EFFECT OF THE FLIPPED CLASSROOM MODEL ON A SECONDARY COMPUTER APPLICATIONS COURSE: STUDENT AND TEACHER PERCEPTIONS, QUESTIONS AND STUDENT ACHIEVEMENT

By

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A Dissertation Approved on

by the following Dissertation Committee:

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DEDICATION

This document is dedicated to my parents, who continue to sacrifice so that I may be successful. And to my children, Stephen and Klaire, who have supported me throughout the completion of this work.

-Lisa Johnson

This work is dedicated to my parents, who were my first and best teachers. And to my wife Jeanna and our children Jillian, Jessica, Jacqueline and Jeremiah who have supported me throughout the completion of this work.

-Jeremy Renner

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ABSTRACT

The purpose of this study was to examine the efficacy of traditional and flipped course delivery methods using a mixed-methods switching replications design. To examine the benefits, shortcomings, perceptions, and academic results of the flipped classroom model while using technology as a supporting tool, a traditional high school computer applications course was "flipped" so that direct instruction occurred prior to class time. Classroom instruction is the independent variable with two levels, traditional and flipped. Student academic achievement is a dependent variable, which in theory will show greater gains by students when participating in the more effective of the two classroom models. The cognitive level of questions asked by students and teachers during class serves as a dependent variable that will gauge the level of student cognition based on the levels of Bloom's Taxonomy. Perceptions of course format serve as a dependent variable that will provide insight into teacher and student preferences of learning method.

It was hypothesized that students in the computer applications class would benefit from the flipped method due to the transitioning of class time from lower-level activities to collaborative group work. Even though our results do not support this hypothesis, the current study does provide insight into further research on the topic as well as observations in relation to our findings.

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CHAPTER I

EFFECT OF THE FLIPPED CLASSROOM MODEL ON A SECONDARY COMPUTER APPLICATIONS COURSE

The Flipped Classroom Model is receiving increased attention in educational circles and popular press (Toppo, 2011; Tucker, 2012). In this model, the traditional practice of spending class time engaged in direct instruction and completing content related activities for homework is "flipped", so that students receive initial content instruction at home, and spend class time working with their peers in a collaborative setting. The concept is gaining popularity, perhaps due to the ubiquitous nature of the tools that teachers use to accomplish the flip such as iTunes, YouTube, and Learning Management Systems (LMS). The flipped classroom model contains "inexorable logic" (Pink, 2010), but little research has been conducted on the approach in a K-12 setting.

In 1995, Eli Noam of Columbia University predicted that the Internet would pave a difficult road for traditional academic institutions; he wrote, "as one connects in new ways [the Internet], one also disconnects the old ways" (Mayadas, Bourne, & Bacsich, 2009, p. 85). His prediction has come to fruition as current K-12 students have grown up in a world where there has always been Google (founded in 1998), iPods (released in 2001) and YouTube (2005). Prensky (2001) referred to individuals born into this modern world as "Digital Natives" and stated that Digital Natives who graduate from college spend 10,000 hours playing video games, 20,000 hours watching TV and that "computer games, email, the Internet, cell phones and instant messaging are integral parts of their lives" (p. 1). Students are accustomed to interacting with audio and video on electronic devices, so it

stands to reason that they would digest educational content in this manner as well.

Just as twenty-first century students are comfortable with electronic devices, they also thrive on learning in social situations. Shroff and Vogel (2009) claimed that it is important to look for clues as to how e-learning technologies can become powerful catalysts for change as well as tools for redesigning our learning and instructional systems. To reclaim its position as a fundamental part of society, now is the time for public education to embrace the proliferation of online learning and certification opportunities to enhance daily classroom experiences. Public education has the opportunity to offer something strictly online learning environments find difficult to provide – motivation for learning (Songhao, Saito, Maeda, & Kubo, 2011).

Strong theoretical and empirical support has been found for the cognitive and motivational benefits of collaborative, as opposed to competitive and individualistic learning activities (Jarvela, Volet, & Jarvenoja, 2010). Collaborative learning allows students to do work together whereas cooperative learning encourages students to divide up group work and then put the individual contributions together (Stahl, 2012). A common barrier to the implementation of collaborative learning activities in the classroom is a teacher's perceived lack of time (Barak & Shakhman, 2008). The flipped classroom model frees up class time by removing much of the direct instruction from class so that the teacher is able to supervise collaborative learning experiences, provide individual remediation and foster meta-cognitive ability by providing the opportunity for communication among diverse learners (Songhao et al., 2011).

In 2001, Chan noted that the growth of information and communication technology, especially internet-related technology, has changed how, what, who, when, where and why we learn (as cited in Lee, 2005). The ubiquitous nature of tools such as

iTunes and YouTube, the benefits of freeing up class time, and the pervasiveness of students' electronic device usage create a condition where the flipped classroom concept may increase student learning. However, documentation of the academic results are lacking. Therefore, the goal of this study is to examine the benefits, shortcomings, student perceptions, and academic results of this teaching method.

History of the Flipped Classroom

As early as 1982, Baker had a vision of using electronic means to "cover" rote material outside of class (Baker, 2000). The barriers he found to accomplishing that goal included a delivery method of the material and the question of "what to do with the time that moving the lectures allows" (Baker, 2011, p. 1). The delivery barrier disappeared with the advent and implementation of the LMS. In the fall of 1995, an early edition of an online content management system allowed Baker to place lecture notes online and retrieve them to show during class meetings. He realized during a lecture that the students were capable of retrieving the slides themselves, and encouraged them to do so. Once he "gave away all the content for the class," he realized he needed to make the class time more meaningful. He developed an action plan centered on four verbs: clarify, expand, apply, and practice.

> The basic concept I applied in that class was to move the rote transmission of information that had been the content of my lectures out of the classroom (delivered instead through network-delivered presentations) and to use the opened-up class time for the students to work on application of the principles from that content while I was there to see what they were doing, answer questions and make suggestions. (Baker, 2011, p. 2)

Student survey responses in the two flipped courses indicated positive student perception

toward the classroom flip. Representative student comments indicated that the learning was more personalized, the cooperative groups fostered critical thinking, and the online resources provided students with more control over their learning. Baker presented the concept to conferences between 1996 and 1998, and in 1998 began to refer to the method as "The Classroom Flip" (Baker, 2011).

At approximately the same time, Lage, Platt and Treglia (2000) designed and implemented a similar procedure. They referred to the concept as "The Inverted Classroom" and similarly held the expectation that students would view lectures in advance of class, then spend class time clarifying difficult concepts and working in small groups. They stated that "inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa. The use of learning technologies, particularly multimedia, provide new opportunities for students to learn," (p. 32). They used the inverted teaching method on five sections of an economics course. Student perceptions measured using a survey instrument with Likert-scale and open-ended questions revealed positive student perceptions about the course. Representative comments on student surveys revealed that it was easier to ask questions, learning from peers was different and enjoyable, and that the video lectures taught a lot.

The concept has recently been adopted by K-12 educators. In a 2010 interview with influential blogger Karl Fisch, Daniel Pink dubbed the process the Fisch-flip (Pink, 2010). Chemistry teachers Aaron Sams and Jonathan Bergmann are credited with popularizing the concept (and frequently credited with originating the idea). Perhaps the greatest contribution to flipping the K-12 classroom has been the advent of the Khan Academy (Tucker, 2012). The Khan Academy is an online repository of over 1,300 videos

on topics ranging from addition and subtraction to advanced physics. The video library has evolved into a learning environment where teachers can view progress of students as they work through tutorials and practice exercises (Flipping the Classroom, 2011). The Khan Academy has streamlined the flip, making it realistic for a teacher to assign direct instruction to a student to be completed outside of class, because the video lecture has been created by Khan for student consumption.

Strayer (2007) reported that in most instances where the classroom flip is used, the goal is to create an active learning environment during class meetings, while ensuring content coverage. Strayer's conceptual framework is derived from Piaget's theories of active learning.

> The classroom flip is usually motivated by a desire to learn through active participation in the classroom. What exactly is meant by active participation? Is not all learning active, whether from a book, a lecture, or small group activity? Piaget says that learning occurs not when a person merely copies an idea, but when a person acts on it. (Strayer, 2007, p. 45)

Many in-class activities that take place once a classroom is "flipped" are constructivist in nature, whereas the pre-class activities are very "traditional". Brooks and Brooks (1999) compared aspects of traditional and constructivist classrooms. They pointed out that traditional classrooms strictly adhere to a fixed curriculum, students are viewed as "blank slates" onto which information is etched by the teacher, and students primarily work alone. In constructivist classrooms, the pursuit of student questions is highly valued, students are viewed as thinkers with emerging theories about the world, and students primarily work in groups.

Providing students with an audio version of a lecture is one way to create a flipped

class. A podcast is a series of audio or video files which can be subscribed to with an iPod or other device. Evans (2007) provided 200 communications students with audio podcasts. The researcher used a Likert-scale questionnaire that compared the participants' attitudes toward lectures, podcasts, and taking notes to aid in comprehension. The results suggest clear benefits perceived regarding the podcasts. Survey results revealed that students believed the podcast to be an efficient, effective teaching style that can help them learn.

The effectiveness of audio podcasts were also assessed in a college psychology course. McKinney, Dyck, and Luber (2009) used a non-equivalent group, post-test only quasi-experimental design with 66 participants. Students either listened to a series of lectures in person or received audio podcasts of identical lectures. The two groups took identical multiple-choice assessments after the treatment. The students in the podcast group scored significantly higher than the lecture group. Survey results indicate that the students who were provided audio podcasts were likely to listen to the lecture multiple times, while the other group had only their notes to study.

Electronic content delivery is not limited to audio and video. Animated and interactive simulations can similarly disseminate content to students in advance of class meetings. Sanger, Phelps and Fiengold (2000) studied a chemistry class (n=70) that viewed a live demonstration during class that illustrated concepts of kinetic molecular theory. When quizzed on the principles demonstrated, the misconceptions were identified by analyzing student responses. The researchers then created an animated computer simulation and arranged for a sample of students view it, while a control group received remediation using an overhead, chalkboard discussion, and illustrations. The students who viewed the animation were more likely to give completely correct responses on a second examination compared to those who received traditional remediation. Table 1

provides a quick glance into a few flipped classrooms.

The Nature of the Learner

Brooks and Brooks (1999) noted that in constructivist classrooms, students are viewed as thinkers with emerging theories about the world. In the present study, students were encouraged to use their combined creativity along with the information acquired outside of class to create projects that required them to interact with the content in a way that would demonstrate content mastery as well as allow them to personalize their experience based on their personal experiences.

Phillips (as cited in Milbrandt, 2004) identified three distinct student roles in constructivism: the active learner, the social learner, and the creative learner. Constructivist theory in the K-12 environment is interpreted many ways, but students in control of their own learning are at the heart of the model. In 1995, Savery and Duffy (as cited in Milbrandt, 2004) concluded that both Dewey and Piaget suggested that motivation for the construction of knowledge often comes from an experience of cognitive conflict or puzzlement. The flipped classroom model allows for the dissemination of information outside of class time so our active, social, and creative learners can experience "puzzlement" in a controlled, cooperative setting.

