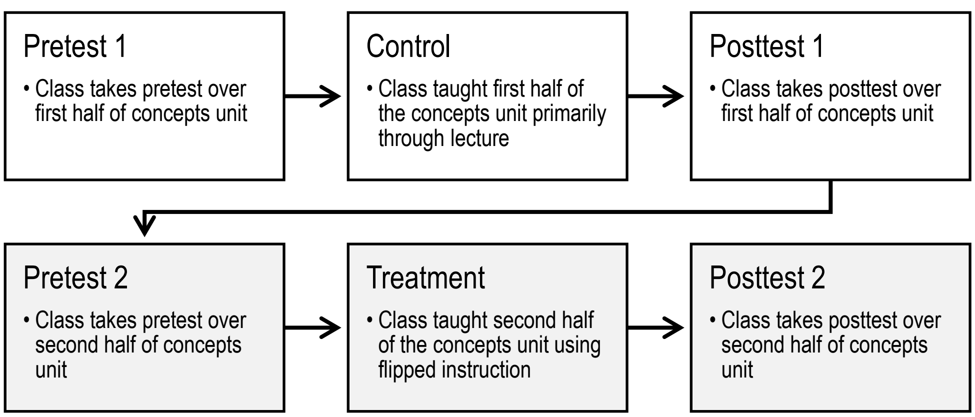

Figure 3.2 Pretest-Posttest Cycle. The study used two pretests and two posttests, each with ten multiple choice questions written to target the identified learning objectives for the unit half.

The objectives of the computer concepts unit were broken up into two groups. When the control was applied during the first half of the unit, students received instruction that reflected the more traditional classroom environment in higher education. The students were presented information through lecture with the integration of minimal class discussion that was targeted at the objectives identified for that unit half. When the treatment was applied, students received instruction through videos watched prior to attending class and on the students' own time.

During class, students participated in active learning activities. All video content and learning activities used during the second half of the unit were again created to teach to the identified learning objectives. During the treatment, students spent more time engaging with the material and less time listening to the researcher regurgitating information. Many of the learning activities used during the flipped half of the unit required collaboration in groups, but some activities were also done individually. Typically, a flipped class session also contained a short video clip (no more than 5 minutes in length) that expanded on the content. Table 3.1 outlines the active learning activities used in the flipped half of the unit.

During each unit half, students were provided an opportunity to assess their own understanding of the objectives by participating in a review activity through the website Socrative. Socrative allows the teacher to create review quizzes that can be taken individually or in groups. The questions used in the review activity were not the same as the ones used in the pretests or posttests. The review was short, containing less than ten total questions. The review allowed students to race one another using the anonymous space race game feature on Socrative. Once an activity was completed, the teacher could pull up questions most groups missed to review and/or address student misconceptions.

Table 3.1

Active Learning Activities Employed

Type of Activity	Activity Description
Cooperative	Students were presented various statements that described one of the four main components of the computer (processor, memory, hard drive, or motherboard) and were asked to identify which component was being described.
Cooperative	Students were paired and given a set of computer specifications. They were asked to make sense of the information provided. Following their discussions in pairs, the class discussed the meaning of each specification.
Cooperative	Students were paired and given two sets of computer specifications. Pairs were asked to compare the two computers and determine which one would be the best (in their opinion). Following their discussions, pairs shared which machine they would recommend and why.
Cooperative	Students were paired and assigned a software category. They were asked to locate a program from that category that would be useful to a college student. They would share a brief description of the program and explain the software requirements with the class.
Independent	Each student downloaded a zipped folder of files. They had to uncompress the files and then organize them in a way that made sense to them. A few students shared their screen with the class and explained their method.
Independent	Students set up a Google Drive account and created an organization system for their student files. They also changed settings based upon their personal needs as a student.

The use of video to implement a flipped classroom was prevalent in the studies reviewed by the researcher (Bergmann & Sams, 2012; Brewley et al., 2015; Crisafulli, 2015; Flumerfelt & Green, 2013; González-Gómez et al., 2016; Grimsley, 2015; Love et al., 2015; Marcey & Brint, 2013; Trogden, 2015). Video content was utilized and placed on the EdPuzzle website, which tracks students who watch the entire video. The instructor began the flipped half of the unit by guiding students through the short process of creating an account on EdPuzzle. There were two ways students could access videos:

through Blackboard with the linked EdPuzzle content or directly through the EdPuzzle website. Students were shown both methods. In addition, time was spent explaining to students the importance of watching the videos prior to attending the next class period to be adequately prepared to actively engage in the class activities.

In the second half of the unit, students were asked to watch a total of three videos on computer hardware, software, and information management. The videos ranged between nine and thirteen minutes in length. All videos provided students with the basic concepts related to the content. Videos were created using the Screencast-O-Matic software program. The researcher took existing PowerPoint presentations and edited them down to create a streamlined slideshow that included only the basic concepts students needed to learn. The slideshow captured with Screencast-O-Matic as the researcher discussed each slide. Minimal text was used on the slides. An effort was made to make the slideshow as visually stimulating as possible. It is important to note that students participating in the study were not disadvantaged if they did not have technology available to them at home. This was a frequent drawback to flipped learning reported by previous researchers (Jensen et al., 2015. While students were required to have Internet access and a device to view video lectures, this could be done on campus during their scheduled lab time. The introductory computer science class sample met two times per week for 50 minutes each session. Each class time was followed by 50 minutes of scheduled lab time that was built into the student’s schedule. This provided a total of 110 minutes of time for students to work on the assignments for the class and to view video lectures. If students could not attend a regularly scheduled lab time, numerous computer labs on campus were available for use.

Pretests and posttests. Figure 3.3 shows the various types of data and instruments used in this study during each half of the computer concepts unit. As previously discussed, pretests and posttests provided the basis of the quantitative data required to determine if learning gains were achieved during each half of the unit. Quantitative data was collected prior to both halves of the computer concepts unit to gauge student understanding prior to any learning. At the completion of each half of the computer concepts unit, students took a posttest to measure if their understanding changed after receiving instruction. The use of a pretest and posttest was utilized by Davies et al. (2013) and was also recommended as one way to measure academic achievement by O'Flaherty et al. (2015).

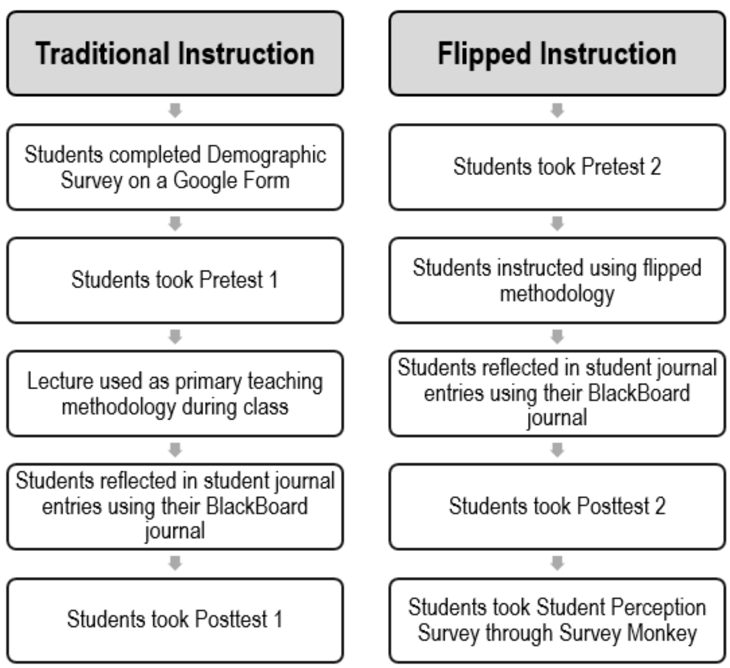

Figure 3.3 Study Methodology. The major difference between the unit halves was the instructional method employed during class. The traditional half of the unit used lecture, while the flipped half used active learning strategies during class.

Student journals. In addition to gathering data through pretests and posttests, the researcher gathered qualitative data throughout the research study. Many researchers studying flipped instruction have used open-ended questions on a survey to gather feedback from their students about their experiences in the flipped classroom (Brewley et al., 2015; González-Gómez et al., 2016; McCallum et al., 2015; Moran, 2015; Sparks, 2013; Strayer, 2012). Mertler (2014) indicates that student journals allow a teacher to see into the "thoughts, perceptions, and experiences" (p. 134) of students. In this study, the teacher incorporated student journals at four strategic points during the unit. The student journals were completed at the end of a given class session. Students were asked to reflect upon their engagement during the class session, as well as provide feedback on what they thought about that day's instructional activities. This data was gathered to provide insight into student attitudes and perceptions of both traditional instruction and flipped instruction.

Teacher journal. In addition to using student journals, the teacher also kept a journal to write down personal observations and reflections during the research study. Mertler (2014) states that teacher journals provide time for the researcher to reflect upon their professional practice. The journal was used to provide additional qualitative data allowing a comparison of teacher and student perceptions of a given class session and the instructional method used.

Student survey. Finally, the researcher gathered additional quantitative evidence through a short student survey completed by study participants at the end of the instructional unit. Ivankova (2015) states that surveys allow a researcher to collect data about the opinions of study participants that can be used to determine the effectiveness of an intervention when used in combination with qualitative data gathered during a study. Many other researchers have used a short student survey to gather information on student experiences within a flipped classroom (Day, 2006; Ferreri & O'Connor, 2013; González-Gómez et al., 2016; Missildine, Fountain, Summers, & Gosselin, 2013; Moran, 2015; Peterson, 2016; Pierce & Fox, 2012; Stone, 2012).

Research Site. The research site is part of a network of five community colleges scattered throughout a metropolitan area in the Midwest. The research site is located on the southeastern side of the metro area in an affluent suburb of over 100,000 residents. According to the research site's Office of Institutional Research and Assessment (2015a), during the fall of 2014, the research site served nearly 5,000 students. Almost 67% of the students enrolled were White, 15.6% were Black, 7.3% were Hispanic, and 2.6% were Asian. Nearly 53% of the student population was female and 47% was male. Almost 75% of the students on campus were considered traditional students with only 47.4% of students were classified as full-time.

A 2006 report by the college's Office of Institutional Research and Assessment analyzed the student retention patterns between 2000 and 2005. The report revealed that females, White students, and traditional students had the highest retention rates. Another factor affecting the retention of students was their student status. Full-time students had rates of retention "22 to 25 percentage points higher than part-time students" (Office of Institutional Research and Assessment, 2006, p. 5). Retention rates are important to community colleges as they offer a window into the complexities of institutions with open enrollment where most students are part-time. Over time, the retention rate at the research site has been around 65%, which the report indicates is typical of urban community colleges (Office of Institutional Research and Assessment, 2006).

Community colleges are challenged with the ever-changing student population on campus as students may dropout, stop-out, opt-out, or transfer-out at any time. In another report from the Office of Institutional Research and Assessment titled *Stop Out and Transfer Report*, it was revealed that 73% of students who chose not to re-enroll for the spring 2015 semester were considered stop-outs (2015b). Hoyt and Winn (2004) define stop-outs as students who enroll in a program of study, stop coursework for a period, and then resume it in the future. Nearly 62% of stop-outs from the research site's campus identified as White, nearly 20% identified as Black, nearly 7% identified as Hispanic, and 1% identified as Asian (Office of Institutional Research and Assessment, 2015b). As previously stated, most students on the campus are part-time students. Part-time students traditionally deal with problems that may impede their completion of a degree, such as children, work, and financial issues (Hoyt & Winn, 2004). A large number of part-time students on the campus is greatly responsible for the high number of stop-outs. All the statistical information presented highlights the challenges affecting the research site in the present study.

Sample. This study used a sample consisting of students enrolled in one section of an introductory computer science course required for all associate degree students. Due to students self-enrolling online, it was impossible to get a random sample for this study. A convenience sample was chosen because it was easiest to obtain. The class section involved was a full computer lab of 25 freshmen and sophomore students meeting on Mondays and Wednesdays at 10 o'clock in the morning. One student was excluded from the data presented in the findings because the student was absent from class on multiple dates during the unit, particularly the dates when pretests and posttests were administered. The remaining 24 students participated in the study. Students were asked to complete a demographic survey on the first day of the course. Table 1.1 shows the demographic makeup of the sample.

Table 3.2

Student Demographic Makeup

Demographic	Number	Percentage
Year		
Freshman	16	66.6%
Sophomore	8	33.3%
Gender		
Female	14	58.3%
Male	10	41.6%
Ethnicity		
Asian	1	4.1%
Black	2	8.3%
Hispanic	2	8.3%
White	19	79.1%

***Ethical Considerations*.** Ethical considerations must be respected in both action research and traditional research. An institutional review board (IRB) at the University of South Carolina (USC) reviewed this study. The IRB panel assessed the present study to assure that risk to participants was limited, data would be kept confidential and private, and that participants had the option to opt out of the study (Fraenkel et al., 2015). The IRB panel at USC determined that the research was considered exempt and an informed consent form was not necessary. Ivankova (2015) states that many action research studies are considered exempt as they involve teachers investigating an instructional method that is part of their professional practice. When students engage in the study as part of the normal course of instruction, no informed consent is required (Ivankova, 2015).