There is evidence this approach can be well accepted. A group of secondary school students were surveyed on their learning preferences (Kinchin, 2004). The study involved students identifying their preferred learning style by viewing scenarios presented using concept cartoons depicting constructivist and objectivist learning environments. The survey results showed an overwhelming preference for the constructivist environment. The few students who preferred the objectivist methods fell into two categories based upon their responses. Either they perceived it to be "easier" or they did not see adequate exam

preparation. Comments such as “I would rather listen than explain” and “I don‘t have to talk to the teacher” possibly reveal fear about revealing their weaknesses to their teacher or peers (Kinchin, 2004).

The Role of the Instructor

Brooks and Brooks (1999) noted that in constructivist classrooms, teachers generally behave in an interactive manner, mediating the environment for students as opposed to behaving in a didactic manner, disseminating information to students. In addition, teachers in constructivist classrooms seek the students’ points of view as opposed to seeking the correct answer to validate student learning. In the present study, the role of the instructor was to provide individualized instruction in response to student misunderstandings since the majority of skill attainment was designed to occur outside of class time.

The instructor plays an integral role in developing the constructivist-learning environment. Baker (2000) referred to the well-worn adage of moving from the “sage on the stage, to the guide on the side” (p. 9). The quest to become the guide was among his influences in the early flipped classes. Wiersma (2008) noted that teachers may revere the idea of student-centered learning but they do not know how to implement the practice, “Even if teachers understand the importance of curiosity, interest, and experience, many do not know how to use them in teaching situations” (p. 111).

While teachers may adopt the constructivist viewpoint in pre-service training, their experiences with teaching and learning tend to lead them to believe that “efficient learning is realized when the teacher delivers knowledge to the students” (Barak & Shakhman, 2008, p. 204). A lack of content knowledge can possibly lead to a teacher-centered classroom. Barak and Shakhman observed,

> Novice teachers in a specific domain tend to adhere to conventional teacher-led instruction, while experienced teachers are more open to move towards reform guided instruction. A third reason that may prevent teachers from acting upon their beliefs may relate to contextual factors, such as lack of time, large classes, or mandatory exams. (p. 204)

The behavior of the teacher also changes in a student-centered learning environment, as noted in a study involving 23 teachers in Grades 8-10 which involved establishing cooperative, small group activities during a four to six week unit of study. Audio recordings and transcripts of the courses were analyzed, and the results showed that the teachers implementing cooperative learning activities made fewer disciplinary comments (Gillies, 2006). One reason for the reduction in disciplinary comments may be attributed to the findings of Johnson and Johnson (as cited in Cooper et al., 1990) as well as Slavin in 1987 (as cited in Cooper et al., 1990) who found that cooperative learning has a more positive impact on student self-esteem than traditional methods of instruction. This increase in self-esteem may lead to better student engagement and less disruptive behavior.

The Nature of the Learning Process

Brooks and Brooks (1999) noted that in constructivist classrooms, curricular activities rely heavily on primary sources of data and manipulative materials as opposed to textbooks and workbooks. Assessment of student learning is interwoven with teaching and occurs through observations and student exhibitions as opposed to being separate from teaching and occurring almost entirely through testing. In addition, students primarily work in groups as opposed to working alone. In the present study, digital textbooks and tutorials were used by students outside of class for initial concept delivery while in-class activities relied on open-ended group project development. The projects were designed to

demonstrate mastery of content. In addition, periodic quizzes over the material were used to measure student learning.

Due to time constraints and advantages of constructivist instructional practices, abandoning the practice of lower-level content delivery altogether may seem like a valid option. However, the technical nature of content, the auditory learning preference of many students and the increased pressure to "cover" content in the present assessment-driven culture are reasons to continue traditional practices. As stated by Toto and Nguyen (2009), "How do we convey the amount of information necessary to support an information rich education and yet also provide the applied experiences so essential to deepening that knowledge?" (p. 1) Moving content acquisition outside of class may prove to be a valid option.

The delivery of the "lecture" prior to coming to class is the first step of the learning process in the flipped classroom model (Baker, 2000; Toto & Nguyen, 2009). In class, students are prepared to engage in the collaborative experiences the teacher has designed because the background knowledge has been consumed prior to class. In 2010, Cherry suggested that blended learning involves a shift in strategy in three areas: from teacher-centered to student-centered learning, from limited to high-frequency interactions between students and resources, and from intermittent to deliberate integration of formative and summative assessments.

Investigating the benefits, shortcomings, student perceptions, and academic results of this teaching method is important to K-12 education on several levels. Establishing whether a flipped classroom produces measurable academic gains is a primary, but not the only intent of this study. Sternberg (1987) provides an interesting view on the topic:

It is a mistake to concentrate only upon knowledge to exclusion of thinking skills,

> because such concentration risks generating students who will know a lot but who are unable to evaluate their knowledge. It is equally a mistake to concentrate only on thinking skills, because the result may be students who know to think but have nothing to think about. (As cited in Barak & Shakhman, 2008, p. 193)

Capturing student and teacher perceptions, as well as the type and frequency of questions asked in a high school flipped classroom may provide previously unexplored insight into the full impact of this teaching method in K-12 education. Student perceptions of the flipped model have been studied at the post-secondary level, and found to be positive (Baker, 2000; Toto & Nguyen, 2009).

A switching replications design will be used that involves one teacher and two groups of students participating in a traditional classroom setting for six weeks and a flipped classroom environment for six weeks. While one group is participating in the flipped classroom environment, the other group will experience the traditional classroom (see Appendix A). After six weeks, the groups will switch. A repeated measures design will be used to compare quiz scores between the two groups.

Research Questions

1. Does the implementation of the flipped classroom model increase student acquisition of knowledge of Microsoft Office applications?
2. How do the types of questions asked by teachers differ in traditional versus a flipped classroom setting?
3. How do the types of questions asked by students differ in traditional versus a flipped classroom setting?
4. How do teacher perceptions of learning experiences differ in a traditional versus flipped classroom setting?

5. How do student perceptions of learning experiences differ in a traditional versus flipped classroom setting?

Methods

Participants

The purpose of this study was to examine the efficacy of traditional and flipped course delivery methods. Two Computer Applications classes at a high school in Kentucky will serve as the context for this study. During the 2010-2011 school year, the enrollment of Study High School (SHS) was among the top ten largest schools in the district. Study High is not one of the ten Title I schools in the district, but it is one of the eleven high schools designated to receive School Improvement Grant funds to improve student achievement. SHS qualified for those funds during the 2010-2011 school year according to the school district's Tier II definition since at least 35% of the enrollment qualified for free/reduced meals, the school did not make adequate yearly progress (AYP) for at least three consecutive years and was either in the bottom 5% or was one of the bottom 5 non Title 1 schools based on averaging the percentage of students who received proficient or distinguished on the reading and math core content tests (Jefferson County Public Schools, 2011).

Convenience sampling was used to select the cooperating teacher due to his collaboration with one of the co-investigators on a non-related project during the 2010-2011 school year. Approximately 62 students (two classes with no more than 31 enrolled in each class) were expected to participate in the study along with the one teacher of both classes. The two classes were selected from the three sections taught by the teacher during the second trimester.

Instrumentation

To answer the question, “Does the implementation of the flipped classroom model increase student acquisition of knowledge of Microsoft Office applications?” pre- and post-test scores and chapter-specific quiz scores were analyzed from students in the two classes participating in the study. At the beginning and conclusion of the twelve-week study, the Key Applications section of the IC3® Exam was administered to both groups of study participants and served as the pre- and post-test. The IC3® Exam was developed and hosted by Certiport, Inc., administered online, and proctored by a school designee. The Key Applications assessment is one-third of the total IC3® exam, and is a timed 45-item multiple choice assessment that is 45 minutes in length and assesses the Microsoft Office applications Word, Excel and PowerPoint. Individuals who pass the Key Applications section as well as the two additional tests earn “IC3® Certification”, which designates an industry standard for computer literacy. All data collected were coded to protect the anonymity of the student participants.

Since one null hypothesis is that student achievement on the IC3® exam would not improve based on the proposed interventions, monitoring the challenge level of classroom engagement was our method for gauging the development of higher-order thinking skills. One way to integrate critical thinking into curriculum is by asking questions that require critical analysis (McCollister & Sayler, 2010). Therefore, weekly classroom observations by the investigators were conducted to record the questions asked by both students and teacher in both the flipped and traditional settings. Since questions can stimulate deeper thinking, provoke interest and inquiry, and spark additional questions, allowing for greater intellectual focus (Wiggins & McTighe, 2005), the questions which are asked in class were recorded for analysis. In 1987, Resnick put forward the concept of “higher-order thinking” which avoids a precise definition of thinking but instead suggests some general

characteristics of higher-level thinking, as follows: higher-order thinking is non-algorithmic, complex, yields multiple solutions, requires the application of multiple criteria, self-regulation, and often involves uncertainty (as cited in Barak & Shakhman, 2008). In light of that definition, one purpose of this study is to capture the uncertainty created by higher-order thinking by monitoring the questions posed in class. The specific research questions: "How do the types of questions asked by teachers differ in traditional versus a flipped classroom setting?", and "How do the types of questions asked by students differ in a traditional versus a flipped classroom setting?" were answered through an analysis of the questions asked by both students and teacher during class time.

At the end of the two six week classroom experiences, students completed an online Likert scale survey to capture their perceptions of the learning experience to answer the research question, "How do student perceptions of learning experiences differ in a traditional versus flipped classroom setting?" The survey (Appendix B), previously used in a study which compared blended and face-to-face course delivery options was used to measure four areas where technology impacted or helped improve student learning. The access and availability of course content and delivery, electronic tools or web-based communication tools for communication and collaboration, online tools for assessment and evaluation of student performance and the learning strategies the students experienced in class were the four areas measured (Araño-Ocuaman, 2010).

As described by Araño-Ocuaman (2010), Cronbach's alpha was used to measure the reliability of the instrument. Of the possible 36 students in her study, 27 valid responses to the questionnaire were used to arrive at the Cronbach alpha coefficient (α=0.731). As noted by Araño-Ocuaman, a reliability coefficient of 0.70 or higher indicates an acceptable level in most social science and educational research.

The teacher will be interviewed every three weeks (four times) throughout the course of the study. The main value of interviews (Fontana & Frey, 2000; Silverman, 1993) is that they offered a rich source of data that provides access to how people account for their understandings and attitudes about everyday experiences (as cited in Barak & Shakhman, 2008). Capturing the teacher's understandings and attitudes about teaching the flipped and traditional courses will offer insight that cannot be gleaned from the other sources of data collection. Qualitative methods were used to analyze the interview responses to answer the research question, "How do teacher perceptions of learning experiences differ in a traditional versus flipped classroom setting?"

The qualitative research included observations of the two participating classes. Field notes were taken by both researchers in order to increase reliability. The researchers coded their observations. Field notes were mined for specific themes, presumably centered on student-to-student interactions and student to teacher questioning. A case study report following Stake's (1995) suggested outline for case study structure will be presented (Creswell, 1998).

Procedure

A switching replications design was used that involved two groups of students participating in a traditional classroom setting for six weeks and a flipped classroom environment for six weeks. While one group is participating in the flipped classroom environment, the other group experienced the traditional classroom (see Appendix A). After six weeks, the groups switched. A repeated measures design was used to compare quiz scores between the two groups.

During the twelve-week study, all students were instructed to complete step-by-step learning modules and projects. As part of the traditional IC3® curriculum,

learning modules are provided in the student textbooks for the purpose of teaching the concepts tested by the assessment. The learning modules are supplemented with teacher-created projects for students to complete to demonstrate understanding of the content (without the aid of the step-by-step guidance provided by the modules).

Methods of Analysis

The first research question will be addressed two ways. First, repeated measures analyses of variance (ANOVA) will be employed. The specific type of ANOVA will employ one between-group variable and one within-group variable (Stevens, 2009). The between group variable will be Class (two levels: class 1 and class 2). The within-group variable will be test scores during each week of measurement (from O_1 , O_2, etc). The ANOVA will be applied twice, once for the first six week period (six levels of the repeated measures variable: from O_1 through O_6) and again for the last six weeks (six levels of the repeated measures variable: from O_7 through O_{12}) . This ANOVA will allow tests of hypotheses about differences between the classes in overall amount learned (main effect of traditional vs. flipped instruction) and the possible differences in learning trends—i.e., differences between the groups in growth of learning over time (interaction of instructional group by weeks of instruction). The second way that research question 1 will be addressed will be with two applications of a one factor analysis of covariance (ANCOVA) (Kirk, 1995). The independent variable will be Class (two levels: class 1 and class 2). The covariate will be pretest score on the multiple choice test (measurement O_1). For ANCOVA number 1, the dependent variable will be the average score on the multiple choice test over the second through the sixth weeks of measurement (average from O_2 through O_6). For ANCOVA number 2, the dependent variable will be the average score over the seventh through the twelfth weeks of measurement (average from O_7 through

O_{12}). The estimated number of subjects (25 x 2 = 50) will allow a moderate to large effect size to be detected with a significance level of .05 and power of .70.

For Research Questions 2, 3, and 4, qualitative analysis of data will employ methods summarized by Creswell (2002). Methods will include conducting observations and interviews, coding responses that are similar, grouping responses together that have similar codes, and naming of codes with thematic titles that represent the data. Vygotsky proposed that learning and truth are socially constructed rather than objectively observed (as cited in Milbrandt, 2004). Therefore, the employed qualitative approaches will facilitate the collection of data which otherwise would be impossible to objectively capture and measure.

Research question 5 will be addressed with two applications of a one factor analysis of variance (ANOVA). The between group variable will be Class (two levels: class 1 and class 2). The ANOVA will be used at week 6 and at week 12. In each ANOVA the dependent variable will be the average attitude score on the Student Perception of Instruction Questionnaire (SPIQ), see Appendices C and D. Each ANOVA will allow a determination of whether there is a significant difference in attitude between the classes as they experience both traditional and flipped instruction. The estimated number of subjects (25 x 2 = 50) will allow a moderate to large effect size to be detected with a significance level of .05 and power of .70. For a summary of variables measured by each research question and the analyses to be performed, refer to Appendix E.

Reliability and Validity of Tests and Questionnaire

Data on the reliability of the multiple choice test will be calculated and reported. Past uses of the test by the teacher have yielded internal consistency reliability coefficients that are acceptable (Cronbach alpha coefficients of .70 or greater). Content validity of the

test was established by the textbook publisher. The test has been aligned with the content of the course. The SPIQ has 13 Likert-scale items that have been previously assessed for internal consistency reliability. The instrument has a Cronbach alpha coefficient of approximately.75. Items are generally consistent with evaluation of perceptions concerning a curriculum with hybrid approaches to instruction (face-to-face lecture/discussion mixed with instructional technology).

CHAPTER II

FLIPPED OR FLOPPED: THE UPSIDE-DOWN TALE BEHIND ONE ATTEMPT TO IMPLEMENT AN INNOVATIVE INSTRUCTIONAL METHOD

The passing period is winding down and the students dutifully shuffle into the computer lab to find their seats. Students are back in uniform today after "Dress for Success" day had not gone well. An announcement yesterday declared that many students did not go along with the homecoming theme, and simply came to school out of uniform. Now they were back in khaki pants with school shirts, and they would try again with "athletic jersey day" tomorrow. The conversation dies out with the tone of the bell, and the few students who still need to log in quickly type names and passwords. The class is quiet as the teacher begins. "Ladies and gentlemen, yesterday we wrapped up Excel, and today we begin PowerPoint." Mr. Cooper (pseudonym) has a voice that fills the room. He is a second-year teacher with a confident stature. "PowerPoint is the easiest thing we are going to do."

There is a PowerPoint slide projected at the front of the room with three bullet points: Read Chapter 20 steps; Begin Chapter 21 on PowerPoint, 'Demonstrate Skills'; Complete Steps. The teacher begins to compare PowerPoint to Word and Excel. He points out that the menus and ribbons are similar. He asks the class a question, "How would I open PowerPoint?" A student replies, "Start, Programs, Office, PowerPoint." Nodding his head to acknowledge the response, he declares again that the students will

notice many similarities between PowerPoint and the other productivity tools. “Look at your screen. Look and tell me what you see that looks a little bit familiar,” he asks.

A student offers, “Ribbons. Tool Bar. Quick Access Bar.”

Nodding his head in acknowledgement, the teacher requests more similarities, “What else is the same?” He waits. “Come on.” He waits some more. “Come on!” he admonishes. “The Office button” he offers. “What else? What’s up top?”

A student responds, “The title bar.”

This vignette gives you a glimpse inside a typical lesson introduction by Mr. Cooper, a Computer Applications teacher at Study High School (pseudonym). We will feature Mr. Cooper in this single subject case study, as he implements an emerging instructional tactic, originally referred to as a Classroom Flip (Baker, 2000). Students in a flipped class view lessons prior to class leveraging technology, freeing up class time for activities related to the content viewed (Bergmann & Sams, 2009).

The purpose of this study was to understand one teacher’s perception of the Classroom Flip learning experience in a high school computer applications class. The intent is that in freeing up class time, students will be more actively engaged in learning, the teacher will be able to ask more higher-level questions, and the content will therefore be covered in greater depth. We hope to add to the body of academic knowledge on this instructional approach by highlighting key considerations in implementing such an approach, with implications for professional development of teachers using the Classroom Flip model.

The Classroom Flip Model

Two converging factors contributed to the original flipped class. The focus of the classroom shifted from the teacher to the learner. The emerging educational research of the time is summed up by moving the teacher from the role as the "Sage on the stage to the guide by the side" (Baker, 2000). The current technology available for enhancing instruction was second factor. As the flip was developing, an early deployment of a Learning Management System (LMS) and PowerPoint slideshows with annotations were the delivery vehicle for flipped instruction. Baker discussed the benefits of using an LMS to do more than deliver lecture content; he mentioned online threaded discussions and quizzes as well. His model utilized early distance learning tools to supplement a traditional class. At roughly the same time, Lage, Platt, and Treglia, (2000) had a similar pedagogical goal, which was to make better use of the contact time with students. They also used annotated PowerPoint presentations to deliver content to students in advance of class meetings, then used class time for simulations and cooperative activities. Toto and Nguyen (2009) state the need for applied experiences to balance information rich curriculum, along with the concept of leveraging the expertise of the instructor.

Defining a classroom flip.

Baker (2000) states that the goals of the original flipped class were:

1. Find an approach that would make it possible for faculty to move from *sage* to *guide.*
2. Reduce the amount of time spent in class on lecturing, opening up class time for the use of active learning strategies.
3. Focus more on understanding and application than on recall of facts, while not sacrificing presentation of factual base.

4. Provide students with more control over their own learning.
5. Give students a greater sense of responsibility for their learning.
6. Provide students with more opportunities to learn from their peers. (p.9)

The structure of a flipped class will vary with the personality of each teacher, but it typically includes a routine with a short assessment regarding the instruction viewed before class, a mini-lesson addressing remediation or difficult concepts needing to be re-taught, and large blocks of times for project work. The approach to structure that Baker (2000) outlined revolved around four verbs: clarify, expand, apply, and practice.

Adoption of the flipped classroom.

K-12 educators have recently adopted the concept. Chemistry teachers Aaron Sams and Jonathan Bergmann popularized the Flipped Classroom idea via blog postings and webinars. They frequently receive credit for originating the idea, though the origins predate their implementation (Sams & Bergmann, 2011).

> Podcasting and vodcasting our lessons at first proved to be an effective way for absent students to catch up, for struggling students to review a lesson, and for us instructors to have high-quality lessons available in our absence. Now podcasting has helped us reconfigure our chemistry courses so that students still receive direct instruction, but class time is not used to deliver it. Instead, class time is now reserved exclusively for lab activities, demonstrations, one-to-one assistance, and small group tutoring. (Bergmann & Sams, 2009, p. 22)

Perhaps the greatest contribution to flipping the K-12 classroom has been the advent of the Khan Academy (Tucker, 2012). The Khan Academy is an online repository of over 1,300 videos on topics ranging from addition and subtraction to advanced

physics. The video library has evolved into a learning environment where teachers can track progress of students as they view tutorials and work through problems (Flipping the Classroom, 2011). The Khan Academy has streamlined the flip, making it realistic for a teacher to assign content to a student outside of class, because Khan has created the video presentation. When reading about flipped classes, it is common for the teacher to mention Khan Academy as the source for the at-home content delivery (Dunn, 2011).

Benefits for teaching.

The flipped class appeals to teachers for several reasons. Gannod, Burge, and Helmick (2007) state three benefits of the flip for instructors:

1. The primary focus of the class is on the most rewarding part of teaching; the interactions with students
2. The hands-on activities in class engage the teacher as much as the student; an excellent antidote for instructor boredom
3. It is an efficient way to bring in outside experts to the class. Using podcasts and internet video of content area and industry experts provides all the benefits of a guest speaker without the difficulty of scheduling.

In addition, the pre-recorded lessons can be viewed multiple times and at a self-determined rate, making it naturally differentiated for a range of learners including struggling readers and English language learners.

Learner-centered.

The flipped class also appeals to the type of learner that instructors encounter in the typical classroom. Howe and Strauss (2000) contend that the Millenial Generation responds to structure and routine in the classroom, citing the hyper-scheduled nature of

childhood in the modern age. The flipped classroom is student-centered and engaging, but follows a structure.