In addition, I followed the procedures of the research site to obtain approval for the study. The process required an outline of the present study in a short memo, as well as submission of the complete research proposal, any instruments being utilized in the study, a letter from a research adviser at USC, and verification that the research study had IRB approval from USC (Office of Institutional Research and Assessment, 2000). The approval process was successfully completed and a letter of approval was received.

Ivankova (2015) warns researchers about issues related to their power and authority over subjects participating in the study. When teachers study their own teaching practices, students may feel coerced to respond in a certain way. Ivankova encourages researchers to make participation voluntary to avoid coercion. Students were informed on the first day of the semester that research would be conducted during their class, even though it is not necessary to reveal this information. The purpose of the study was discussed, what participants could expect was described, and they were guaranteed that information would be kept confidential. Efforts were made to create a community within the class where all participants felt like they were contributing to the action research study.

The study upheld the principle of beneficence described by Mertler (2014). This is primarily because the study allowed for testing of a new instructional method, which if proven effective will enhance the classroom experience for future students. In addition, the study upheld to the principle of honesty as data was collected and analyzed (Mertler, 2014). Finally, the findings of the study were shared with other colleagues in the field to contribute to the professional knowledge of other educators and hold to the principle of importance explained by Mertler.

Acting. Mertler (2014) identifies the second phase of action research as the acting stage in which the researcher collects and analyzes data. This step of the process allows the researcher to begin to answer the research question. This study collected both quantitative and qualitative data and used statistical analysis to ascertain if the treatment of flipped instruction had any effect on computer science students.

Data collection. The present study involved data from both quantitative and qualitative sources. All data was collected concurrently throughout the short computer concepts unit and then analyzed following the conclusion of the study.

Pretests and posttests. The pretests and the posttests were created by the researcher from the objectives in the computer concepts unit for the course. Figure 3.4 shows the learning objectives in both halves of the computer concepts unit that were assessed on both the pretest and the posttest during the study.

The researcher used a table of specifications, similar to ones used by Green and Johnson (2010), to ensure that exam items were focused only on unit objectives and that a range of cognitive levels was required of students. The table of specifications also served as a check for validity based on instrument content, which Mertler (2014) recognized as an "essential quality in quantitative research data" since it determines if the test measured what was intended to be measured (p.149).

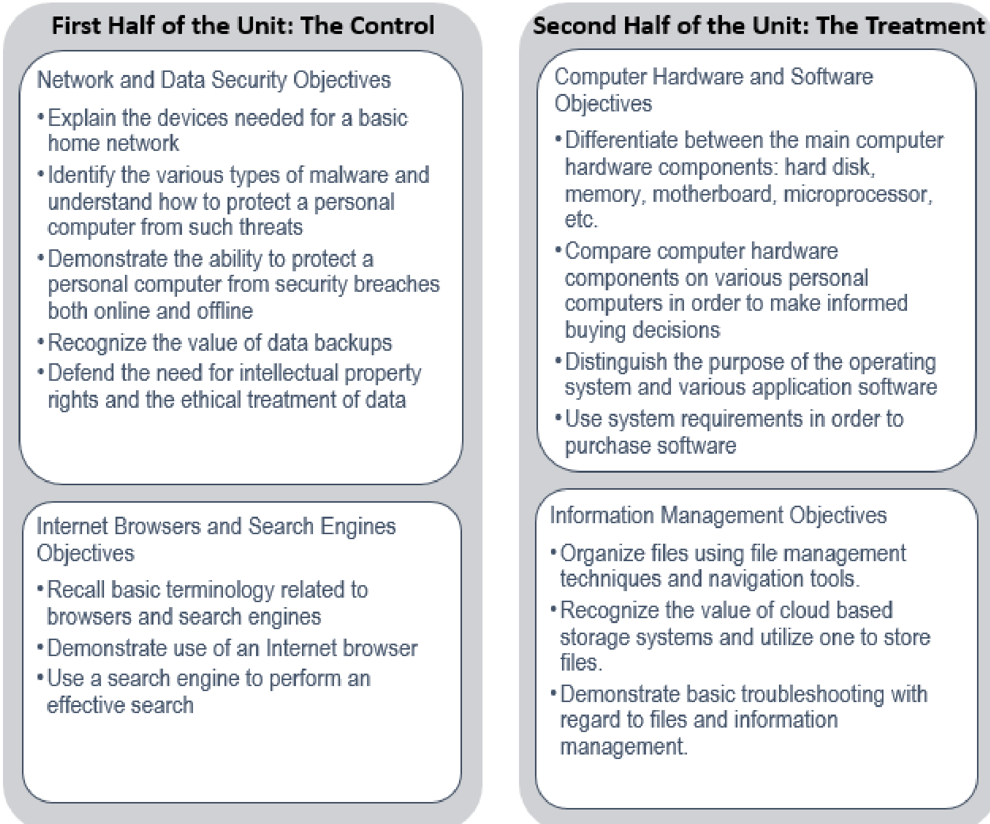

Figure 3.4 Learning Objectives in the Computer Concepts Unit. The unit was broken into two halves. The researcher identified the objectives for each half prior to planning any instructional activities.

Green and Johnson's (2010) recommendations for writing selected response items were followed to ensure that both pretests and posttests were free of trivial test questions, required higher-level cognitive skills, contained effective distractors, and were well-designed instruments measuring what students know, understand, and can do. Only selected response items were utilized since Green and Johnson indicated that these are the simplest for teachers to score. Pretest 1 (see Appendix A) was administered prior to the start of the first half of the computer concepts unit on the following topics: network and data security, Internet browsers, and search engines. Posttest 1 (see Appendix B) was administered to students following the completion of the first half of the concepts unit. The second half of the computer concepts unit contained content on computer hardware, software, and information management. Prior to the start of this half of the unit, pretest 2 assessed student understanding of the material. Pretest 2 is provided in Appendix C. At the completion of the second half of the unit, students took posttest 2 (see Appendix D). To analyze the pretests and posttests easier, a table of specifications has been created for each on the last page of its corresponding appendix.

To ensure that the pretests and posttests were valid measurements of student knowledge about computer concepts, the researcher administered all test items to a sample of students in the fall 2017 semester and then analyzed the questions using the item analysis tool in Blackboard. Blackboard, the learning management system used at the research site, can furnish "statistics on overall test performance and individual questions" making it possible to identify questions that are of low quality and do not adequately measure student understanding ("Blackboard Help," n.d., para. 1). The researcher was concerned with statistics indicating the level of question difficulty and discrimination. Blackboard rates questions by placing them in three categories: easy (more than 80% of students were correct), medium (between 30% and 80% were correct), and hard (less than 30% were correct). Blackboard recommends that instructors review questions rated as easy or hard because they may be of low quality. In addition, Blackboard offers discrimination statistics that differentiate between students who truly know the answer and those who likely guessed. According to Blackboard Help (n.d.), "a good question is a good discriminator when students who answer the question correctly also do well on the test" ("Question stats," para. 6). Blackboard uses the Pearson correlation coefficient to calculate the discrimination value, which ranges from -1.0 to +1.0. The item analysis rates question discrimination as good (questions with values greater than 0.3), fair (values between 0.1 and 0.3), and poor (values less than 0.1). In general, Blackboard recommends that instructors review test questions that have discrimination values labeled as poor. Figure 3.5 shows a sample from the item analysis of the pretests and posttests involved in the research study.

	Question	Question Type	Discrimination	Difficulty	Graded Attempts	Average Score	Std Dev	Std Error
	Posttest 1: Which of the following is an example of a uniform resource locator?	Multiple Choice (QS)	0.41	30.77%	13	0.31	0.49	0.14
●	Posttest 10: The campaign manager for a Missouri governor candidate used a photograph of t...	Multiple Choice (QS)	-0.27	76.93%	13	0.77	0.44	0.13
	Posttest 2: Which of the following describes the behavior of a cookie?	Multiple Choice (QS)	0.44	76.93%	13	0.77	0.44	0.13

Figure 3.5 Blackboard Learning Management System Item Analysis Tool. This is a sample of the data analysis provided by Blackboard. The analysis was used to test the objective questions from each pretest and posttest.

The results of the Blackboard item analysis were placed in an Excel spreadsheet so that test questions could be organized by their respective pretest and posttest. Appendix E contains the full item analysis for the pretest and posttest items. Since there are two pretests and two posttests, pretest 1 questions are identified with numbers and pretest 2 questions are identified with letters. Similarly, posttest 1 questions are identified with numbers and posttest 2 questions are identified with letters. Excel conditional formatting was used to highlight the discrimination values. Items with a discrimination greater than 0.3 were marked with a green dot, items between 0.1 and 0.3 were marked with a yellow dot, and items less than 0.1 were indicated with a red dot. The same process was used to quickly identify the difficulty level of items. Excel conditional formatting labeled easy test items with a green dot, medium test items with a yellow dot, and hard items with a red dot. Blackboard (n.d.) recommends that teachers look at any questions that have an easy or hard difficulty level combined with a poor discrimination value. In the item analysis run, two test items were found that fell into this category. These two test questions were reviewed to check for errors. No errors were found in the test items, so it was decided to keep the two items and to not make changes.

Demographic data. Students were asked at the beginning of the study to report their gender and ethnicity as a means of learning more about the study sample. This was accomplished by asking each student to complete a demographics survey (see Appendix G). The demographics survey was provided to students through a Google Form. Data gathered from the form was pulled into a spreadsheet.

The study sample was not diverse, so it was decided not to analyze the quantitative data by ethnicity or race. Each set of posttest data was broken down to show the mean scores of students based on their gender. This data was analyzed to determine if gender had an impact on student academic performance in both the lecture and flipped methods of instruction. This added analysis provided more insight to the researcher.

Student journals. Students were asked to complete a reflective journal during the research study on Blackboard using the journal feature of the learning management system. Students were asked to complete four journal posts on four separate days during the instructional unit. The first two journal entries were done during the first half of the unit when traditional teaching methodologies were being employed. The second two journal entries were completed during the second half of the unit when flipped instruction was being utilized. Students were asked to respond to two questions by providing a short description of their experiences for the given class period. All entries in the student journal on Blackboard were private or not viewable by other students in the class to maintain each student's privacy. Students were encouraged to be honest in their journal entries and to report their experiences even if they felt it might not be what the researcher wanted to hear. Students were informed that the student journal entries would not be read until the conclusion of the unit, which hopefully alleviated any hesitation to state their honest opinions about the instructional method being used. The journal prompt can be seen in Figure 3.6.

Journal Instructions

During our computer concepts unit, I would like to learn more about your experiences as a student during class. Please spend a few minutes reflecting on your personal experience during our class today. Use the questions below to guide your reflection:

- During our class today, how engaged did you feel you were? What either helped you stay engaged or caused you to be disengaged?
- During our class today, did you feel that the instruction provided was suited to your personal preferences for learning? Why or why not?

If there is anything else that you feel you need to share regarding your learning experience today that goes beyond the scope of the above questions, please add it to your journal.

Figure 3.6 Student Journal Reflection Prompt. The journal prompt was written to get students to share their feelings about their level of engagement on the given class day and to find out if the instruction met their needs for learning.

Teacher journal. In addition to student journals, the researcher/teacher kept a journal throughout the study to record personal thoughts on the research process and to note observations on student engagement. Notes were taken during class periods and after class periods. Comments in the teacher journal included observations on what was being observed and avoided making conclusions about student behavior or study results.

Student survey. One final type of data was collected during the present study. At the end of the unit, students were asked to respond to a survey anonymously through the Survey Monkey website to measure student perceptions. The survey had four parts, all using a five-point Likert scale, to measure the students' attitudes or behaviors as it related to a set of statements. The first section of the survey addressed student attitudes toward traditional instruction. The second section gathered data regarding student attitudes towards flipped instruction. Students were asked about the use of video in the third section. Finally, students shared their opinions about active learning activities in the last section of the survey (see Appendix G).

The survey questions were designed to gather information about the students' overall experiences during the unit. The data was compared to the data collected from the student journals and the teacher journal to triangulate data. Ivankova (2015) states that triangulation establishes credibility within a research study because it allows you to compare different forms of data. The researcher wanted to confirm that what students described in their journals aligned with the survey at the end of the unit and with the researcher/teacher's own notes.

Statistical Analysis. The process of analyzing data collected during a study should be done with "careful scrutiny" (Dana & Yendol-Hoppey, 2014, p 166). Dana and Yendol-Hoppey stress the importance of data analysis as it should lead to action or change in the teacher's practice. The researcher needs to carefully consider the type of data collected and how best to analyze the data. This study is a mixed method concurrent quan + qual design that allows quantitative and qualitative strands to be "combined or synthesized to create meta-inferences aimed at providing corroborating evidence" (Ivankova, 2015, p. 154). A combined data analysis process described by Ivankova was used. The combined data analysis involves first analyzing the quantitative and qualitative data separately and then comparing the results from the different strands. Quantitative data was analyzed first, followed by qualitative data.

Mertler (2014) indicates that researchers can utilize descriptive statistics, inferential statistics, or even both when analyzing data from a study. Descriptive and inferential statistics require different approaches, depending on if the researcher collected categorical or quantitative data (Fraenkel et al., 2015). Descriptive statistics are used to summarize vast amounts of data (Ivankova, 2015; Mertler, 2014). When using descriptive statistics, Mertler cautions researchers as they make conclusions since “correlation does not imply causation” (p. 172). This study analyzed data with both descriptive and inferential statistics. A complete and thorough explanation of the specific statistical methods employed is outlined in chapter four.

Developing. The goal of an action research project is to investigate a problem relevant to the teacher and then develop “workable solutions that improve learning” (Auger & Wideman, 2000, p. 121). The developing stage, the third phase of the action research process outlined by Mertler (2014), directs the researcher to develop an action plan as to how to proceed in the future. The results of the study were analyzed to determine whether flipped instruction changed the academic performance and classroom engagement of the students in class. Following data analysis, the researcher crafted a plan for future implementation or revision of this methodology.

Reflecting. The final stage of the action research process outlined by Mertler (2014) is reflecting. Dana and Yendol-Hoppey (2014) point out that reflection is part of the daily routine of teachers as they think about their teaching practice or their students, but the type of reflection that follows teacher inquiry is more structured and formal. This type of formal professional reflection is a powerful tool “for reflecting on where your action research has taken you, reflecting on what you have learned from engaging in action research, and . . . reflecting on where your action research can take you as you move forward" (Mertler, 2014, p. 214). The researcher reflected on the study in chapter five of this dissertation.

Another part of the reflection process is sharing the results of the study with others (Mertler, 2014). Mertler suggests that researchers need to share the results of their research to eliminate the gap between traditional research and teacher inquiry. The researcher shared the flipped model with two groups of teachers at professional conferences during the past year. First, the model was presented at a state conference for career and technical educators during a workshop session during the summer of 2017. Since the findings of the study were not available to present, only the benefits and challenges of a flipped classroom along with some ways to use the method within introductory computer science courses at the secondary level was shared. The model was also presented, along with preliminary data from this study, at a professional conference for educators from community colleges and universities in the local metropolitan area during the spring of 2018. The researcher was able to provide workshop participants with some of the data, but conclusions had not been made since data analysis was incomplete. The audience was informed that the data was not conclusive, just informational. Overall, the postsecondary group of educators was interested in the method and had many questions about my implementation of it in the classroom.

Summary

Today's college students value active learning strategies (Lumpkin et al., 2015), which are difficult to incorporate when lecture can take up most of the in-class time. By implementing a flipped classroom environment, the lecture is moved out of the classroom and replaced by engaging active learning strategies. The present study sought to determine if a flipped classroom improved the academic performance and perceptions of community college students. This question was investigated using Mertler's (2014) four-step action research cycle. The first step of the cycle involves thoughtful planning, including the research and identification of a problem experienced in the researcher's classroom and then the development of a research plan. The next step, acting, requires the researcher to collect and analyze data to determine if the problem has been resolved. In this study, a pretest and posttest were used to collect data about student achievement in both unit halves. Student journals were also used to capture student reflections on both traditional and flipped learning. A teacher journal allowed the investigator to reflect upon both methods, as well as record observations about student engagement. Finally, a student perceptions survey allowed for the gathering of data on student perceptions about both teaching methods. Developing, the third step of the cycle required the researcher to develop an action plan. The final step of the action research cycle is reflecting, which asks the researcher to think deeply about the research inquiry results and then share those findings with others.

Chapter Four: Findings and Interpretations of Results

Introduction

The teaching methodologies used in higher education have remained nearly the same over the past several decades (Nouri, 2016) despite the introduction of technology and differences in the way younger generations prefer to learn. The Boyer Commission on Educating Undergraduates in the Research University (1998) called for universities to commit to providing learning experiences that require inquiry, as recommended by Dewey (1938) nearly a century ago. Furthermore, the Boyer Commission challenged university faculty to use technology in a way that enriches teaching and learning. Despite these calls for change, universities are still subject to criticism for their devotion to passive learning techniques (Nouri, 2016).

Even though the learning environment within higher education seems much the same, there is some faculty branching out to use more student-centered learning methodologies to engage students (Blair, Maharaj, & Primus, 2016). Wallace et al. (2014) stated “if instructors desire students to gain a deeper understanding of the content and begin thinking like experts, then they need class time for active, collaborative learning” (p. 253). The flipped learning model allows the instructor to spend less time delivering information and more time helping students (Bergmann & Sams, 2012), particularly as they participate in active learning activities.

This study investigated the impact of the flipped classroom on the academic achievement and experiences of students in the researcher’s introductory computer science classroom within a community college context. An answer the following research question was sought: What is the impact of the flipped classroom on the academic performance and perceptions of community college students? The flipped learning model was explored to better engage a new generation of learners who embrace technology readily (Espinoza, 2012), crave affirmation (McAllum, 2016), and are driven to learn and succeed (Worley, 2011). Not only did the researcher seek to engage students more, but also to expand teaching pedagogy and better utilize technology within the classroom.

Findings of the Study

This study collected data with the following instruments: pretests and posttests, student journals, a teacher journal, and a student perceptions survey. Also analyzed were the statistics collected on the videos used during the flipped half of the unit. The quantitative and qualitative data was collected concurrently in this mixed method concurrent quan + qual research study. Priority was given to the quantitative data in this study, but both types of data were analyzed to gather a more complete picture of student experiences with both traditional and flipped instruction.

The study sample. It is important to begin with a brief overview of the study participants before diving into the findings. As already discussed in detail in chapter three, the study involved a class of 25 introductory computer science students. It is important to mention that this study took place at the beginning of the spring semester during which the region was experiencing a widespread flu epidemic and unseasonably cold, icy conditions. In total eight students missed at least one day of the unit because of illness or weather conditions. Considering that only one student missed class during the month following this study concluded, the number of absences during the study was high for this group of students. Based on the recommendations of Davies et al. (2013), students enrolled in the course, but who did not attend most class sessions during the unit would not have their scores included in the data analysis. There was one student who was unable to attend class multiple times during the unit and subsequently missed a couple of pretests and posttests. This student was excluded from the study because of low attendance. Two students missed the posttest during the second half of the unit because of illness. The data was analyzed without the scores for these two participants.

Pretests and posttests. As in the Peterson (2016) study, the mean score for each subunit pretest and posttest was examined to compare the performance of the students based upon the instructional method. The researcher watched for outliers in both groups, which could cause misleading results. No outliers were found in the data. In addition to using measures of central tendency, also used were measures of dispersion by calculating the range and the standard deviation for all pretests and posttests. Table 4.1 presents the number of students who participated in each pretest and posttest, measures of central tendency, and measures of dispersion.

Table 4.1

Measures of Central Tendency and Dispersion

	N	Mean	Mode	Median	Range	Std. Deviation
Traditional Model						
Pretest 1	24	6.29	6.00	6.00	6	1.55
Posttest 1	24	6.21	6.00	6.00	5	1.25
Flipped Model						
Pretest 2	24	4.79	3.00	4.50	6	1.77
Posttest 2	22	6.14	5.00	6.00	7	2.23

As shown in Table 4.1, during the first half of the unit in which traditional lecture methods were used for instruction, the mean scores on the pretest and posttest were almost identical, but students appeared to do slightly worse on the posttest. The mode, representing the most frequent score in the distribution, and the median, representing the midpoint, were identical. The range was smaller on the posttest, showing that there was less difference between the highest and lowest test scores in the distribution. The standard deviation shows the spread of the distribution. For the first half of the unit, the standard deviations on the pretest and posttest reveal that scores were close to the mean.

The flipped half of the unit revealed data that was more varied. The mean score on the pretest was 4.79, but it improved to 6.14 on the posttest. Students appear to have made more academic gains during the second half of the unit. While the mean did increase, the standard deviation was quite a bit higher on posttest 2, revealing that test scores were quite varied and spread out.

To help make sense of the data from the pretest and posttest scores, two frequency polygons were created to compare the data from each set of pretests and each set of posttests for each instructional method. Figure 4.1 displays the frequency polygons for the pretests during the unit.

Figure 4.1 Frequency Distribution on Pretests. Each line represents the frequency of student pretest scores during each unit half.

The data from the pretest administered during the traditional half of the unit appears similar to the bell curve. Scores on the pretest during the flipped half of the unit are more varied and do not show a positive or negative skew. What is also revealed from the frequency distribution is that students generally did better on the pretest given during the first half of the unit taught using traditional instruction.

Figure 4.2 shows the frequency distribution for the two posttests taken during the unit. The frequency data for the posttest scores are very similar to what was seen in the pretest frequency data. The posttest scores following the traditional method of instruction resembled the normal curve and data from the flipped half of the unit were varied and spread out.

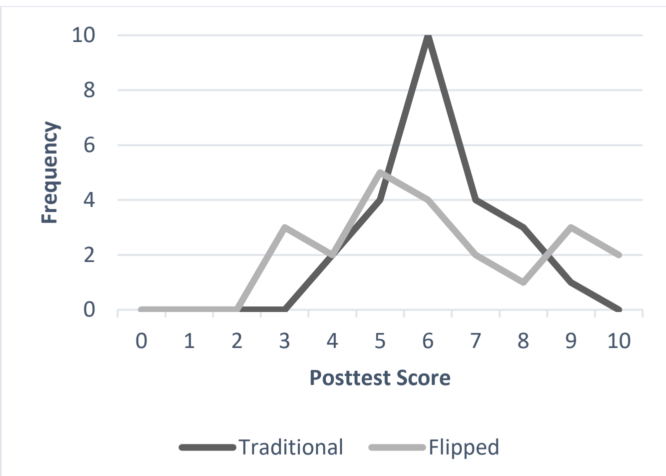

Figure 4.2 Frequency Distribution on Posttests. Each line represents the frequency of student posttest scores during each unit half.

Figure 4.3 shows the distribution between the pretest and the posttest in the traditional half of the unit. When comparing the frequency of scores between the pretest and the posttest during the traditional half of the unit, it is easy to see why the mean scores for these two tests were so similar. Most students scored near the middle.

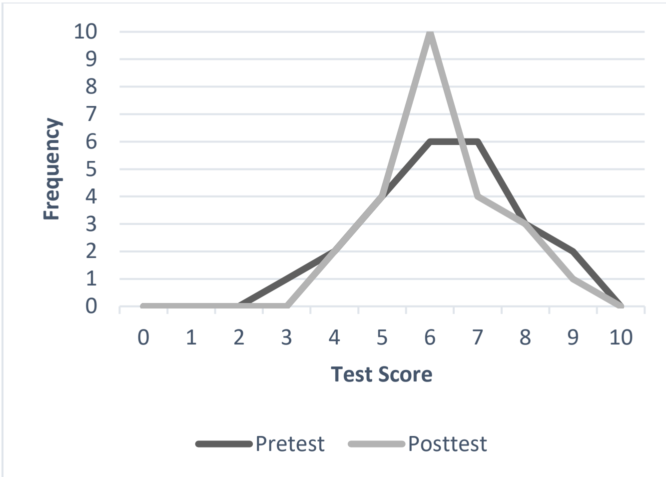

Figure 4.3 Frequency Distribution on Pretest and Posttest during Traditional Half. The lines compare the pretest and posttest scores from the traditional half of the unit.

Figure 4.4 shows the distribution between the pretest and the posttest in the flipped half of the unit. The comparison of the pretest scores and posttest scores from the flipped half highlight the variability of the data. It is encouraging that more students scored eight or above on the posttest and no students scored below a three.

Figure 4.4 Frequency Distribution on Pretest and Posttest during Flipped Half. The lines compare the pretest and posttest scores from the flipped half of the unit.

While it does appear that students did improve more between the pretest and posttest during the second half of the unit, it would be even more helpful to see the percentage of student scores that indeed increased, remained the same, or decreased between the pretest and posttest during each half of the unit. This is particularly useful since the scores on the pretest and posttest during the flipped half of the unit was quite varied. Table 4.2 shows the number and percentage of students who improved their score on the posttest, earned the same score, or who received a worse score.

Table 4.2

Number and Percentage of Students Showing Improvement or Decline

	N	%
Traditional Model		
Improvement	8	33.3
Same	5	20.8
Decline	11	45.8
Flipped Model		
Improvement	12	54.5
Same	7	31.8
Decline	3	13.6

The data in Table 4.2 supports the evidence revealed by the mean scores that students did improve their test scores between the pretest and the posttest during the flipped half of the unit. During the traditional half, students were more likely to either see their test score stay the same or decrease. During the second half of the unit during flipped instruction, over half of the students who took the posttest saw an improvement in their posttest score.

As reported earlier in this study, students were given a demographic survey on the first day of the unit where they self-reported their gender and ethnicity which allowed the researcher to gather information on the sample. The pretest and posttest data was analyzed by gender since the sample was roughly half male and half female. While this was not the focus of the study, the investigator was curious if there would be any differences in the achievement between males and females. An analysis by ethnicity was not possible due to the small sample size. Table 4.3 displays the results of the data analysis broken up gender.