In addition, the lesson can be viewed "on demand", making learning available despite the time and place. The concept of time-shifting, along with the proliferation of mobile devices, made podcasting an important form of media delivery. A similar concept created the demand for TiVo and DVR as viable alternatives to viewing traditional broadcast television. Learning can also take place on-demand. The lesson that one student views on the school bus can be watched by another student in the living room. A third student can take in the material with a friend and another student may need to watch it multiple times. The flipped class makes all of these scenarios possible.

The typical fifteen-year old who participated in this study was born in 1997, placing them in the Millennial Generation (Howe & Strauss, 2000). They are the "first generation since World War II to be confronted with higher academic standards than the last generation" (p. 18). He or she was four when the first iPod was sold, seven when YouTube was founded, and has never known a world where they were not surrounded by technology. They would give you a blank stare if you asked them to "roll down the car window, turn the channel, press the carriage return, or quit sounding like a broken record" (p. 24).

Prensky (2001) uses the term "Digital Natives" to describe students born into this modern world. He compares them with native speakers of a language, while the rest of us are immigrants who will never fully understand the nuances and tendencies of the culture. Prensky cites evidence from Baylor College of Medicine that, "it is very likely that students' brains have physically changed and are different from ours" (p. 1), as have their

thinking patterns. Digital Natives are comfortable around technology. Students who are comfortable around technology exhibit a preference for using it for learning (Jonas-Dwyer & Pospisil, 2004).

Multiple modes of delivery.

McKinney, Dyck, and Luber (2008) determined that lectures provided via audio podcast were both appealing to students and had a positive effect on learning. They designed a non-equivalent group, post-test only quasi-experimental design comparing audio lectures on an iPod with identical face-to-face lectures. The results indicated that the audio lectures were effective, and the student surveys indicated that the group with the iPods listened to the lectures multiple times.

Carlisle (2010) worked with three instructors of a computer-programming course. They provided 21 short YouTube videos to three sections of the same course. The students reported watching the videos at a rate of 90%-100% before class time. The instructors used the freed up time to increase the hands-on experience in the lab. Representative comments from students indicated they wished more classes would do this, and that they preferred the videos to assigned reading on similar topics.

An animation can have a positive effect on learning as well. Sanger, Phelps, and Fienhold (2000) report on using a computer animation to increase student understanding of a difficult science concept. After a traditional lecture and quiz, analysis of the student responses revealed a sweeping lack of understanding of the concept taught. A control group received another lesson, with an overhead projector and diagrams as visual aids. A second group experienced an animated computer simulation explaining the concept. The

results of a second exam revealed that the simulation was more effective for re-teaching than a second lecture.

For all these reasons (benefits for teaching and learning, meeting the needs of the millennial student, and availability of emerging technologies), the Flipped Classroom Model is receiving increased attention in schools and in the popular press (Toppo, 2011; Tucker, 2012). With so much potential, and yet minimal research on its impact, it is imperative to study how teachers can effectively implement a Classroom Flip, and the related benefits to student learning and engagement. Findings can inform what professional development is needed in order to enable teachers to implement the key features of a flipped classroom to maximize learning opportunities for students.

Methods

In order to better understand the implementation of the Classroom Flip, a mixed-methods study was designed that included questions related to teacher implementation and student engagement. The teacher implementation employed Case Study methodology in order to answer the following research questions:

- How do the types of questions asked by teachers differ in traditional versus a flipped classroom setting?
- How do teacher perceptions of learning experiences differ in a traditional versus flipped classroom setting?

Setting

During the 2010-2011 school year, the enrollment of SHS was among the top ten largest schools in the district. Study High is not one of the ten Title I schools in the district, but it is one of the eleven high schools designated to receive School

Improvement Grant funds to improve student achievement. SHS qualified for those funds during the 2010-2011 school year according to the Tier II definition since at least 35% of the enrollment qualified for free/reduced meals, the school did not make adequate yearly progress (AYP) for at least three consecutive years and was either in the bottom 5% or was one of the bottom 5 non Title 1 schools based on averaging the percentage of students who received proficient or distinguished on the reading and math core content tests (Jefferson County Public Schools, 2011).

Background

The school district that employs the researchers recently underwent an extensive Curriculum Management Audit (CMA). The audit investigated the curriculum design and delivery systems (Phi Delta Kappa, 2012). The district worked with 25 licensed auditors, who conducted a rigorous audit based on the model developed by English using "generally-accepted concepts pertaining to effective instruction and curricular design and delivery, some of which have been popularly referred to as the 'effective schools research'" (Phi Delta Kappa, 2012, p. 6). The CMA was an independent examination of documents, interviews, and site visits. It will shape the restructuring of the school district in the upcoming years and provide context for the theme of teacher-centered instruction woven into this case study.

The audit revealed several findings related to instruction and technology in JCPS. While instructional technology was available and used in approximately 47% of observations, it was generally teacher-centered with non-innovative use. Direct instruction and seatwork were observed most often during the audit. "The most common

levels of cognition noted during classroom visits were recall and comprehension" (Phi Delta Kappa, 2012, p. 401).

The CMA indicated the prevalence of teacher-centered instruction and lower levels of questioning (Phi Delta Kappa, 2012). A goal of the flipped method is to provide instruction at home in order to move the focus of the class meetings toward a student-centered, highly engaged experience. Members of the Millennial generation exhibit distinct learning preferences, such as preferring teamwork, experiential activities, structure, and the use of technology (Jonas-Dwyer & Pospisil, 2004). The flipped classroom addresses each of these items.

We attempted to create a classroom environment based on open-ended projects. Students paired up to work on projects designed to show mastery of the skills acquired during the consumption of the videos at home. Shared learning experiences improve the dialogue in a classroom. Gillies (2006) states that cooperative learning situations encourage multi-directional conversations, as opposed to bi-directional. He also reported higher levels of sophistication in student discourse, and fewer student interruptions. In a flipped class, teamwork on collaborative projects becomes possible due to newly found blocks of time during the school day. Johnson and Johnson (2009) state cooperative learning theory is an "unusually strong psychological success story" (p. 374), and emphasize how it is a standard and widespread teaching procedure.

Participants

Mr. Cooper

Mr. Cooper is a second-year teacher at SHS. He has experience in the business world and teaches three sections of computer applications. Prior to the study, he had been

teaching using a combination of direct instruction, the projects provided in the text book, and assessments created from banks of questions provided by the publisher.

Mr. Cooper participated in a series of four two-hour professional development sessions to learn about the key features, develop student group projects, and learn about the screen casts created for use in his flipped classroom. The researchers delivered the sessions, which continued after the trimester started. Guskey (2002) states that "high-quality professional development is a central component in nearly every modern proposal for improving education" (p. 381). Guskey (2002) acknowledges that change is difficult for a teacher:

> Learning to be proficient at something new and finding meaning in a new way of doing things requires both time and effort. Any change that holds great promise in increasing teachers' competence and enhancing student learning is likely to require extra work, especially at first. (p. 386)

In the implementation of the flipped classroom, Mr. Cooper used screen casts prepared by the researchers. Mr. Cooper reported that the tutorials are a valuable resource.

Students in Mr. Cooper's Class.

The classes in the study were chosen through convenience sampling. Of three sections of computer applications taught by Mr. Cooper, the two in the study were selected because they had were most similar with respect to race, age, and sex (Table 3).

Design

We conducted a mixed-methods study of the treatment. This paper will deal primarily with the qualitative piece of the puzzle, and is written as a single case study. We employed a switching-replications design using two groups of students. As practitioners, we did not wish to deny any student access to the treatment. Trochim and Donnelly (2008), state that switching replications is one of the strongest experimental designs. "The implementation of the treatment is repeated or replicated. In the replication of the treatment, the two groups switch roles; the original treatment acts as the control" (Trochim & Donnelly, p. 205). We triangulated the qualitative data in the study by conducting field observations, teacher interviews, and student surveys. Patton (2002) states, "triangulation within a qualitative inquiry strategy can be attained by combining both interviews and observations" (p. 248).

We administered the treatment during the second trimester of the 2011-12 school year. During the first two weeks, we issued equipment, conducted a pre-test, and students acclimated to the course. Having students take the Internet and Computing Core (IC3®) exam as a pre-test is not protocol for the course, but it strengthened the pre-test, post-test design of our study. It would be typical for the teacher to use an IC3® practice exam to begin the course, so administering the actual test was not a significant variation to the class routine. A pre-test does not give the same level of detail in the results as the IC3® certification exam. The Computer Education Support (CES) unit reimbursed the school for the extra expense of the exam.

For the purpose of this study, the group that was "flipped" was expected to use the screen casts in place of reading the "step-by-steps" in the textbook while at home. At school, students participated in collaborative learning activities designed to encourage

higher-order thinking and demonstrate the skills outlined in the textbook. The class that we called “traditional” worked through the “step-by-steps” using the screen casts as a guide during class time, completing similar projects in isolation for homework. After the first unit of study, the groups switched roles, so each student experienced the flipped class treatment.

The researchers conducted twelve official observations to the participating classrooms. We transcribed our field notes at the end of the treatment. Creswell (2008) writes, “Conduct multiple observations over time to obtain the best understanding of the site and individuals” (p. 212). We devised a coding system (Table 2) and independently coded the observations. We spent time in the classroom other than taking field notes. We had contact with the students when we discussed the nature of the research, issued equipment, and supplied occasional incentives. For the purpose of this study, we selected not to interview individuals or focus groups on their attitude toward the learning experience, due to time limitations and additional level of approval needed from the University Office of Human Subjects Protection Institutional Review Board (IRB) that would have ensued. We frequently interacted with the classroom teacher, including three recorded and transcribed informal conversation interviews (Patton, 2002). The principal of the school approved the study. He and Mr. Cooper each acted as a gatekeeper (Creswell, 2002) providing permission and access to the site. We also obtained official permission from the University IRB and the research department of the school district.

Data Collection and Analysis

Observations.

During our 10-week study, we conducted 12 official field observations and made an additional 12 informal visits to check in with the teacher and confirm that the technology tools were adequate. We used the open-coding (Patton, 2002) method to analyze our field notes. We increased the validity of the field notes by independently coding them and performing a member check with the subject.

Interviews.

Our interview sessions had characteristics of the informal conversation interview described by Patton (2002). They were open ended and the questions related to what we observed in the field. Patton (2002) states that the strength of such interviews lie in the ability of the interviewer to, "go where the data and respondents lead" (p. 342). All interviews with Mr. Cooper were transcribed. As Patton (2002) states, "transcribing offers another point of transition between data collection and analysis as part of data management and preparation" (p. 441). Through immersion and analysis of the teacher's responses, we gained an understanding of Mr. Cooper's perception of the learning experiences in the traditional versus flipped settings. The interview transcriptions were analyzed using an inductive analysis method of discovering patterns, themes, and categories in the data (Patton, 2002).

Threats and barriers

Human-subjects research guidelines stated that students were to opt-in to the study, their parents had to grant consent for participation, and documentation clearly stated that they could opt-out of the study. The paperwork was a barrier to participation. In two classes of 56 students, we had an initial participation of 28 students. When the study concluded, 26 students remained. We provided incentives to encourage participant

continuation in the study and completion of projects. A significant number of students in each class chose not to opt-in to the study, making it a challenge to implement a flipped class experience with fidelity.