Table 4.3

Measures of Central Tendency and Dispersion by Gender

	N	Mean	Std. Deviation
Traditional Model			
Pretest 1			
Female	14	5.64	1.54
Male	10	7.20	1.03
Posttest 1			
Female	14	6.21	1.25
Male	10	6.20	1.31
Flipped Model			
Pretest 2			
Female	14	3.93	1.38
Male	10	6.00	1.56
Posttest 2			
Female	13	6.00	2.38
Male	9	6.33	2.12

Overall there were some notable findings after analyzing the data by gender. First, females saw more growth in their test scores during the flipped half of the instructional unit with a pretest mean score of 3.93 and a posttest mean score of 6.00. Males showed no improvement during the traditional half of the unit and only a minor improvement during the flipped half of the unit (mean of 6.00 on pretest and 6.33 on posttest). Currently, there is no research to support any conclusion that females benefit more than males in a flipped classroom, but it is interesting that these results indicate such.

Video data. Since viewing videos prior to attending class was an important part of the flipped approach, the data related to how many students watched the assigned videos is relevant to a complete analysis of this study. Figure 4.5 shows the percentage of students who viewed each video assigned during the second half of the unit. Overall, most students in the class chose to watch the assigned video content prior to attending the next class. It is important to note that students were only reminded to watch the computer hardware video before attending the following class period.

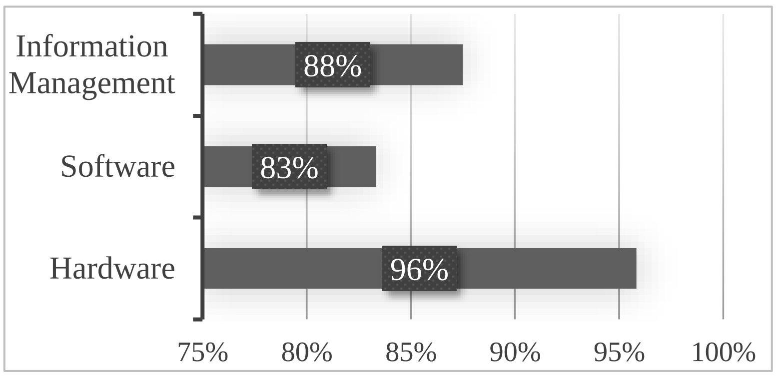

Figure 4.5 Percentage of Students Viewing Assigned Videos. Each bar represents the percentage of students who watched the assigned video prior to attending class.

Student journals. Ivankova (2015) states that qualitative data gathered in a study to be analyzed in a systematic way following logical steps. Ivankova recommends that researchers go through the following steps when analyzing qualitative data: organize the data, review all data to get an overall sense of its meaning, begin coding the data, look for themes in the data, organize themes, and interpret the findings. The researcher followed the outline provided by Ivankova for analyzing the student journal entries gathered during the unit.

Four journal entries were collected from students, two related to their experience with traditional instruction and two related to their experience with flipped instruction. In total, the researcher collected 85 journal entries during the unit, 42 from the first half involving traditional instruction and 43 from the second half involving flipped instruction. The researcher did not read the journal entries until after the completion of the research study.

The first step in the analysis process was to copy each journal entry from Blackboard to a Word document organized by the date of the entries. This made the process of reading and analyzing the journal entries easier. All journal entries were then read in chronological order several times. The researcher looked for themes while reading through all student journal entries. Ivankova (2015) stated that action researchers in education use this type of inductive process for coding. The researcher then developed a qualitative codebook based on the themes that emerged from the journal entries. The researcher decided to use the codes in Table 4.6 as the journal entries were read again to note the themes in each student's entries. Codes were noted next to each journal entry. Sometimes multiple codes were used for an entry.

Table 4.4

Codes Used for Student Journal Analysis

Code	Meaning
EHigh	Student mentions a high level of engagement or attentiveness
EMid	Student rates engagement or attentiveness in the middle
ELow	Student mentions disengagement
TPer	Journal mentions the teacher's personality or likeability
TKnow	Journal mentions the teacher's knowledge of the subject matter
Org	Journal mentions the overall organization of the class
RW	Student comments on the real-world nature of the information
Tech	Journal mentions the use of technology (slideshow, video, etc.)
LAP	Student mentions the learning activity used in a positive way
LAN	Student mentions the learning activity used in a negative way

Student engagement. After analyzing and coding the data collected from student journal entries, the researcher noticed some trends. The first three codes that were used to analyze the journal entries focused on the student's self-rated level of engagement. Students did not always describe their level of engagement in a way that was easy to classify. In general, if a student stated that they were engaged, the journal entry was coded EHigh, meaning they had high engagement. If a student mentioned being somewhat engaged or less engaged than normal, the entry was coded EMid. Finally, if the student directly mentioned low engagement in their entry, the journal entry was coded ELow. Figure 4.6 shows the number of comments from each half of the unit that related to varying levels of engagement.

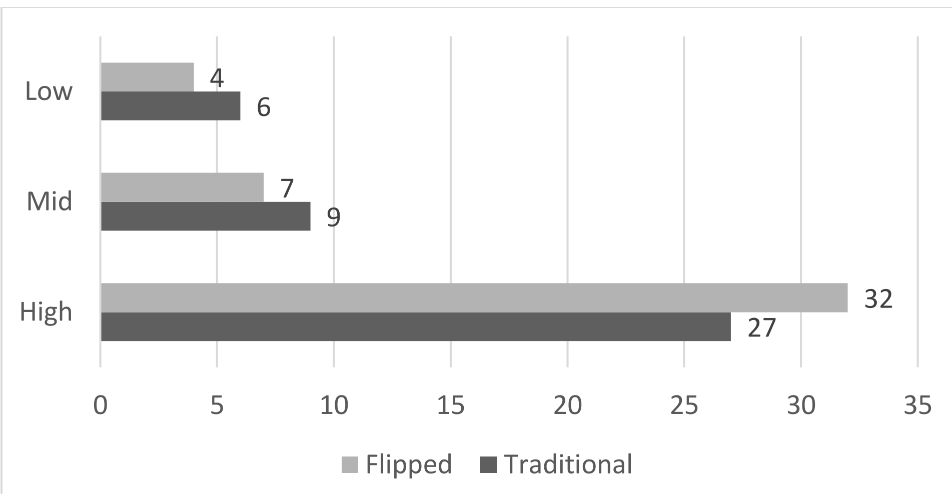

Figure 4.6 Frequency Data from Student Journal Entries Related to Engagement. Each bar represents the number of journal entries coded by the student's engagement level for each type of instruction experienced.

It is noteworthy that during the second half of the unit students commented more frequently about having high levels of engagement. Based on the frequency data, it appears that students were overall more engaged during the flipped half of the unit.

Connection of learning to the real world. Students also appreciated the connection of the content to the real world. Students made a total of 16 comments specifically mentioning the use of examples or application during class instruction to their daily life. More of these comments came during the first half of the unit during lecture. One student commented that the teacher "made connection to what we experience in our lives and how it works." Another commented "the teacher used personal examples from her own experience to help explain what she was talking about."

Teacher characteristics. In addition, the students appreciated the teacher's personality and organization during the unit. The comments indicated that students valued moving through concepts in a logical order, that unnecessary topics were excluded from the discussion, and that instructions were always given in a clear manner. Students also commented on the instructor's personality and use of humor a total of 11 times during the journal entries. One student commented that the instruction included "humor and real-life scenarios" which made paying attention easier. Another student found it easy to stay engaged because the teacher is "very likable."

Use of technology. The use of technology was mentioned 27 times in the student journals during the traditional half of the unit. Comments related to the use of technology in that half of the unit most often referred to the slideshow used to present notes during lecture. One student stated, "paying attention to the notes slides helped me stay focused." Another also liked the slideshow as a means for learning and added that putting the slide notes on Blackboard allowed her to make sure no information was missed. Other students commented that it is their personal preference to have a visual to look at during a lecture.

While comments on the use of a slideshow were the most prominent type of comment, some students also noted the use of video in the lecture class periods. A short video clip was shown on each of the lecture days during the unit. The video clip was always shorter than four minutes and related directly to the concept being discussed. One student noted that the video clip made it easier to stay engaged during the class. Another noted that the use of video broke up the talking. It was clear that for some students, the main highlight of the lecture-based class periods was the use of a slideshow and a short video clip.

Learning activities. Twenty-seven journal entries from the flipped half of the unit mention something related to a learning activity used during the class period in a positive connotation. One student commented that "everything in class today was very interactive" and then described the experience of working in a group and connected this type of learning activity directly to the student's level of engagement. Another student stated, "I felt engaged in class because we worked with our classmates." Finally, another stated that the hands-on nature of learning was helpful.

Some student comments regarding the learning activities directly related to their experiences in groups. One student commented that "Giving feedback to other student's in a group is not very engaging. I would prefer to work alone." Another student stated, "I tried to activate myself a little more in the group activities which kept me very engaged." One student appeared to be conflicted about the use of activities and about one's level of engagement. This student's journal entry began her journal entry by stating "I was pretty bored" and rated her engagement overall as very low. The student went on to describe liking the group activities and helping others in her group. In the end, the student concluded the journal entry with the statement "This class was good."

Technology during the flipped half. A short video clip was typically included in each flipped class period that connected to the content, but very few students mentioned the use of technology during their journal entries during the second half of the unit. In fact, only two journal entries mention the use of technology and in both instances the student references the video shown. Technology was used beyond the use of short video clips during the flipped classes. Students used the computer to research and collaborate on topics in each of the flipped class periods, so it is interesting that so few students mention technology since it was a predominant theme from the entries found during the traditional half of the unit.

Teacher journal. Finally, the teacher journal was analyzed to see if student perceptions matched teacher perceptions for each instructional method. It is important to first note that recording my impressions of student behavior during the class periods was difficult to do during the actual process of teaching the class. Sometimes notes were jotted down in brief seconds where students were navigating to a resource, working in groups, or pondering a question. Most of the time, notes were recorded after the class period ended and instruction had ceased.

Student disengagement during traditional instruction. On the two dates involving lecture instruction, the most common note theme revolved around student behavior that demonstrated disengagement. For example, it was noted on both dates that students were observed on their cell phones, staring blankly at the slideshow, and even putting their heads down on the desk. In the second class period involving lecture, at least two students were working on homework for another class. During the first class period, the researcher noted that students were not interested in answering questions. It took quite a bit of wait time to get any student to respond. Many seemed to want to sit back and not interact with me. Body language observed during the second class period seemed to illustrate this as many students were sitting back in their chairs with their arms crossed.

During the second lecture class period, it was observed that students were very antsy toward the end of the class. Ten minutes before the end of the class the researcher noted that students appeared ready to bolt out of the room. Five minutes prior to the end of class, even though the lecture was not over, students were packing up their belongings. It seemed that the class could not end soon enough for students on this class day.

Student engagement during traditional instruction. Despite an overwhelming majority of the comments written in the teacher journal relating to observations of student disengagement, a few comments on each date during lecture did point to some students staying engaged. On both lecture dates, the researcher observed at least three students taking notes. It was also noted that anytime a video clip was shown, all students were watching the screen and at least appearing to actively listen.

Student engagement during flipped instruction. While most of the notes from the first half of the unit revolved around student disengagement, the notes from the second half of the unit pointed mostly toward student engagement. During group learning activities it was noted that students were actively discussing the material, asking questions of group members, and asking for clarification from the teacher. There were only two notes in the teacher’s journal mentioning disengagement. It was noted seeing a student look at their phone for a moment and the other instance mentioned some apprehension on the first day of the flipped unit as students started their first group activity.

Another theme that emerged from the teacher journal notes revolved around the student’s behavior during the activities. It was noted that students were laughing and smiling multiple times during the second half of the unit. Students were also seen showing confidence in their conclusions during the active learning activities. They readily shared their group’s opinions. They also were seen showing support for other group’s conclusions. Groups were also noted as having a competitive spirit during learning activities.

Student survey. The end of unit student survey (see Appendix G) was given on the last day of the unit through the Survey Monkey website. The survey had four sections that sought to analyze student perceptions about traditional instruction, flipped instruction, video content, and in-class active learning strategies. In each of the four sections, students were provided with a few statements to rate on a Likert scale of 1 (strongly disagree) to 5 (strongly agree). The survey was completely anonymous. A total of 22 students responded to the student perception survey questions, although one student did opt out of responding to a few of the items on the survey.

Table 4.5 shows the results of the first section of the student perception survey on the statements related to the traditional half of the unit. The weighted averages on each statement reveal the average response by the survey respondents. Overall, you can see that the average student was neutral about their feelings about the lecture method. In addition, it is interesting that many students agreed that they have no issues paying attention during classes when the teacher lectures.