There are several fidelity of implementation considerations. Shadish, Cook, and Campbell (2002) discuss treatment implementation and attrition. The researchers note that field experiments are not ideal; all treatment groups do not always receive the same or full treatment. The requirement for opting in to the study, and ability to opt out jeopardized our attrition threat almost immediately. Some students who began the study quickly realized that they were doing "extra" work and turned in their laptop, exercising their right to opt out of the study. The level of participation placed Mr. Cooper in a situation where he felt it was necessary to teach the content in the traditional way to the non-participants. The participants, even during the period of time they were "flipped," had access to the traditional content, decreasing the treatment validity of the study.

The videos did not replace the bulk of the direct instruction, which is a characteristic of the flipped class. This further decreased the validity of the treatment. Since the screen casts were available in the LMS, it was possible for students to access them even if they were not part of the treatment group. Masked non-participant data was used as an additional control group. The possibility that non-participants voluntarily viewed portions of the screen casts exists, decreasing the validity of the study

Role and Background of Researchers

We assumed changing observational roles (Creswell, 2002). We designed the student projects, created instructional screen casts and supported the teacher with implementation. We spent a great deal of time in the classroom, but we did not teach

lessons. Our interactions with the students were not significant. We briefed them on the nature of the study, issued student computers and occasionally answered a study-related question. We fielded two calls from parents. One parent wanted clarity on the expectations placed on the students who elected to participate, another requested permission for her student to participate in the study using their home computer. We took on both participant and non-participant observational roles.

The researchers are members of the CES unit. Assistance and support of technology integration projects fall within the mission of CES. Technology usually plays a large role in a flipped class, providing the tool for direct instruction homework. The flipped class study is relevant to the mission statement of our department:

> Computer Education Support helps JCPS staff become proficient users of technology and supports student achievement, including technology literacy, through the effective integration of technology into teaching and learning. (Jefferson County Public Schools, 2012)

One of the co-investigators mentored Mr. Cooper during his one-year Kentucky Teacher Internship Program requirement during the previous school year. As resource teachers from CES, both researchers are in a supportive, non-evaluative role, where we frequently assist and mentor JCPS instructors. These dynamics led to the professional, respectful, and cordial relationship described by Patton (2002) necessary for qualitative interviewing and data collection.

Our preparation for the implementation was extensive. We used Adobe Captivate screen recording software to record and annotate the step-by-step instructions from the student textbook. The screen casts last between two and five minutes, were saved as

Adobe Flash files, and placed in multiple locations. We put the screen casts in the LMS, on CD-ROMS and on the desktop of the student laptops. The district-adopted text for this course is Computer Literacy Basics: A Comprehensive Guide to IC3 (Morrison & Wells, 2010). The purpose of the Computer Applications course is to ensure all students are competent users of technology, as measured by the IC3® exam.

The student laptops were HP Tablet PCs running Microsoft Windows XP and Microsoft Office 2007. The participants took the computers home for the length of the study. The computers had recently been turned in by teachers as part of a "refresh" of the Technology Integration Project, which provides all 6,000 full-time JCPS teachers with a Tablet PC and LCD projector for integration of technology in teaching. The laptops were four years old, and finding an innovative use for the machines was a minor goal for the research project. Due to privacy and safety concerns, we elected to disable the wireless card on the computer, and create a non-administrator account for student use. We issued computers to students after they completed the IRB required documentation, signed a loan-agreement (Appendix F) and opted in to the study (Appendix G). Participants could elect to receive a CD-ROM with the screen casts if they already had a computer with the appropriate version of Microsoft Office. We provided a USB thumb drive to place files on for transferring work from home to school. The logistics of creating the screen casts and preparing the machines were significant. It is not typical for the district to issue laptop computers for student home use.

Findings

Here we share the findings from the case of Mr. Cooper. Mr. Cooper agreed to participate in the study. As part of his commitment, he was willing to participate in

interviews and allow access to the class for observation. Mr. Cooper expressed a willingness to help, and during the early phases of planning stated that he was especially interested in providing alternative motivations for learning. He also revealed that the use of the video tutorials was appealing. Based on the analysis of the twelve official field observations, twelve additional informal visits, and three teacher interviews, two significant themes emerged related to teacher practices in implementing the Classroom Flip. Both of these are discussed in detail and then followed by eight implications in the Discussion section of this paper.

Interactions in a Flipped Classroom

One research question addressed in our study was, "How do the types of questions asked by the teacher differ in a traditional versus a flipped classroom?" Based on descriptors of the Classroom Flip, which identify higher-level thinking as a feature of the method, we focused observations on the type of questions posed by the teacher. Table 2 presents the themes and frequency of interactions that emerged from our observations. We labeled our field observations according to the order and treatment. For example, our observations of the traditional lessons are 1T…6T. Our flipped class observations are labeled 1F…6F.

We defined higher instances of open-ended and active-learning questions as questions that could not be answered with a simple one or two word response. For example, the following teacher prompts were coded as open-ended:

> "Tell me how you got that." (Observation 4T)
>
> Mr. Cooper asks the students to tell how to add a slide to a presentation (there are several ways to accomplish this). (Observation 5F)

The traditional class had nearly twice as many open-ended or active learning prompts as the Classroom Flip. This may have been the result of the flipped classroom spending less time in full class discussion and more time on student projects. In addition to asking students for open-ended explanations, Mr. Cooper asked students to stand in response to a prompt, and this was coded as active engagement. This was noted in Observations 1F and 1T as, "Stand up when you have completed the task," after a set of instructions. As he circulated to check student work, they took a seat. These occurrences were equal across the two classrooms.

Higher instances of off-task behavior were observed in the flipped classroom. Discussion with the teacher and class observations revealed instances of students listening to music on YouTube when the expectation was to be working. This became a bigger problem when the traditional classes were to view the screen casts during class time since Mr. Cooper allowed the students to bring headphones to minimize the noise caused by the screen casts. Aside from observing music videos being viewed, it was common to see a video game played during instruction time, and at one point during Observation 2T there were 3 students playing games.

Overall, between the traditional and flipped classrooms, the *types* of questions asked by Mr. Cooper did not change. In both the flipped and traditional settings, it was common to hear questions that had only one answer. For example:

"Are these relative?" (Observation 2T)

"What is my range?" (Observation 2F)

A strategy implemented to raise the cognitive level of instruction was assigning students to group projects. These projects included evidence of higher level thinking

questions. For example, a task required them to take on the role of a teacher. The students were to design a learning activity for other students, using the skills they recently acquired. During the study, ten projects were assigned, approximately one each week. Observation data indicates that students had to be prompted to pair-up, such as the instance in Observation 4F when one pair was observed at length. The field notes included, “not much dialogue, staring at the screen, book closed, one partner with her head down.” Later during the same observation, our notes included, “neither appears interested, directions appear to be read again.” The pair finally did get some work completed, as the notes indicate, “book out, dialogue, friendly exchange of ideas, fonts explored, Zapf-Chancery settled on.” The productivity was not sustained for long, as five minutes later it was noted that, “A Word document is opened, and the first line reads ‘WWWWWWWWWWWWWWWWWWWW’, not much work is being completed.”

There were few instances of students working together successfully. Collaboration among classmates was an anticipated result of the flipped classroom. There was increased on-task discussion by the students. Eighteen instances of student-to-student academic interactions were noted in the flipped classroom as opposed to eight in the traditional class. Evidence of higher level thinking was apparent in the projects submitted.

Summary.

In the traditional and flipped classroom there were practices that were the same and practices that differed related to teacher-student interactions. In both classrooms, motivational comments from the teacher were related to grades and certification. Students were off task at roughly the same rate, and the non-instructional questions were asked at

the same rate. There were more teacher instructions and fewer student-to-student academic interactions in the traditional classes, indicating that there were blocks of time set aside for student project work during the flipped sessions.

Fidelity of Implementation of Flipped Classroom

Using the indicators outlined by Baker (2000) and previously referenced, let us examine the fidelity of the flip class implementation:

1. *Find an approach that would make it possible for faculty to move from sage to guide.* Mr. Cooper did not initially appear to move from sage to guide in the flipped class observations. When the data was coded, however, it was revealed that there were fewer instructional commands given during the flipped classes compared to the traditional classes. This indicates that students were involved in project work. There were also fewer non-instructional commands noted in the flipped classes, indicating that the routines and procedures were being followed.
2. *Reduce the amount of time spent in class on lecturing, opening up class time for the use of active learning strategies.* There were students in each class that did not opt-in to the study. These students compelled Mr. Cooper to continue to teach the material in the traditional way, which was primarily via lecture. The students in the study who were experiencing the flipped treatment could not avoid exposure to the lecture, which negatively affected the fidelity of the flipped class implementation.
3. *Focus more on understanding and application than on recall of facts, while not sacrificing presentation of factual base.* The flipped implementation did not

sacrifice the presentation of factual base. The projects were designed by the researchers to focus on student understanding of the various MS Office products.

4. *Provide students with more control over their own learning*. The students checked out laptop computers for use at home. The computers included screen casts, a digital copy of the textbook, and practice files. The opportunity for students to control their own learning was present. We did not interview students on this subject; it would be a viable focus for further study.
5. *Give students a greater sense of responsibility for their learning*. Field observations did not indicate that students were given a great sense of responsibility for their own learning. In the field notes, it was recorded frequently that grades and test scores were the motivating factors for assignment completion. Comments such as, “this might be one of the toughest questions on the test,” in Observation 4F and, “right now you have a zero, so be sure to get that turned in,” in Observation 2F indicate the extrinsic nature of the motivation for student learning.
6. *Provide students with more opportunities to learn from their peers.* The projects were designed for collaboration, which would have addressed the peer-learning piece of the flipped class. Factors that threatened this aspect of the implementation included frequent absences and student confusion regarding assignments. The split nature of both classes lead to confusion, as the teacher would tell one group to begin work on “step-by-steps” and another group to begin their project work. It was difficult to recall who was participating and who was

not, and frequent absences created many situations where the projects designed for cooperative learning were done in isolation.

Mr. Cooper's Perceptions

The second research question, "How will the teacher's perceptions of learning experiences differ in a traditional versus flipped classroom setting?" was answered after three recorded interviews and 12 field observations.

A strong recurring theme that emerged from the interviews was one of implementation challenges. Mr. Cooper stated multiple times that he wished the flipped model could have been the norm for the class from the very first day. He also stated that each student should have participated in the project. In all three interviews he lamented that he was essentially teaching a split class, which made it hard to maintain grading, grouping, and assisting students.

> The classroom norms need to be set up right from the beginning, stating this is how the class works. The kids need to understand that in order to be successful in the class they must complete both parts, not just what happens at school while the teacher is there, but what happens outside of the school, at home. They need to be able to take responsibility and do it, do the work at home as well. It should be non-negotiable the way the class works. (S. Cooper, personal communication, January 9, 2012)

The situation that led to this frustration was partial participation. IRB guidelines require subjects to opt in to the study. This led to two groups of students in each class period (participants and non-participants) and it was not an ideal situation for the teacher. Other students opted out of the study once it began, citing the extra effort that the flipped

class required. Shadish, Cook, and Campbell (2002) discuss post-assignment attrition as a threat to statistical power, and we saw this phenomenon firsthand.

Another theme that emerged from the teacher interviews was the general attitude that the students were not motivated. We noticed that he mentioned student motivation when he talked about the student projects. The observations confirmed this; students frequently needed prodding to pair up when it was time to work collaboratively. We tracked off-task behavior in both settings. The off-task behavior we noted including playing video games, listening to music and surfing the internet during the lessons and work-time. "Could be they don't value education, I don't know. Maybe they don't like the class, maybe they don't like computers." (S.Cooper, personal communication, January 9, 2012)

A similar theme of not participating in homework emerged. In the first interview, Mr. Cooper stated that the students in the technology classes simply were not accustomed to doing homework. He restated this in subsequent interviews. This concept led us to reflect on the role of homework in the flipped class. Since students were not in the habit of spending time doing homework, a major component of the flipped class was missing. Adding anything to do at home was simply adding more work. If students are already in the habit of doing homework, the shift from project-based work completed in isolation to the more sedentary activity of listening to instruction while at home may be welcome. Without prior content coverage, the project-based classroom may not have the positive outcome desired by the teacher.

Observation data suggests that grades and test scores appear to be the preferred motivational ploy. Mr. Cooper cited grades and "passing the test" as the reason students

needed to complete certain tasks more frequently than any other motivational reason. Mr. Cooper made these motivational statements at roughly the same frequency in the flipped and traditional settings. He also acknowledged in our conversations that the book and the activities are not engaging to the students, but they are necessary for learning the content needed for the IC3® Exam. The interview sessions confirmed this finding,

> Oh yeah the steps, they hate doing the steps, they hate them. But we have them do them because the terminology they use on the IC3 test, that is the same terminology. And if they don't do those steps, if they don't do those type of things, they won't do well on the test. A kid can know what the cursor is; but does he know what the insertion point is? I mean until he does the steps or until he at least looks through them, they won't know the definitions. (S.Cooper, personal communication, February 6, 2012)

The first interview (conducted two weeks into the implementation) revealed concerns about the flipped classroom model; the second interview (six weeks in to the implementation) was more positive about the treatment. For example, Mr. Cooper talked about how much better the collaborative projects were than the projects done in isolation. He praised their open-ended nature, in contrast to those in the book. He mentioned how students asked questions and worked diligently that particular day, and stated that he likes the course text, but it tends to tell the students what to do every step of the way. Mr. Cooper noted that the projects in the study challenge the students by making them create something. He also saw some positive potential for the screen casts, mentioning how they have been helpful for students with specific questions.

Discussion

This Case Study provided valuable insight into the implementation of the Flipped Classroom. Mr. Cooper implemented various key features of the Classroom Flip, including cooperative learning projects and direct instruction to be completed before class meetings. However, the key features of higher-level teacher questioning was not attained . This may have been due to a large percentage of his students not participating in the flip. However, even with a split flip, the data indicate other challenges that Mr. Cooper encountered during project implementation. These have important implications for creating a flipped classroom, and the related professional development. The promise of a flipped classroom is strong, and yet the difficulty in a high fidelity implementation, as indicated by this case study, is significant. We offer these lessons learned about the flipped class:

1. *The expectation of spending time doing homework should be clear.* In a setting where this is established practice, viewing instruction via technology might actually be less strenuous than completing traditional homework assignments. If there is not a routine or culture where homework is required, this will be a primary barrier to achieving the goal. Possible accommodations might include open labs before and after school.
2. *A flipped class implementation does not have to be "all or nothing"*. We encountered examples in our reading where teachers would flip selected lessons. The flip is one instructional strategy, not a curriculum or stand-alone pedagogy. Teachers might experience positive results flipping lessons on occasion.

3. *Students do not automatically prefer cooperative group work, nor do they intuitively know how to work in a group successfully*. We assumed that students had the desire to pair up and complete meaningful tasks. We did not consider that in some situations students are perfectly happy working alone, and that cooperation might be a barrier to success. A flipped lesson where students work in isolation still makes effective use of class time, because the teacher is available for further explanation and individual conferencing. There is still benefit to receiving the instruction before class. While Howe and Strauss (2000) document that Millennials prefer teamwork and cooperation, it is important to honor differences, and that collaborative learning is not the goal; efficient use of class time is. If a collaborative learning environment is to be achieved, Johnson and Johnson (2009) state that, "students must be taught the interpersonal and small-group skills needed for high-quality cooperation and be motivated to use them" (p.369).
4. *Teachers do not have to create all of their own content for a flipped class*. We encountered instances where commercially purchased content and free content such as the Khan Academy provided direct instruction outside of class. An LMS or class website could streamline delivery of content.
5. *Lecturing is not bad pedagogy, but it should not be the primary or sole means for instruction*. It is an efficient form of conveying large quantities of information. Providing access to lecture content via technology does more than free up class time. It allows students to view or hear lessons multiple

times. The flip balances the requirement of covering content with the opportunity to apply the theory being learned (Toto and Nguyen, 2009).

6. *Mobile technology access is growing*. In 2011, half of all computing devices sold were mobile devices (Gartner, 2012). The flipped class is one way to utilize mobile devices for learning that can take place on demand.
7. *Pre-testing in K-12 classes warrants further study.* Two students in our study passed the IC3® exam before any instruction occurred. A student in this situation might benefit from placement in a higher-level class. Perhaps other classes should give exams at the beginning of course for diagnostic and placement purposes. The CMA noted that JCPS was lacking in "student prior mastery of target standard" (Phi Delta Kappa, p. 269) and noted a lack of diagnostic assessments. "Without this data, teachers may waste students' time on content already mastered" (Phi Delta Kappa, p. 269). The diagnostic assessments in the audit were in the context of beginning a learning unit, but it is prudent to consider the implications of assessments at the beginning of a course as well.
8. *Students respond to multiple means of representation*. The teacher in our study stated that students benefited from the screen casts. It is effective to use audio, video, and computer animations to supplement or complement instruction.

Summary

Mr. Cooper was circulating among the students, answering questions and offering help. It was project time in one of the flipped sessions. The students had received

instruction at home, and a large block of time during class was allocated to work on a project. The open-ended task involved the student taking on the role of a teacher. They were to design an activity for other students, which taught and assessed them on the Office skills they learned in the preceding lessons. A young lady raised her hand and motioned for the teacher to come to her. She showed him what she had done so far, but with a quizzical look she requested some clarification on the directions. He rephrased the instructions in a way that appeared to sink in with her. She looked at him once she understood and made a confirming statement, "So you want *me* to tell *them* what to do?"

The teacher nodded, as if to reply, "Yes."

Without missing a beat, the student declared to anyone within earshot a stunning and honest revelation about what she finally internalized about the task. She exclaimed loudly, "Oh my god, that's a lot of work!"

We chuckled at her candor, but agreed with her assessment. It is a lot of work. It is extra preparation for the teacher, who has to prepare direct instruction in advance, and leverage technology in order to deliver it. It is an increased workload for the student, who must consume the lesson in advance. The student and teacher will both be working harder during class. As this case study demonstrates, this hard work includes an awareness of the key features of the classroom flip, as well as skills that go beyond the flipping of classroom and homework time, such as higher level questioning, keeping students on task, and creating projects that are engaging and appropriate for the content and collaborative learning. The flipped classroom entails more than rearranging the order of events, it is a philosophical transformation.

CHAPTER III

EFFECT OF THE FLIPPED CLASSROOM MODEL ON A SECONDARY COMPUTER APPLICATIONS COURSE: STUDENT PERCEPTIONS, QUESTIONS AND ACHIEVEMENT

At the same time the current study was performed, a curriculum management audit was conducted of the school district where the study was done by the International Curriculum Management Audit Center of Phi Delta Kappa International. A finding of the audit pertaining to instruction and technology was the following,

> Teacher and student activities observed in district classrooms were most often direct instruction and seat work. Lesson objectives were not clearly defined in the majority of classroom visits recorded with the protocol instrument. Although technology was mentioned in board policy as having a "positive impact on learning," technology was observed during the snapshot data an average of 47 percent of the time. Available classroom computers were in use in less than 25 percent of the recorded classroom visits. The most common levels of cognition noted during classroom visits were recall and comprehension, the lowest of the four levels of cognition auditors observed. (p. 401)

The authors of the quote above imply that the absence of lesson objectives and technology use contributed to the low levels of student cognition. Cognition in these classrooms could not have been raised by the use of technology alone. Technology is a tool that allows us to do things we would not otherwise be able to accomplish. The classrooms described here were not in need of additional tools. They were in need of purpose.

So we raise the question, what is the purpose of attending a physical school at a time when there is increasing availability of virtual schooling? The answer may seem obvious, but those of us in public education are overlooking it. The perceived need to cover large amounts of content in order to prepare students for high stakes accountability measures (Stillman & Anderson, 2011) has clouded our vision. The best thing about our public educational system is the fact that groups of similarly aged students are physically in managed social settings to learn from and alongside one another. No online learning environment can truly replicate those conditions. The audit findings suggest that engaging, higher cognition learning opportunities do not automatically happen, even though the environment for those conditions does currently exist.

One way to take full advantage of the public education system, as well as online opportunities to transform the classrooms described by the audit, would be to employ the flipped classroom model of instruction. The flipped classroom model is receiving increased attention in educational circles and the popular press (Toppo, 2011; Tucker, 2012). In this model, the traditional practice of spending class time engaged in direct instruction and completing content application activities for homework is "flipped", so that students receive initial content instruction at home, and spend class time working with their peers in a collaborative setting.

Providing direct instruction prior to coming to class is the first step of the learning process in the flipped classroom model (Baker, 2000; Toto & Nguyen, 2009). This is, in itself, not a revolutionary concept. Those of us who attended college in the United States experienced the practice of reading content prior to class and raising questions regarding the assignment during class time (the fact that direct instruction was still the focus of

class meetings will not be explored at this time). What is worth noting, however, is that technology has advanced to the point where it can now be the tool to provide direct instruction prior to class time. The question is then raised, why is a new tool needed when the textbook has served that purpose for decades? The answer to that question lies in the ability of multimedia technologies to meet the needs of diverse learners (Jackson, Gaudet, McDaniel, & Brammer, 2009).

The use of technology to facilitate the acquisition of skills and concepts prior to class time will allow students and teachers the opportunity to take advantage of the best things public education has to offer: each other. A common barrier to the implementation of collaborative learning activities in the classroom is a teacher's perceived lack of time (Barak & Shakhman, 2008). Collaborative learning allows students to do work together whereas cooperative learning encourages students to divide up group work and then put the individual contributions together (Stahl, 2012). Strong theoretical and empirical support has been found for the cognitive and motivational benefits of collaborative, as opposed to competitive and individualistic learning activities (Jarvela, Volet, & Jarvenoja, 2010).