Table 4.5

Student Perception Survey: Question 1

Statement	N	SD (1)	D (2)	N (3)	A (4)	SA (5)	Weighted Average
Perceptions about Traditional Instruction							
I prefer learning using traditional instruction (lectures).	22	0	2	9	8	3	3.55
Paying attention during class is easier when the instructor lectures.	22	0	2	7	9	4	3.68
I would prefer to enroll in future classes that use lecture as the primary teaching method.	22	0	5	8	5	4	3.36
I learned the computer concepts content easier because the instructor primarily taught using lecture.	22	1	1	8	7	5	3.64

Table 4.6 presents the data from the second question related to the student's experiences in the flipped portion of the unit. The statements used in question 2 mirrored the statements from question 1. For example, statement 1 on question 1 stated "I prefer learning using traditional instruction (lectures)." Statement 1 on question 2 read "I prefer the flipped method over the traditional lecture method." Overall, students rated the flipped approach lower on the survey as all the weighted averages were lower than the corresponding statements from question 1. Students responded that they were not in favor of the flipped method when compared to the traditional method and that they would prefer not to enroll in future courses using this method. Even though the overall weighted averages were lower when compared to the statements related to traditional instruction, it is interesting to note that the students were less neutral on the statements related to flipped instruction. More students either indicated disagree or agree on the flipped question statements. The students at least had stronger opinions about the learning methodology.

Table 4.6

Student Perceptions Survey: Question 2

Statement	N	SD (1)	D (2)	N (3)	A (4)	SA (5)	Weighted Average
Perceptions about Flipped Instruction							
I prefer the flipped method over the traditional “lecture” method.	22	2	7	5	8	0	2.86
I was able to pay attention during class easier when the instructor used the flipped method.	22	2	6	2	11	1	3.14
I would prefer to enroll in future classes where the instructor uses the flipped method.	22	4	3	7	8	0	2.86
I learned the content easier when flipped instruction was the primary teaching method.	22	3	4	5	8	2	3.09

Since the statements on questions 1 and 2 mirrored each other, it is possible to compare the responses from each of the four statements to one another. Figure 4.7 shows how the student weighted averages compare on each of the four statement stems. Overall students were more favorable of traditional instruction when compared to flipped instruction.

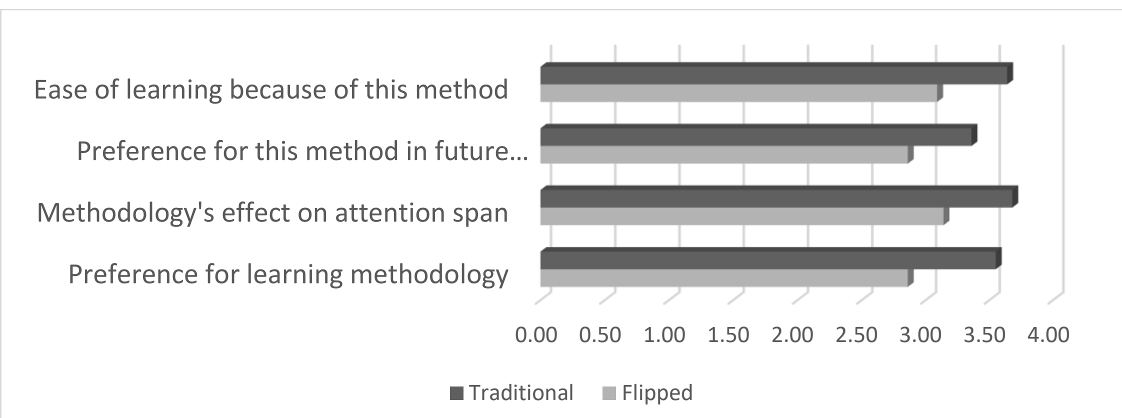

Figure 4.7 Comparison of Traditional and Flipped Instruction Perceptions. Each bar represents the average response for a statement on the student perceptions survey. Statements from question one and two are compared here.

In addition to asking students about their perceptions about the two methods employed during the study, the researcher asked students to respond to some statements in question 3 related to their experiences using the video content during the flipped half of the unit. Table 4.7 shows student responses to the statements regarding the videos.

Table 4.7

Student Perceptions Survey: Question 3

Statement	N	SD (1)	D (2)	N (3)	A (4)	SA (5)	Weighted Average
Perceptions about Video Content							
I watched the assigned videos.	21	0	2	2	6	11	4.24
I found the videos useful.	21	1	1	8	4	7	3.71
I thought the videos were just the right length.	21	0	1	5	11	4	3.86
The videos provided enough information on the topic to allow me to participate in the activities during the following class.	21	0	1	4	10	6	4.00
I had technical difficulties viewing the videos.	21	12	6	1	2	0	1.67

Overall, students appear to have watched the assigned videos, found the videos to be an appropriate length, and found the video to provide enough information to participate in the active learning activities used during the following class. Most students did not have any technical difficulties viewing the videos. Many students were neutral about whether they found the assigned videos useful.

The final question on the survey asked students about their perceptions and experiences related to the in-class learning activities during the flipped half of the unit. Table 4.8 shows the data from question 4. On the whole students had favorable opinions about the in-class activities. The weighted averages for each statement were all above

3.00, which means most students were neutral or above. Most students responded that the in-class activities during the flipped half of the unit allowed them to learn.

Table 4.8

Student Perceptions Survey: Question 4

Statement	N	SD (1)	D (2)	N (3)	A (4)	SA (5)	Weighted Average
Perceptions about In-Class Activities							
I prefer spending class time participating in activities, rather than just listening to the teacher lecture.	22	0	0	9	10	3	3.73
I learned during the in-class activities.	22	0	0	2	17	3	4.05
I liked working in groups during class.	21	0	5	8	6	2	3.24
The in-class activities allowed me to apply what I had learned during the videos.	22	0	0	7	13	2	3.77
The in-class activities helped me perform better on the homework assignments.	22	0	1	5	13	3	3.82

Interpretation of the Results of the Study

This study involved both quantitative and qualitative data to analyze the implementation of flipped learning in a computer science context. Ivankova (2015) highlights the use of both types of data to form conclusions and when developing an action plan. Triangulation increases the integrity of the study findings (Ivankova, 2015). Quantitative data was analyzed first, followed by the qualitative data, but conclusions were drawn following a complete data analysis.

Like other studies (Day & Foley, 2006; Peterson, 2016; Pierce & Fox, 2012; Stone, 2012; Sun & Wu, 2016), students demonstrated more mastery of the content when flipped instruction was used. The pretest and posttest data revealed that the mean scores during the traditional half of the unit decreased (Traditional Instruction M=6.29; Flipped

Instruction M=6.21). During the flipped half of the unit, student mean scores increased (Traditional Instruction M=4.79; Flipped Instruction M=6.14).

Possibly the most important data impacting the researcher's interpretations of academic achievement in the flipped half of the unit pertained to Table 4.2 that showed the percentage of students who improved, remained the same, or declined between the pretest and the posttest during each half of the unit. Most students improved their score on the posttest during the flipped half of the unit (54.5%) compared to the traditional half of the unit (33.3%). To the researcher, this data combined with the mean scores in each half unit strongly suggests that the flipped method increases the likelihood that student achievement will improve. The researcher found it particularly interesting that during the traditional method of instruction 45.8% of students saw a decline in their score on the posttest. It seems that nearly half of the class could have skipped that half of the unit's instructional days and still had the same outcome. This is extremely alarming to the researcher considering the popularity of the traditional model of instruction.

The data pertaining to student achievement by gender provided the researcher with some insight into how both genders are impacted by flipped instruction. Touchton (2015) found that females outperformed males when flipped instruction was implemented in an advanced statistics course. The same was found in this study when comparing female and male performance. During the traditional half of the unit, females increased their score between pretest and posttest relatively little. During the flipped half of the unit, mean scores went from 3.93 on the pretest to 6.00 on the posttest. Males did improve during the flipped half of the unit (Pretest M=6.00; Posttest M=6.33), but not as much as females. Females seem to have benefited from flipped instruction more than males. While this study did not seek to determine why one gender performs better when flipped instruction is implemented, it could possibly be attributed to student personality and learning preferences.

The video data analysis revealed that most students did watch the assigned videos prior to attending class. The researcher did not find this data surprising, as past experiences indicate that students generally enjoy video content. Students were only reminded to watch the first video on computer hardware prior to attending the next class period. Students were expected to remember to watch the other two videos on their own. Had a reminder been provided to students regarding the other two videos it is possible that student viewership would have likely risen.

What was particularly interesting was the students' perceptions about their experiences during the traditional half of the unit. As noted earlier in the findings, many students during the traditional half wrote in their student journal entries that they felt engaged during the class lecture. Many may have noted this level of engagement because of the small infusion of technology using a slideshow and a short video. The teacher journal revealed that the instructor did not see faces and behaviors during the lecture class periods that indicated engagement, but rather boredom and disengagement. In addition, the student perceptions survey revealed that students favored the traditional method of instruction. Again, this seems surprising considering that student test scores on the posttest went down on average, rather than up. In a sense, the findings seem to contradict one another.

During the process of coding the engagement level of each student from their journal entry, it became apparent that students often did not seem sure of their engagement level or what it meant to be engaged. While some were very direct about their level of engagement, others would make contradicting statements within their journal entry. One student wrote about an experience during the traditional half of the unit by stating that “the instruction provided fit well towards my personal preferences.” Then, in the next sentence, the same student indicated that they had a difficult time paying attention during notes. A few students commented that they were barely awake during class, which made it challenging to pay attention, but they still mentioned feeling engaged. It almost seemed as though students wanted to indicate engagement during class, even though they really did not feel very engaged.

While many students mentioned being engaged, at least a little, a total of six journal entries mentioned low engagement. Despite the low engagement students reported, a few justified it. One student stated that “It’s hard to stay engaged when it’s just notes on the board. But I understand that’s pretty much the only way to teach this subject.” Another stated that “today’s lesson aligned well with my personal preferences since there is not many other ways to learn the material.” It seems that some students have accepted that sometimes learning is simply boring. This is disheartening. These student comments also seem to indicate that students felt guilty reporting feeling disengaged and needed to provide justification as to why that is acceptable.

When comparing the entries from student journals to the entries made in the teacher journal, it almost seems like the students and the teacher were in separate classrooms during instruction. The teacher journal indicated that the body language of students pointed toward disengagement, but the student journals indicated that students felt engaged. The researcher concluded that students mostly reported positive feelings about the traditional method of instruction because of two factors. First, students may have wanted to report positive feelings because they believed that was the type of comments the instructor wanted to hear. Second, the traditional method of instruction is so familiar to students that they felt that not praising it would be contradictory to the norm in higher education.

It is also possible that students simply appreciated a well-delivered lecture. Student comments from the journals revealed that many appreciated that the lecture class periods included humor and real-world connections. Some content needs to be delivered through lecture. The data from student journals suggests that students do feel engaged when they feel the content is relevant.

College students appreciate the use of technology in the classroom (Goldman & Martin, 2016; Worley, 2011). Even though technology was used throughout the entire unit, the number of comments in student journal entries regarding technology was significantly higher during the traditional half. The researcher assumes that students appreciated the integration of technology more when lecture was being used as it helped them to stay engaged. Looking at a well-designed slideshow and viewing a short video clip was enough, for many students, to stimulate some interest in the lecture. The researcher found it interesting that so few comments in the flipped half revolved around technology, particularly since technology was used frequently and in a more interactive way. There were numerous mentions of the learning activities in the student journals; however, so the assumption was made that students did appreciate the use of technology during the second half of the unit as well, but simply did not explicitly state this in their entry.

Data from the pretests and posttests indicate that most students did improve their test scores during the flipped half of the unit, but the student perceptions survey revealed that students favored the traditional method of instruction. Some researchers (Heyborne & Perrett, 2016; Lage et al., 2000; Love et al., 2015; Pierce & Fox, 2012; Stone, 2012; Touchton, 2015) have found students prefer the flipped classroom to a traditional one, but other studies (Missildine et al., 2013; Van Sickle, 2016) have reported that students rate the method as inferior. Ferreri and O'Connor (2013) and Van Sickle (2016) found that when given a course survey students provided more negative feedback about the use of a flipped classroom, despite the fact that more students were passing the course and performing better on assessments.

Van Sickle (2016) provides a few reasons as to why students may rate the traditional classroom approach more favorably on a survey. First, Van Sickle believes that students often feel they understand a lecture in the moment, but then, when they leave class the content becomes more confusing as students are applying the concepts to homework assignments on their own. In addition, Van Sickle points out that not doing homework assignments before attending the next class does not typically mean students will not be able to follow along with the lecture. If, however, students fail to prepare for class in the flipped format, they are unable to meaningfully participate and understand learning activities during class. Essentially, it is easier to coast along in a traditional class. Finally, Van Sickle states that participating in learning activities during class creates the opportunity for students to be wrong in front of the teacher and/or their peers. Given that McAllum (2016) asserts that millennials are not risk-takers, Van Sickle's point could explain why students are not as excited about the flipped method. The observations from

Van Sickle seem to apply in the present study to some extent. It is easier for students to show up for class each day and mindlessly listen to a lecture, rather than adequately prepare for class and then actively engage in activities during the class period that may challenge them and force them to be vulnerable.

It was not surprising that the video content was well received by students. Most students did watch the video content prior to attending class and found them useful in preparing them for the learning activities. Enfield (2013) had similar results when surveying students about their perceptions about video content. Many students in the present study made comments indicating that they watched the videos between classes on their mobile phones because of convenience. A few students even arrived early to class to watch the video content, as this is an option due to lab scheduling at the research site.