Summary

A 2012 curriculum management audit in the district of study found that most often, classrooms were focused around direct instruction and seat work. Recall and comprehension were the most common levels of cognition noted during the classroom visits, perhaps due to the need of teachers to cover large amounts of content due to high-stakes accountability testing. As an attempt to cover the content as well as provide opportunities for students to collaborate in class, the flipped classroom model is offered

as an alternative to direct instruction. To assist with the flipped classroom implementation, students use technologies outside of class to cover content traditionally taught during class.

Shroff and Vogel (2009) claim that it is important to look for "clues as to how e-learning technologies can become powerful catalysts for change as well as tools for redesigning our learning and instructional systems" (p. 60). To reclaim its position as a fundamental institution of society, now is the time for public education to embrace the proliferation of online learning and certification opportunities to enhance daily classroom experiences. Public education has the opportunity to offer something that strictly online learning environments find difficult to provide – motivation for learning (Songhao, et al., 2011).

To examine the benefits, shortcomings, student perceptions, and academic results of the flipped classroom model while using technology as a supporting tool, a traditional high school computer applications course was "flipped" so that direct instruction occurred prior to class time. Microsoft Word, Excel and PowerPoint provided the content of the twelve-week class. Our focus was on the interaction of the method of classroom instruction with student academic achievement, student questions asked during class and student perceptions of course format.

Review of the Literature

In 1995, one of the earliest instances of "The Classroom Flip" approach can be attributed to J. Wesley Baker at Cedarville University. During a lecture as he was clicking through a PowerPoint (which he was accessing through the university learning management system), he exclaimed,

> This is really stupid! The information on the slides is going from the screen to your notes without passing through either of our brains. The presentation is on the network. Just access them online before class and let's not waste time in class just copying down slides. (Baker, 2011, p. 1)

Goals of the flip approach included: reducing lecturing while increasing active learning, focusing more on understanding and application than on recall of facts, providing students with more control and greater sense of responsibility over their own learning, and providing more opportunities for students to learn from peers (Baker, 2000).

No indication of the effect of the teaching method on academic achievement was provided. End of course survey results indicated,

> the class encouraged me to spend more time collaborating with other students than I typically do in other classes, class discussions encouraged critical thinking, compared to other classes of this size I felt that there was more personal attention provided me, I feel I learned from my fellow students through their presentations and comments in class discussion, the online resources provided me with more control over my own learning, in-class time was spent more in discussing implications than in presenting facts. (Baker, 2000, p. 14)

The inability to individualize instruction due to time constraints led instructors of an introductory economics course to implement an inverted classroom model in five sections at Miami University (Lage, Platt & Treglia, 2000). In their model, students were expected to read a chapter in the assigned textbook as well as view videotaped lectures or PowerPoint (with sound) presentations prior to coming to class. Class time was spent answering questions, engaging in an economic experiment or lab then completing

worksheets and review questions.

No indication of the effect of the teaching method on academic achievement was provided. End of course survey results indicated: the majority of students were favorably impressed by the course, students had favorable reactions to the peer group-work component of the course, students viewed the in-class experiments as beneficial, and students did not view the class as "easier" (Lage, Platt & Treglia, 2000).

Strayer (2007) began exploring effects of the flipped classroom in 2001 due to his college math students' unwillingness to read the textbook prior to coming to class, his desire to give students control over when they were presented new information and the ability of the Thinkwell web-based homework to provide instant feedback. His students were required to watch an hour of video lecture and complete web-based multiple choice homework assignments prior to each class session. Class time was spent addressing questions from the assignment due that day as well as engaging in more difficult problems similar to those done as homework.

No indication of the effect of the teaching method on academic achievement was provided. End of course survey results indicated no significant differences in student opinion of how technology allowed them to control their learning or whether it allowed increased opportunities to master the content. Technical difficulties and perceptions of class time as wasteful provided valuable insight into Strayer's next steps (Strayer, 2007).

Strayer (2007) again investigated the classroom flip in two of his college Introduction to Statistics classes taught in 2002. In the three-day study, students in the flipped class were required to view a video lecture in the library as the homework assignment prior to coming to class. Three class periods were then spent involved in

completing a group project. In the traditional class, lecture and homework continued as normal.

Test scores showed that students in the flip class did not perform as well as students who experienced the lecture and homework. Student interviews revealed concerns over altering personal learning strategies to fit the new classroom structure as well as working in groups. Strayer (2007) noted three findings from this study,

> students must have time to adjust to the changes the classroom flip brings, there must be flexibility so that students can become comfortable with the things they do and do not have control over in the learning process, and students must come to see that group learning activities can benefit their personal learning. (p. 12)

Strayer (2007) applied the lessons learned from his previous work in the field to a study he deployed in two of his college Introduction to Statistics classes in 2004. In this four month study, students in the flipped class were introduced to new content prior to class by working with an intelligent tutoring system. Class time was spent interacting with peers and the instructor engaged in activities designed to provide opportunities to interact with the content in a different context. The traditional class format consisted of participating in an "interactive lecture" and then completing problems from the book as homework.

Data were collected and analyzed from student interviews and focus groups, in-class observations, audiotaped classroom sessions, student assignments, student written reflections, and researcher reflections. Strayer (2007) found that students in the flip environment preferred and experienced a higher level of innovation and cooperation in their classroom. However, those same students were unsettled by the learning activities

in the flip classroom. No indication of the effect of the teaching method on academic achievement was provided.

Creating videotaped lectures to be used in an online environment for a distance education course prompted a professor in the College of Engineering at The Pennsylvania State University to wonder how he might incorporate those same videos into his face-to-face course offerings. Toto and Nguyen (2009) described the outcomes for the course as: increased student engagement in the classroom, opportunities for students to get a real world sense of the tools they will be working with, and covering the required instructional content (p. 1). In this flipped model, students were encouraged to watch a video lecture prior to coming to class by requiring a one to three question quiz on the lecture content. Class time was spent using real tools and engaging in practical applications.

Results indicated students spent about 30 minutes in one sitting watching the video lectures and they felt 30 minutes to be the optimal length for the video lectures. However, they also noted it was easier to get distracted while watching the video lectures. In addition, they preferred using class time for problem solving and hands-on activities as opposed to lecture. Also worth noting were comments made to the effect that time and classroom management could have been improved (Toto and Nguyen, 2009). No indication of the effect of the teaching method on academic achievement was provided.

In 2008, Bergmann and Sams (2009) made video podcasts (vodcasts) of their high school chemistry lessons so they could physically be available while their students were doing labs, working out problems, and wrestling with an assignment. In their vodcasting model, students were required to view the vodcasted lessons prior to class. Class time

was spent in more hands-on learning activities, with the teachers actively walking around the classroom engaging students and checking for understanding.

Anecdotal evidence of the vodcasting model suggested positive results. One student attributed her grade increase to use of the podcasts. One parent admitted that her fear of her student having less contact with the teacher was "very wrong". The teachers implementing the model claim that they have gotten to know their students better. Science scores on the Colorado state exams were lower for the flipped group than the previous years' group, but the teachers attribute that to a lower prerequisite math requirement for the course. Average scores on identical science tests given before and after implementation were nearly the same (Bergmann & Sams, 2009).

In 2008, Alfaro and Johnson implemented The 180 Degree Classroom in a pre-calculus class in the school district where the current study was done. Even though the teacher had previously recorded his lessons and posted them to a podcast server for student consumption outside of class, this model took advantage of the students using technologies to create the video lessons for posting on the class website. Every student was assigned an iPod Touch for internet access during class time and for viewing the video lessons outside of class. Placing the students in role of teacher was the main goal of this project, for those of us in education have experienced the opportunity we wanted to provide the students: deeper understanding after teaching a concept than before. In fact, Alfaro often quoted his mentor in El Salvador, Settimo Rossoni as saying, "If you want to learn…study. If you want to learn more…teach" (Johnson, 2009, p. 5).

Anecdotal evidence of The 180 Degree Classroom suggested positive results. Overall, students thought the process was engaging and that collaboration improved

understanding. No indication of the effect of the teaching method on academic achievement was collected due to the number of confounding variables. However, lessons were learned which guided the implementation of the project the following year in two additional schools, as well as the current study.

Of the four studies and two pilot programs, capturing student perception was the most common form of data collection. In the present study, our additional interest is in exploring whether the flipped method has an effect on academic achievement. Refer to Table 1 for additional examples of classrooms that have implemented a flipped model of instruction.

Method

Purpose

The purpose of this study was to examine the efficacy of traditional and flipped course delivery methods. Establishing whether a flipped classroom produces measurable academic gains was a primary, but not the only intent of this study. Capturing student perceptions, as well as the type and frequency of questions asked in a high school flipped classroom may provide previously unexplored insight into the full impact of this teaching method.

Study Design

A switching replications design was used that involved one teacher, Mr. Cooper (pseudonym) and two groups of students participating in a traditional classroom setting for one unit of study and a flipped classroom environment during a second unit of study. While one group participated in the flipped classroom environment, the other group experienced the traditional classroom (Appendix A). At the conclusion of the initial unit

of study, the groups switched. According to Trochim and Donnelly (2008), this is one of the strongest experimental designs because it addresses the issue of denying the program to participants through random assignment.

All study participants were provided with a laptop for use at home, a thumb drive for transporting homework files to school, a digital copy of the textbook and video tutorials to accompany the written "step-by-step" instructions. The laptop network cards were disabled due to concerns regarding internet access at home. Files were provided on compact discs for use on home computers if participants did not wish to receive a laptop computer.

The setting for the study, two twelve-week Computer Applications courses, consisted of three units of study: Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. The switching-replications process did not begin until the second unit of study. Therefore, students in both classes learned Microsoft Word using traditional methods. Mr. Cooper began each class by providing step-by-step demonstrations of the skills to be learned that day. Students were then given time to individually complete the step-by-step learning modules provided in the textbook to reinforce those skills. When the step-by-step activities were completed, projects were assigned from the book which provided additional practice using those skills. At the conclusion of class, Mr. Cooper provided opportunities for students to demonstrate the skills learned that day in front of the class using his computer and multimedia projector. Since both classes received consistent instruction in Microsoft Word, it is assumed that both groups began the study with a similar knowledge base of the Microsoft Office suite.

Variables

Classroom instruction was the independent variable with two levels, traditional and flipped. During the traditional class format, students spent class time working through the textbook, completing "step-by-step" tutorials. The tutorials were designed to be used with a "starter file". Once opening the starter file, students followed the written directions to perform various tasks utilizing features of the appropriate productivity tool. For homework, the students in the traditional class were individually required to complete a project. The project consisted of the students creating a "starter file" and series of instructions to be followed by other students in order to demonstrate mastery of the skills associated with the lesson. Instead of using a generic file and following steps written by the publisher, the task was to recreate that process from scratch.