The final question on the student perceptions survey indicates that overall, students enjoyed the in-class learning activities. It is interesting that despite nearly all students agreeing that they learned during the activities and responding that they prefer to learn in that way, many were neutral or disagreed that they liked working in groups. Nearly all activities completed during the flipped half of the unit were cooperative in nature. It seems that students may prefer to work independently near other students, possibly to avoid becoming vulnerable if they misunderstand the content (McAllum, 2016). This conflicts with previous research done by Worley (2011) who found that millennials generally do enjoy working in groups during class since they are social beings. What also makes this data interesting is the fact that many students were favorable toward the use of active learning, but rated the flipped method low, which is essentially what provides the in-class time needed to use active learning strategies. The issue may revolve around what type of cooperative learning activities students are most comfortable completing in class.

Conclusion

Even though students seem conflicted about the flipped instructional method, the data gathered in the present study does not indicate that student achievement suffered or that students were more disengaged. When compared to the traditional method of instruction, students in this context and from this sample did perform better in the flipped half of the unit and did enjoy the active learning activities. The study is inconclusive, as the findings do not provide ample evidence that the flipped approach radically changed the classroom environment. The results, though, are enough to convince the researcher to continue to refine and develop this approach in future classes.

Chapter Five: Summary and Discussion

Introduction

Higher education classrooms have been full of spectators for too long. Spectators enjoy some benefits of a lecture-based course. They can simply exist in the classroom while the teacher does the work. They can follow along, even if they have never cracked open their textbook or completed any homework assignments. They can also sometimes even guess their way through objective-based exams. Passive learning strategies, such as lecture, do not force students to actively engage with the new information they are learning. Without this active engagement with the content, are students gaining a deep understanding of the material and developing the higher-order thinking skills needed in the contemporary workplace?

King (1993) urged educators to switch to a constructivist mindset in the classroom by incorporating more active learning that requires students to dig into content, rather than regurgitate information heard during a course lecture. Lumpkin et al. (2015) found that college students appreciated the use of active learning strategies in the classroom because they allowed them to connect learning to the real world, collaborate with others, discuss what they have learned, and ask questions to clarify their thinking. Professors seeking to incorporate active learning activities in the classroom can easily make room for them by moving lectures out, but many professors still want to convey some facts and information to their students to lay a foundation for learning. Flipped instruction provides the avenue to lay a foundation of content prior to class so students can dig into the content more deeply during class.

The researcher observed my students during lectures and found them to be disengaged and became tired of glazed over faces. During the computer concepts unit, students seemed to check out. Despite a thorough coverage of the topics during lecture and homework assignments over the same content, students were not doing well on the unit summative assessment. It became clear that students were not mastering the content.

In addition, the study's investigator grew bored with the lecture method. Beyond using a slideshow to provide notes for students, little technology was being used in the classroom. While providing students with a course lecture over the material seemed like the natural thing to do, it was decided that something needed to change to make learning more interactive, improve student achievement, and incorporate more technology during the learning process.

Focus and Overview of the Study

This study investigated the problem of student disengagement in an introductory computer science classroom at a community college with the following research question: What is the impact of the flipped classroom on the academic performance and perceptions of community college students? As a means of resolving this disengagement problem and to incorporate more technology in the classroom, the concepts unit was taught using both traditional and flipped instruction to compare student achievement, engagement, and perceptions of both methodologies. Measurable learning objectives were established for each half of the unit. A pretest and posttest were then written for each unit half, aligning questions to each of the established objectives. Also created was a survey to administer at the end of the unit to measure student perceptions of both traditional and flipped learning, the video content, and the in-class learning activities. Finally, a student journal was used to gather data about how students would describe their engagement level during the unit during both halves.

This study was implemented at a community college located in the Midwest in a suburb of a large metropolitan area. Although the researcher teaches multiple sections of the course, one section was used as the sample for the study. Students self-enrolled in the course based upon their schedule preferences. The section involved in the study had 25 students, all freshmen and sophomores pursuing an associate of arts degree. One student was excluded from the data due to low attendance during the unit, leaving 24 students in the sample.

The study was conducted during the first part of the college semester, beginning in mid-January of 2018. Students spent the first half of the computer concepts unit learning about network and data security, Internet browsers, and search engines using a traditional approach to instruction that primarily involved lecture and class discussion. The second half of the unit focused on computer hardware, computer software, and information management. The second half was taught with a flipped approach that required students to watch a video prior to attending class and then participate in active learning activities during class.

Before the unit began, students were given a short demographics survey to collect data about their gender identity and ethnicity. Students also took the pretest for the first half of the unit. On the following class days, students experienced a class lecture during the entire class period and then reflected upon their engagement in a student journal completed on Blackboard at the end of class. Notes on student engagement were also collected in the teacher's journal during each class day. At the end of the unit half, students took the posttest over the content. During the second half of the unit, the pretest was given again prior to any instruction. Students then were given information on how to access video content and were instructed to watch videos according to their course schedule prior to attending class. During class, students engaged in active learning activities primarily in cooperative groups, to apply the information from the videos. Again, students were asked to reflect on their engagement in class by completing student journals on Blackboard. Notes were once again collected in the teacher journal, as was done in the first half of the unit. At the end of the unit half, students were asked to take the posttest and complete the student perceptions survey.

Summary of the Study

Quantitative and qualitative data were gathered in this mixed methods study to measure both student academic achievement and perceptions. Pretests and posttests were used to measure academic achievement during the computer concepts unit halves to determine how students performed when lecture and flipped instruction were used to teach content. During the lecture unit, student mean scores on the posttest went down slightly. Over 65% of students saw no improvement in their score on the posttest or saw their score decline. It was recorded in my teacher journal that students were disengaged during this half of the unit. Students gave blank stares, had their heads down, and even worked on assignments for other classes during the lecture days. Despite their body language exhibiting disengagement, many students reflected in their student journals during the lecture half of the unit that they felt engaged. It was concluded that students appreciated the lecture mostly because of the small use of technology during each lecture day and the connection of the material to the real world.

During the second half of the unit, student mean scores between the pretest and the posttest improved overall. Scores were quite varied on the second posttest, but 54.5% of students improved their score from the pretest. During the first half of the unit, 45.8% of students saw their test scores decline, but only 13.6% of students experienced this during the flipped half of the unit. Each assigned video during the flipped unit was watched by at least 83% of students in the class prior to attending class. Students commented in their student journal entries more frequently about their high level of engagement during class during the flipped half of the unit. Despite the use of technology during the learning activities in the flipped classes, students commented less about its use. The teacher journal contained more comments about student engagement during the flipped unit. Students were noted to be enjoying the learning activities, smiling, and asking questions.

Students were asked to state their perceptions of both traditional and flipped instruction at the end of he unit in a survey. Despite the behavior noted in the teacher journal and the positive comments from the student journals, the flipped method received a less favorable review by students on the survey. Students were more neutral on their position about traditional instruction, but the weighted averages on each statement were higher when compared to comparing statements regarding flipped instruction. Students did have an overall favorable review of the video content used during the flipped half of the unit. Most found the videos useful, containing enough information to get them started in the content. Students also had an overall favorable opinion about the use of activities during the flipped unit instead of lecture. An overwhelming majority of students responded that they did learn during the active learning activities. Many also responded that they prefer active learning activities to listening to a teacher lecture.

Limitations of the Study

This action research study sought to resolve an educational problem within the teaching context. To make the study manageable, the sample size in the study was small. This is a major limitation of the study, making it impossible to generalize the results to the greater population of community college students. Despite this limitation, the results of the study were applicable to the researcher who was seeking to improve teaching pedagogy in this study's computer science course. The findings of this study will not necessarily be found in other teaching contexts and other subject areas within higher education but could be useful to another researcher preparing to study flipped instruction or an educator seeking tips for implementing this method for the first time.

Another limitation of this study was the potential for data collector bias, which Fraenkel et al. (2015) explain can occur when the primary researcher is carrying out the study with full knowledge of what the study is attempting to discover. In this study, the researcher did not begin the research process attempting to champion one method. The purpose of the research was to test the flipped classroom against the traditional classroom to determine if academic achievement and/or student perceptions improved. From the start, the researcher attempted to keep their personal bias out of the study by avoiding comments about either method to students in the sample. The investigator also avoided looking at the collected data until the conclusion of the entire study. This was possible since most data was collected using sites, such as Blackboard, Survey Monkey, EdPuzzle, and Google Forms. When analyzing the collected data, the researcher attempted to do so without preference for one method over the other. The student journals required the most time for data analysis because of the subjective nature of the task. The investigator read the student journal comments multiple times before developing the codebook. After coding the data, the researcher went through it again several days later to check for any mistakes in coding. These steps allowed for removal any of the researcher's own personal bias from the study as much as was possible.

Action Plan: Implications of the Findings

The findings of the present study were not conclusive enough to deem flipped instruction superior to all other instructional methods, but the study's investigator intends to continue experimenting with the method in courses to better engage students. The most conclusive findings in this study indicated that video content is valued by students. Other researchers, such as Crisafulli (2015), Enfield (2013), Kay and Kletskin (2012), have also found that students value video content. In the future, the researcher plans to harness the power of video in courses by expanding a collection of video lectures to include a wider variety of both content and readiness levels. The researcher would also like to also expand the use of video beyond this flipped unit by integrating it more into traditional contexts as well as in online courses.

The findings from the student survey indicate mixed feelings about flipped instruction. Davies et al. (2013) also had inconclusive results regarding student perceptions, but just as in this study, determined that the flipped approach was at least equal to the lecture method. While student perceptions were more favorable toward traditional instruction on the survey, student comments recorded in student journals and observed behavior from the teacher journal indicated that students were more engaged during the flipped half of the unit. What may be needed in future use of the flipped model is more information to help students recognize what constitutes as engagement during class.

Even though students seemed conflicted about whether they preferred the flipped method to lecture, the researcher believes that students not only enjoyed class more during its use but also learned the content better. The data from the pretests and posttests reveal that students did improve more during the second half of the unit when flipped instruction was implemented. While this data lacks statistical significance, it is suggestive. Barkley (2015), Day and Foley (2006), and Zainuddin and Halili (2016) also found that flipped instruction led to academic gains in the classroom, but their analysis was not conclusive either. Other researchers (Albert & Beatty, 2014; Davies et al., 2013; Marcey & Brint, 2013; Peterson, 2016; Pierce & Fox, 2012; Van Sickle, 2016) have found more conclusive evidence that flipped instruction does improve academic achievement. The researcher believes the method is promising after analyzing the data collected in this study and after reviewing the studies done by other researchers in preparation for this study. The investigator plans to continue to experiment with this method in the same introductory computer science course. In the future, the reseracher would like to expand the use of it into a different computer science course focused on the ethical use of technology. While the flipped approach may not be useful in every class unit, the researcher can see the value of the method in units that are concept heavy.

The findings and experiences have been shared with other educators both at the local institution and within the region. Throughout the course of the study, the researcher was able to have meaningful conversations with other educators at the local institution who had previous experience using flipped instruction to compare experiences. Also discussed was the method of flipped teaching with educators at the institution who no prior knowledge of the approach. As stated previously, the advantages and disadvantages of flipped instruction were formally presented at a state conference for career and technical educators during the summer of 2017. Also presented was the method, along with preliminary findings, at a regional professional development conference for higher educators in the metropolitan area during the spring of 2018. Now that the researcher has analyzed all data and has concluded the research process, the researcher plans to continue to share the research with other educators. During the summer of 2018 all computer science instructors at this study's institution will gather for the annual curriculum meeting. This will be another opportunity to formally present the method and discuss the findings from the study. Finally, the researcher plans to seek out additional opportunities to present at regional conferences over the next year.

Suggestions for Future Research

Further study of the flipped classroom approach is needed to determine if the method truly impacts the academic achievement of students. The findings in this study were not conclusive or generalizable to the greater population of computer science students. The findings do suggest that the flipped classroom can improve student performance. More studies need to be conducted in a greater variety of subject areas and with larger sample sizes (Kim et al., 2014).

As future studies analyze student academic achievement in the flipped classroom, they should consider analyzing the data by gender and ethnicity to determine how various groups are affected by the methodology. To do this, sample sizes need to be diverse and larger than the one used in this study, preferably involving students from numerous course sections taught by several instructors. The findings in this study suggest that females benefited more from flipped instruction. Lage et al. (2000) also suggest that females prefer flipped instruction, but more research is needed. In addition, more studies are needed to determine how students of color are affected by the methodology (Van Sickle, 2016).

Beyond the scope of academic performance in classes using the flipped method, more studies could be conducted on how the flipped method affects student retention rates in various courses. The findings of Missildine et al. (2013) and González-Gómez et al. (2016) suggest that students pass classes at a higher rate when flipped instruction is incorporated. Since few studies have studied this aspect of flipped instruction, it is not apparent whether those findings are typical. Lage et al. (2000) found that female student retention rates increased when the flipped classroom was incorporated in an economics course. Their findings were not conclusive, but more research in this area would be particularly beneficial in the STEM areas where females and students of color are less likely to be enrolled. If the flipped method is found to benefit these groups, it could be a way to draw students into academic areas typically avoided.

Beyond student retention, more research should be conducted that analyzes student attendance and course withdrawal. Stone (2012) found that students attended class more frequently when flipped instruction was used. It would be interesting to analyze this type of data in future studies to see if the method does indeed entice students to attend a course more frequently than one using traditional instruction. Touchton (2015) found that students were less likely to withdraw from a class using flipped instruction. This data was not analyzed in other studies, but it would be helpful to know if the method has any influence on whether a student chooses to persist in a course.

In addition, more research is needed on how the flipped classroom specifically affects a student's engagement during class. This study gathered qualitative data on student engagement, but future studies are needed involving larger sample sizes and that also use quantitative measures. Particularly, focus needs to be given to how students perceive their own engagement during a class, as many in this study seemed conflicted on whether they were engaged. Van Sickle (2016) also saw contradictions in student perceptions. More in-depth research involving student interviews could reveal why students seem to perform better under flipped instruction and then review the method poorly on student evaluations.

Zainuddin and Halili (2016) recommend that more studies should focus on the in-class component of flipped learning. The researcher also believes that more research is needed to analyze student perceptions of the actual active learning activities employed in a flipped classroom. It would be useful to learn about student perceptions of various activity types used to see which students prefer. For example, do students prefer working cooperatively on a task or would they prefer to work independently? Do students prefer discussion, projects, or simulations? The type of activities used may impact the student perceptions of flipped instruction.

Conclusion

The flipped classroom places the responsibility for learning on the student, while allowing the teacher to facilitate learning through questioning, activities, and real-world experiences. Incorporating a flipped classroom into one's teaching pedagogy is challenging, but as this study suggests, it is a worthwhile endeavor. This study compared a traditional approach to learning with a flipped one to determine the impact on student achievement and perceptions. Students seemed conflicted about their engagement level during both types of instruction and about their preferences for learning, but their achievement suggests that students did learn more during the half of the unit that was flipped. From the perspective of the study's investigator, the flipped method not only allowed for more interaction with students during class, but also provided time for learning to be meaningful and enjoyable for students. In the future, the researcher plans to continue to refine implementation of flipped instruction as a means to make learning more engaging for students.

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Appendix A: Computer Concepts Unit Pretest 1

This pretest will gauge your knowledge of networking, data security, internet browsers, and search engines. This pretest is to simply determine your level of knowledge prior to the start of our unit. Read each question carefully and choose the correct answer.

1. A program used to view web pages is called a/an:
    a. Domain Name Server
    b. Internet Service Provider
    c. Uniform Resource Locator
    d. Web Browser

2. You see a billboard advertising a new restaurant that has opened in your area. You are curious and would like to view the menu. What will you need to find the restaurant's website on the Web?
    a. The restaurant's domain name
    b. The restaurant's GPS coordinates
    c. The restaurant's IP address
    d. The restaurant's MAC address

3. Reese is doing research for a paper. He is looking for statistics related to the number of people immigrating to the United States from Ireland in the 1800's. Which of the following represents the BEST way to search for this information on a search engine?
    a. 1800's+immigrants+Ireland-United States
    b. Irish immigration statistics 1800's to United States
    c. "1880's immigration statistics"
    d. How many people immigrated to the United States in the 1800's?

4. You are using Google Chrome to look up information on the Web for a research paper. You are reading a news article when you come across a word that is unfamiliar to you. You need to look up the word. What is the best way to use your browser to accomplish this?
    a. Open a new tab on the browser and search for the unfamiliar word.
    b. Finish reading the news article first. Then use the same tab to look up the unfamiliar word.
    c. Close out of the browser window. Open a new window to search for the unfamiliar word.
    d. Don’t look up the unfamiliar word.

5. Which device directs packets and provides a Wi-Fi Internet connection?
    a. ISP
    b. Modem
    c. Router
    d. Server

6. You downloaded a free software application last week. This week you notice that your computer is acting strangely. Which type of malware is likely the cause of the strange behavior?
    a. Virus
    b. Worm
    c. Trojan Horse
    d. Distributed Denial-of-Service Attack

7. Tamara has a Wi-Fi network at home. Which of the following is a way that she can protect her network from hackers?
    a. Turn off her router when the network is not in use
    b. Turn on the SSID broadcast
    c. Use anti-virus software
    d. Use encryption and a password for the network

8. You would like to set up a network in your home. You are trying to decide which type of connection to use. Which type of connection provides both speed and the most security?
    a. A wired connection
    b. A wireless connection

9. Hector has a lot of projects saved on his laptop. These projects will be used to create a portfolio during his senior year, so it is critical that he does not lose them. Which of the following things should Hector do regularly to ensure his projects are safe?
    a. Backup the projects on an external hard drive
    b. Print the projects and keep a copy of them at his father's house
    c. Scan them with anti-virus software daily
    d. Use a firewall to protect the projects from being stolen by hackers

10. Poetry, architecture, musical compositions, choreography, and sculptures are examples of:
    a. freeware
    b. intellectual property
    c. protected art
    d. trademarked commodities

Table of Specifications for Pretest 1

Learning Goal (Standard)	Remember	Higher Order Cognitive Strategies	Total Items	Percentage
Internet Browsers and Search Engines				
1. Recall basic terminology related to browsers and search engines	1		1	10%
2. Demonstrate use of an Internet browser	1		1	10%
3. Use a search engine to perform an effective search	1	1	2	20%
Network and Data Security				
4. Explain the devices needed for a basic home network	2		2	20%
5. Identify the various types of malware and understand how to protect a personal computer from such threats	1		1	10%
6. Demonstrate the ability to protect a personal computer from security breaches both online and offline	1		1	10%
7. Recognize the value of data backups		1	1	10%
8. Defend the need for intellectual property rights and the ethical treatment of data	1		1	10%
Totals	8	2		
Percentages	80%	20%		

Appendix B: Computer Concepts Unit Pretest 2

This pretest will gauge your knowledge of computer hardware, software, and information management. This pretest is to simply determine your level of knowledge prior to the start of our unit. Read each question carefully and choose the correct answer.

1. Which of the following computer hardware components is the brain of the computer?
    a. Hard Drive
    b. Memory
    c. Microprocessor
    d. Motherboard

2. What is the difference between the hard drive and memory?
    a. The hard drive stores data temporarily, while memory stores it permanently.
    b. The hard drive stores data permanently, while memory stores it temporarily.
    c. Memory can be formatted, but the hard drive cannot.
    d. Memory can be defragmented, but the hard drive cannot.

3. When shopping for a new laptop you see various computer specifications on store displays. Which of the following measurements below is describing the amount of hard drive space on a laptop?
    a. 1 TB
    b. 2 MB
    c. 8 GHz
    d. USB 3.0

4. What does it mean if the computer hardware specifications state that the graphics card is integrated?
    a. The graphics card comes on the motherboard.
    b. The graphics card can be boosted to get extra processing power.
    c. The graphics card has its own built-in fan to keep cool.
    d. The graphics card has its own memory, which means it will not use the system memory.

5. Which of the following is an example of system software?
    a. Microsoft Office 365
    b. Microsoft Windows 10
    c. Rosetta Stone: Spanish
    d. Kaspersky Internet Security

6. The table below lists software applications used by a photographer to do her job. Look over the system requirements below and then answer the question that follows:

Adobe Photoshop CC	*Intuit QuickBooks Desktop Pro 2017*
▪ Intel or AMD processor; 2GHz or faster ▪ Windows 7, 8.1, or 10 ▪ 2 GB RAM (8 GB recommended) ▪ 2.6 GB available hard drive space	▪ Windows 7, 8, or 10 ▪ 4 GB RAM ▪ 2.4 GHz processor speed

Considering the two software applications listed above, what is the LEAST amount of RAM that should be used to run these applications on the photographer's computer and maintain optimum performance?
    a. 2 GB
    b. 4 GB
    c. 6 GB
    d. 8 GB

7. What is the purpose of a file extension?
    a. Identify the date and time a file was created
    b. Identify the name of the file
    c. Identify the size of the file
    d. Identify the type of file

8. Gino is a college student. He doesn't have his own computer yet, but still manages to access one to do his school work. He uses his roommate's laptop, his mom's desktop computer, and the library computer lab each week depending on what is most convenient and available to him. What is the best type of storage for Gino to rely on since he uses so many different devices to complete school assignments?
    a. CD-ROM
    b. Each computer's hard drive
    c. The cloud
    d. USB flash drive

9. The following file path is in the footer of a document you are currently looking at during a weekly management meeting: Z:\Shared Documents\Finance\Payroll\2017 Payroll Assumptions.docx. This document is saved on a network drive used by all company employees. Which subdirectory will you have to be in to open the 2017 Payroll Assumptions file?
    a. Z:\
    b. Shared Documents
    c. Finance
    d. Payroll

10. You need to send a very large file through email to your coworker who is currently out of state on a work-related trip. Every time you attempt to attach the file to an email and send it a message pops up that the attachment is too large. What is the best solution to this issue?
    a. Mail a flash drive to the hotel where your coworker is staying.
    b. Split the file into smaller parts and email all of the parts in separate emails as attachments.
    c. Compress the file in a zipped folder and then email it.
    d. You cannot solve this issue. The file cannot be sent.

Table of Specifications for Pretest 2

Learning Goal (Standard)	Remember	Higher Order Cognitive Strategies	Total Items	Percentage
Computer Hardware and Software				
1. Differentiate between the main computer hardware components: hard disk, memory, motherboard, microprocessor, etc.	2		2	20%
2. Compare computer hardware components on various personal computers to make informed buying decisions	1	1	2	20%
3. Distinguish between the purpose of the operating system and various application software	1		1	10%
4. Use system requirements to purchase software		1	1	10%
Information Management				
5. Organize files using file management techniques and navigation tools	1	1	2	20%
6. Recognize the value of cloud based storage systems and utilize one to store files		1	1	10%
7. Demonstrate basic troubleshooting with regard to files and information management		1	1	10%
Totals	5	5		
Percentages	50%	50%		

Appendix C: Computer Concepts Unit Posttest 1

This posttest is to determine your understanding of the first half of our computer concepts unit over networks, data security, internet browsers, and search engines. Read each question carefully and select the correct answer.

1. Which of the following is an example of a uniform resource locator?
    a. .edu
    b. 100.132.8.255
    c. AB-3C-R8-QU-91
    d. http://www.mcckc.edu

2. Which of the following describes the behavior of a cookie?
    a. Screens IP addresses
    b. Tracks your path through a website
    c. Maintains the bandwidth for your Internet connection
    d. Juggles multiple tasks coming through a server, such as email, downloads, etc.

3. Ivan is a new college student at MCC-Longview. He goes to the following webpages at least once per day: the MCCKC Blackboard Log In page, the MyMCCKC Log In page, the MCCKC student calendar page, and the MCCKC Longview Library page. Since he visits these sites frequently he should:
    a. bookmark these pages in his web browser.
    b. open these pages in separate browser windows and leave them open all the time.
    c. simply navigate to each page by using a simple Google search for it each time he needs it.
    d. create shortcuts to these pages within a folder named "Important Pages" on his desktop.

4. Jazmine is doing research on the Holocaust. She specifically wants to learn more about the people murdered by the Nazis who were not Jewish, such as the mentally handicapped, homosexuals, gypsies, etc. Which of the following keyword searches would give her the BEST results?
    a. The Holocaust
    b. Jews Holocaust Nazis
    c. "Nazi annihilation of Jews" Holocaust
    d. Nazi concentration camps murder of non-Jews

5. Which is required to have a home Internet connection?
    a. Hub
    b. ISP
    c. Range Extender
    d. Server

6. Alex receives an email from Bank of America requesting that he click a link within the message and log in to his online backing account. What type of scheme is this?
    a. Distributed Denial-of-Service Attack
    b. Phishing
    c. Sniffing
    d. Spam

7. Dwight is starting his own small business. He will have three employees, each with their own computer in the office. Each employee will need their computer to access customer account information, some of which is confidential. What is something Dwight should train his employees to do to protect this confidential information?
    a. Change your password a few times per year and never share it with anyone.
    b. Create an easy to remember password. Write the password down on a sticky note in your desk if you cannot remember it easily.
    c. Shut down their computers each night.
    d. Turn off your monitor when leaving your desk so that confidential information is not easily seen.

8. Which type of network would be best for a small coffee shop wanting to allow customers free Wi-Fi during their visits?
    a. A wired connection
    b. A wireless connection

9. Sonya had thousands of photos of her grandchildren on her laptop. Unfortunately, the hard drive crashed and she lost all of the data on the hard drive. Which of the following would have been the BEST solution to prevent this problem?
    a. Email important pictures to her children for safekeeping.
    b. Move all photos to a flash drive once per year and store in her home.
    c. Print all of the photos and store them in albums.
    d. Sync her pictures library from her hard drive to Google Photos in the cloud.

10. The campaign manager for a Missouri governor candidate used a photograph of the candidate for campaign materials. The photograph was not edited and permission was not given by the photographer. This is a violation of ____ .
    a. copyright law
    b. ethical campaign statutes
    c. the Constitution
    d. trademark law

Table of Specifications for Posttest 1

Learning Goal (Standard)	Remember	Higher Order Cognitive Strategies	Total Items	Percentage
Internet Browsers and Search Engines				
1. Recall basic terminology related to browsers and search engines	2		2	20%
2. Demonstrate use of an Internet browser		1	1	10%
3. Use a search engine to perform an effective search		1	1	10%
Network and Data Security				
4. Explain the devices needed for a basic home network	2		2	20%
5. Identify the various types of malware and understand how to protect a personal computer from such threats	1		1	10%
6. Demonstrate the ability to protect a personal computer from security breaches both online and offline		1	1	10%
7. Recognize the value of data backups		1	1	10%
8. Defend the need for intellectual property rights and the ethical treatment of data	1		1	10%
Totals	6	4		
Percentages	60%	40%		

Appendix D: Computer Concepts Unit Posttest 2

This posttest is to determine your understanding of the second half of our computer concepts unit over computer hardware, software, and information management. Read each question carefully and select the correct answer.

1. Which of the following computer hardware components is the heart of the computer?
    a. Hard Drive
    b. Memory
    c. Microprocessor
    d. Motherboard

2. Which of the following is TRUE regarding the hard drive and memory?
    a. Memory is considered permanent storage, while the hard drive is considered temporary storage.
    b. Memory stores pieces of programs for the processor to access quickly and the hard drive stores data, such as photos, applications, documents, etc.
    c. The hard drive stores the operating system, but memory stores other software applications.
    d. When the computer turns off the data on the hard drive empties, but the data in memory remains.

3. You are shopping for a new computer. You see four laptops on display in the store and compare them based on only the hard drive. Which one is the BEST choice?
    a. 3.4 MHz single-core processor
    b. 3.1 GHz dual-core processor
    c. 2.8 GHz quad-core processor
    d. 3.4 GHz single-core processor

4. Your best friend is looking at new laptops. He makes the following four statements upon reviewing the computer specifications. Which of the statements made is TRUE?
    a. 1 GB of memory would give him lots of space to store music and videos.
    b. Screen size is measured in inches horizontally from left to right.
    c. This computer comes with Microsoft Office, which he's heard is a nice operating system.
    d. This computer has an HDMI port, which will allow him to connect it to a high-definition TV.

5. Which of the following is an example of system software?
    a. Adobe Acrobat
    b. Google Docs
    c. Device drivers for a printer
    d. Microsoft Office 365

6. The table below lists software applications that will be used by a web designer. Look over the system requirements below and then answer the question that follows:

Adobe Dreamweaver CC ▪ Intel or AMD processor; 2GHz or faster ▪ Windows 7, 8.1, or 10 ▪ 2 GB RAM (4 GB recommended) ▪ 1.1 GB available hard drive space	*Adobe Animate CC* ▪ Windows 7, 8, or 10 ▪ 2 GB RAM (4 GB recommended) ▪ 2 GHz processor or faster ▪ 4 GB available hard drive space

Considering the two software applications listed above, what is the minimum amount of hard drive space that would be required to run these applications on the web designer's computer?
    a. 1.1 GB
    b. 2 GB
    c. 2 GHz
    d. 5.1 GB

7. Terry emailed a Word document he created in Word 2016 to another student working with him on a group project in Biology. His friend opened Excel 2016, but cannot get the Word document from Terry to open. What is the problem?
    a. Excel can only open files native to Excel, which does not include Word documents.
    b. His friend does not have the newest version of Word.
    c. Terry did not save the document with the correct file extension to be opened in Excel.
    d. The file is corrupt so it cannot be opened.

8. Sachin scanned some old family photographs for his father onto his computer. There are about 40 photographs total. He needs to get these to his father in their new digital format. What is the BEST method to do this?
    a. Buy a new external hard drive to store them on
    b. Email them by sending 4 separate emails with 10 attachments each so they aren't too large to go through the email server
    c. Put them on an USB flash drive
    d. Save them to a high-speed zip drive

9. Sheila saved a photograph she took this morning from her camera to her computer, but cannot find it where she thought she put it. How could Sheila locate this photograph quickly?
    a. Go to File Explorer and look in the music library
    b. Go to her camera and find the photograph file name. Then, look through the various folders on the computer for that specific name
    c. Go to the pictures library and view the pictures by date (newest to oldest)
    d. Use File Explorer to search for "recent photographs."

10. Which of the following is NOT TRUE regarding cloud storage?
    a. Files stored in the cloud are scanned for malware automatically.
    b. Files stored in the cloud can easily be shared with others.
    c. You can access files stored in cloud storage from any computer with Internet access.
    d. You can organize files stored in cloud storage using folders.

Table of Specifications for Postest 2

Learning Goal (Standard)	Remember	Higher Order Cognitive Strategies	Total Items	Percentage
Computer Hardware and Software				
1. Differentiate between the main computer hardware components: hard disk, memory, motherboard, microprocessor, etc.	1	1	2	20%
2. Compare computer hardware components on various personal computers to make informed buying decisions		2	2	20%
3. Distinguish between the purpose of the operating system and various application software	1		1	10%
4. Use system requirements to purchase software		1	1	10%
Information Management				
5. Organize files using file management techniques and navigation tools	1	1	2	20%
6. Recognize the value of cloud based storage systems and utilize one to store files	1		1	10%
7. Demonstrate basic troubleshooting with regard to files and information management		1	1	10%
Totals	4	6		
Percentages	40%	60%		

Appendix E: Item Analysis

Question	Discrimination	Difficulty	Average	Std Dev	Std Error
Pretest 1: A program used to view web pages is called a/an:	-0.05	0.9231	93%	0.28	0.08
Pretest 2: You see a billboard advertising a new restaurant that has opened in your area...	0.51	0.7693	77%	0.44	0.13
Pretest 3: Reese is doing research for a paper. He is looking for statistics related to ...	0.4	0.4616	47%	0.52	0.15
Pretest 4: You are using Google Chrome to look up information on the Web for a research ...	0.84	0.9231	93%	0.28	0.08
Pretest 5: Which device directs packets and provides a Wi-Fi Internet connection?	0.19	0.9231	93%	0.28	0.08
Pretest 6: You downloaded a free software application last week. This week you notice th...	0.3	0.5385	54%	0.52	0.15
Pretest 7: Tamara has a Wi-Fi network at home. Which of the following is a way that...	0.84	0.9231	93%	0.28	0.08
Pretest 8: You would like to set up a network in your home. You are trying to decide whi...	N/A	1	100%	0	0
Pretest 9: Hector has a lot of projects saved on his laptop. These projects will be...	0.84	0.9231	93%	0.28	0.08
Pretest 10: Poetry, architecture, musical compositions, choreography, and sculptures...	0.33	0.5385	54%	0.52	0.15
Posttest 1: Which of the following is an example of a uniform resource locator?	0.41	0.3077	31%	0.49	0.14
Posttest 2: Which of the following describes the behavior of a cookie?	0.44	0.7693	77%	0.44	0.13
Posttest 3: Ivan is a new college student at MCC-Longview. He goes to the following webpa...	0.65	0.6154	62%	0.51	0.15
Posttest 4: Jazmine is doing research on the Holocaust. She specifically wants to learn m...	0.84	0.9231	93%	0.28	0.08
Posttest 5: Which is required to have a home Internet connection?	0.41	0.3077	31%	0.49	0.14
Posttest 6: Alex receives an email from Bank of America requesting that he click a link w...	-0.16	0.7693	77%	0.44	0.13
Posttest 7: Dwight is starting his own small business. He will have three employees, each...	0.33	0.7693	77%	0.44	0.13
Posttest 8: Which type of network would be best for a small coffee shop wanting to allow ...	N/A	1	100%	0	0
Posttest 9: Sonya had thousands of photos of her grandchildren on her laptop. Unfortunate...	0.29	0.7693	77%	0.44	0.13
Posttest 10: The campaign manager for a Missouri governor candidate used a photograph of t...	-0.27	0.7693	77%	0.44	0.13

Question	Discrimination	Difficulty	Average	Std Dev	Std Error
Pretest A: Which of the following computer hardware components is the brain of the compu...	0.48	0.5385	54%	0.52	0.15
Pretest B: What is the difference between the hard drive and memory?	0.47	0.7693	77%	0.44	0.13
Pretest C: When shopping for a new laptop you see various computer specifications on sto...	0.07	0.6924	70%	0.49	0.14
Pretest D: What does it mean if the computer hardware specifications state that the...	0.64	0.6924	70%	0.49	0.14
Pretest E: Which of the following is an example of system software?	-0.46	0.8462	85%	0.38	0.11
Pretest F: The table below lists software applications used by a photographer to do her ...	0.61	0.2308	24%	0.44	0.13
Pretest G: What is the purpose of a file extension?	0.52	0.6154	62%	0.51	0.15
Pretest H: Gino is a college student. He doesn¿t have his own computer yet, but still ma...	-0.15	0.5385	54%	0.52	0.15
Pretest I: The following file path is in the footer of a document you are currently look...	-0.41	0.3077	31%	0.49	0.14
Pretest J: You need to send a very large file through email to your coworker who is curr...	0.19	0.9231	93%	0.28	0.08
Posttest A: Which of the following computer hardware components is the heart of the compu...	0.49	0.4616	47%	0.52	0.15
Posttest B: Which of the following is TRUE regarding the hard drive and memory?	-0.03	0.6154	62%	0.51	0.15
Posttest C: You are shopping for a new computer. You see four laptops on display in the s...	0.37	0.8462	85%	0.38	0.11
Posttest D: Your best friend is looking at new laptops. He makes the following four state...	0.59	0.8462	85%	0.38	0.11
Posttest E: Which of the following is an example of system software?	0.34	0.077	8%	0.28	0.08
Posttest F: The table below lists software applications that will be used by a web design...	0.52	0.6154	62%	0.51	0.15
Posttest G: Terry emailed a Word document he created in Word 2016 to another student work...	0.19	0.9231	93%	0.28	0.08
Posttest H: Sachin scanned some old family photographs for his father onto his computer. ...	0.17	0.5385	54%	0.52	0.15
Posttest I: Sheila saved a photograph she took this morning from her camera to her comput...	0.34	0.4616	47%	0.52	0.15
Posttest J: Which of the following is NOT true regarding cloud storage?	0.62	0.7693	77%	0.44	0.13

Appendix F: Student Demographics Survey

Student Demographics Survey

During your class this semester your instructor will be conducting research on a teaching methodology within one unit of the course. You will provide data for the instructor through the normal course of instruction during class. Just as you would expect in any course, your academic achievement will be kept confidential at all times. Your name and test scores will never be reported to anyone other than you. Your test scores and the information provided on this survey will be used to analyze the test data for the purpose of the research, but your name will never be attached to that data. In addition, the name of our institution will never be used in the research report to further protect your identity.

Please complete the demographic information below:

* Required

First Name *

Your answer

Last Name *

Your answer

Gender: *

Choose

Ethnicity (please choose the one that you most identify with): *

Choose

SUBMIT

Appendix G: Student Perceptions Survey

1. On a scale of 1 (strongly disagree) to 5 (strongly agree), rate your experience during the 1st half of the computer concepts unit that was taught using traditional instruction (primarily lecture).

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I prefer learning using traditional instruction (lectures).	○	○	○	○	○
Paying attention during class is easier when the instructor lectures.	○	○	○	○	○
I would prefer to enroll in future classes that use lecture as the primary teaching method.	○	○	○	○	○
I learned the computer concepts content easier because the instructor primarily taught using lecture.	○	○	○	○	○

2. On a scale of 1 (strongly disagree) to 5 (strongly agree), rate your experience during the 2nd half of the computer concepts unit that was taught using flipped instruction (watch a video prior to class and then apply the information during class).

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I prefer the flipped method over the traditional "lecture" method.	○	○	○	○	○
I was able to pay attention during class easier when the instructor used the flipped method.	○	○	○	○	○
I would prefer to enroll in future classes where the instructor uses the flipped method.	○	○	○	○	○
I learned the content easier when flipped instruction was the primary teaching method.	○	○	○	○	○

3. Think about your experiences using the videos to prepare for our classes that used flipped instruction. On the scale of 1 (strongly disagree) to 5 (strongly agree), indicate your experience using videos in our computer concept unit.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I watched the assigned videos.	○	○	○	○	○
I found the videos useful.	○	○	○	○	○
I thought the videos were just the right length.	○	○	○	○	○
The videos provided enough information on the topic to allow me to participate in the activities during the following class.	○	○	○	○	○
I had technical difficulty viewing the videos.	○	○	○	○	○

4. Think about your experiences participating in the activities during class in our second half of the computer concepts unit. On a scale of 1 (strongly disagree) to 5 (strongly agree), indicate your experiences during the in-class activities.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I prefer spending class time participating in activities, rather than just listening to the teacher lecture.	○	○	○	○	○
I learned during the in-class activities.	○	○	○	○	○
I liked working in groups during class.	○	○	○	○	○
The in-class activities allowed me to apply what I had learned during the videos.	○	○	○	○	○
The in-class activities helped me perform better on the homework assignments.	○	○	○	○	○