During the flipped class format, students spent class time working with a partner to complete the same project the students participating in the traditional class were required to do for homework. The project consisted of the pair of students creating a "starter file" and series of instructions to be followed by other students in order to demonstrate mastery of the skills associated with the lesson. Instead of using a generic file and following steps written by the publisher, the task was to recreate that process from scratch. For homework, students in the flipped class worked through the textbook, completing the same "step-by-step" tutorials completed by the other group during class. Since the teacher would not be available to answer questions, a movie file was provided which demonstrated the process of each set of step-by-step instructions.

Student academic achievement is a dependent variable, which in theory will show greater gains by students when participating in the more effective of the two classroom models. However, since the concepts tested are lower-level in nature, participating in the

flipped class format may have no effect on academic achievement since the purpose of the flipped format is to provide students with opportunities for engagement in higher-level cognitive activities.

The cognitive level of questions asked by students during class serve as a dependent variable that will gauge the level of student cognition based on the levels of cognition recognized in the curriculum management audit. It was hypothesized that students in the flipped class would ask higher-level questions to the teacher as well as to one another since they would have been engaged in higher-level activities.

Student perceptions of course format serve as a dependent variable that will provide insight into student preferences of learning method. It was hypothesized that students would prefer the flipped class format due to the required peer interaction and higher levels of cognition.

Population and Sample

Two Computer Applications classes at Study High School (pseudonym) in Kentucky served as the context for this study. During the 2010-2011 school year, the enrollment of Study High School placed it among the ten schools with the highest enrollment in the district. Study High qualified for School Improvement Grant funds to improve student achievement during the 2010-2011 school year according to the school district's Tier II definition. At least 35% of the enrollment qualified for free/reduced meals, the school did not make adequate yearly progress (AYP) for at least three consecutive years and was either in the bottom 5% or was one of the bottom 5 non Title 1 schools based on averaging the percentage of students who received proficient or

distinguished on the reading and math core content tests (Jefferson County Public Schools, 2011).

Convenience sampling was used to select the cooperating teacher due to his collaboration with one of the co-investigators on a non-related project during the 2010-2011 school year. The two participating classes were selected from the three sections taught by Mr. Cooper during the second trimester of the 2011-2012 school year based on the two classes having similar grade level composition. Table 3 provides an overview of students involved in the study.

Data Collection

In order to examine the efficacy of traditional and flipped course delivery methods, five research questions guided our study. The purpose of this paper is to focus on the three that specifically relate to the student. Does the implementation of the flipped classroom model increase student acquisition of knowledge of Microsoft Office applications? How do the types of questions asked by students differ in traditional versus a flipped classroom setting? How do student perceptions of learning experiences differ in a traditional versus flipped classroom setting? Data collection occurred between November 2011 and February 2012. See Appendix A for the data collection timeline.

To measure acquisition of knowledge of Microsoft Office applications, the Certiport Internet and Computing Core Certification (IC3®) exam was administered as the pre- and post-test. This is the second year the IC3® exam has been used district-wide to measure student computer literacy. As part of the Computer Applications course in Study High, the test is traditionally administered at end-of course only after students pass

the practice test provided by Certiport. However, all students enrolled in the two classes involved in the study were tested at the beginning and conclusion of the course.

To determine how the types of questions asked by students differ in the traditional versus flipped classroom setting, twelve observations were conducted to record the student questions asked of Mr. Cooper and peers. Since the curriculum audit cited recall and comprehension as the most common levels of cognition noted during classroom visits, our focus was on classifying questions as recall, comprehension, and above.

To capture student perceptions of learning experiences in the traditional and flipped classroom settings, students will complete an online Likert scale survey. The survey was previously used in a study to examine the efficacy of traditional and blended course delivery methods. The survey questionnaire was designed to determine student perceptions in the areas of content and course delivery, assessment and evaluation, as well as communication and learning experiences (Araño-Ocuaman, 2010).

Data Analysis

Analyzing data collected during this project included both quantitative and qualitative techniques. Results of IC3® pre and posttest scores and surveys were analyzed using SPSS to determine if significant differences in academic achievement and student perception could be attributed to project implementation. The questions asked by students were classified as “recall”, “comprehension” or “other” in order to compare our findings with those of the recent district curriculum management audit.

The use of both quantitative and qualitative techniques qualifies this study as a mixed methods research design. According to Creswell (2008), combining both techniques provides a better understanding of the research problem than either method by

itself. In previous studies on the topic, mostly qualitative methods were used to assess the effectiveness of the flipped method of instruction. In this study, our additional interest in studying relationships between academic achievement and teaching method expanded the need for data beyond qualitative measures.

An independent-samples *t* test was calculated comparing the posttest scores of students who did and did not participate in the flipped instructional units. This particular statistical analysis compares the means of two samples, which are normally from independent randomly assigned groups (Cronk, 2010). Due to the safeguards associated with the switching replications design, no evidence supported the existence of a variable other than teaching method affecting the outcome, so the use of a covariate, strictly speaking, was unnecessary.

A paired-samples *t* test was calculated comparing the pre and post survey responses of students who participated in the study. Since the same survey was used for both, and utilized the Likert-scale format, the scores are measured on the same scale.

Reviewing the combined field notes from the 12 observations was the first step in categorizing the types of questions asked by students in both instructional settings. The questions asked by students were highlighted and identified as originating in either the flipped or traditional classroom. Questions were then categorized according to the cognitive levels identified in the curriculum management audit: recall and comprehension. In addition, "other: non-instructional" and "other: higher cognitive levels" were identified in order to accommodate all possible question types.

More detailed statistical analyses were included in the project proposal (see chapter one). However, due to flaws in treatment implementation, not all measurements

were necessary. Objections to burdensome measurement (Shadish, Cook, & Campbell, 2002) led to low numbers of participation. Delays experienced in the IRB process caused truncation of the treatment window.

Results

Results of the independent-samples *t* test comparing the post test scores of students who did and did not participate in the flipped Excel unit found no significant difference ($t(21) = 1.487$, $p > .05$). The mean of the scores from the class which did experience the flipped Excel unit ($m = 68.75$, $sd = 14.55$) was not significantly different from the mean of the scores from the class which did not experience the flipped Excel unit ($M = 78.57$, $SD = 14.64$).

The independent-samples *t* test comparing the post test scores of students who did and did not participate in the flipped PowerPoint unit found no significant difference ($t(21) = .727$, $p > .05$). The mean of the scores from the class which did experience the flipped PowerPoint unit ($M = 88.57$, $SD = 22.68$) was not significantly different from the mean of the scores from the class which did not experience the flipped PowerPoint unit ($m = 78.75$, $sd = 32.22$).

Results of the paired-samples *t* test found no significant difference between the mean pre and post survey results of students who participated in the treatment ($t(10) = .078$, $p > .05$). The mean on the pre test was 3.85 ($SD = .54$), and the mean on the post test was 3.84 ($SD = .50$). As a result, student perceptions of the flipped class experience do not provide evidence that the flipped experience changed attitudes. These findings are concurrent with the diversity of open-ended survey responses: "I liked the opportunity because I learned a lot while working on the projects with my partner and having the

laptop has made it possible for me to complete work at home" and, "I felt like I was doing the same thing every time. It felt like I wasn't getting much out of it."

Overall, data revealed there were more questions asked in the traditional than in the flipped classroom. Of the 26 questions asked by students in the traditional class, 11 were categorized as recall, 11 comprehension and 4 were non-instructional in nature. Of the 14 questions asked in the flipped environment, 7 were categorized as recall, 6 comprehension and 1 as non-instructional. The fact that more questions were recorded in the traditional classroom may be attributed to the study…if students were working in pairs, questions asked of partners could have gone unnoticed by observers. In neither environment were higher cognitive level questions observed, which meant there was no evidence to reject the null hypothesis.

Discussion

Limitations

Findings indicate no benefit to using the flipped method of classroom instruction in a secondary computer applications class. Mr. Cooper's classroom was chosen as the setting for the study for two practical reasons: convenience sampling and subject area content. These perceived strengths were not enough to offset the limitations created by those decisions as well as the realized threats to implementation.

The course was chosen based on the role of the co-investigators in the district of study. One of the goals for the department which employs the co-investigators, Computer Education Support, is to assist with ensuring the technology literacy of JCPS students, as defined by the National Education Technology Standards for Students. To measure success toward accomplishing that goal, all high schools in the district receive

IC3® exam testing vouchers. In order to prepare for the exam, the computer applications course is designed to teach the tested skills. As designed, the course does not include a homework requirement. The addition of a homework requirement created conditions which were not favorable for successful project implementation. Due to the research protocol, approved by the University Office of Human Subjects Protection, students were required to opt-in to the study. It is believed that the addition of class requirements not only discouraged participation but also convinced two students to drop out of the study after implementation.

In the reviewed flipped class implementations (Baker, 2000; Bergmann & Sams, 2007; Lage, Plat & Treglia, 2000; Strayer, 2007; Toto & Nguyen, 2009), the desire to change instructional practice originated with the practitioners, not a third party. In none of these instances was an instructor approached and asked to implement the flipped instructional method. Had a need not been realized, no change would have been sought. In this study, Mr. Cooper was approached and willing to change his instructional practice in the absence of perceived need. The IC3® exam pass rates of his class had been comparable with other teachers in his department, so no need to change was apparent.

Implications

It was hypothesized that students in the computer applications class would benefit from the flipped method due to the transitioning of class time from lower-level activities to collaborative group work. Even though our results do not support this hypothesis, the current research study does provide insight into further research on the topic as well as observations in relation to our findings.

For those who question the nature of courses which would work most effectively with the flipped classroom method supported by technology, the answer lies in the creativity and desire of the individual teacher. If a teacher is driven to implement the flipped approach and is willing to commit to the extra work required in order to ensure success, content area should not be a significant factor. Future research on determining the efficacy of the flipped method of instruction should only be conducted when teachers realize the need for drastic change in instructional practice and are willing to tackle the drawbacks associated with time, student work ethic, personal work ethic, technology access and history.

Lack of class time for direct instruction as well as collaborative learning experiences is addressed with the flipped approach. However, the amount of time spent by teachers preparing for such a class can be overwhelming, depending upon the resources available for student consumption prior to class. If none are available freely or through purchase, teacher time will be required to produce the learning objects.

A strong student work ethic is acknowledged and encouraged with the flipped approach. Assigning homework that requires students to internalize course content as opposed to interact with information (not knowing if they are correct until the following class meeting) requires a level of student work ethic not traditionally expected. As exciting as that possibility is, as soon as students realize the approach requires more work of them (challenging their work ethic) they will be tempted to give up.

A strong teacher work ethic is necessary with the flipped approach. Not only will the flipped teacher be required to ensure learning objects are available for each lesson, but collaborative activities as well. Essentially, two traditional lesson plans equate to one

flipped lesson plan. In-class responsibilities will increase as well. Instead of lecturing one time to everyone, a beautiful thing happens with collaborative learning: students ask questions and want to learn as opposed to being "lectured at". The slight difference of providing students information when they request it, as opposed to when it is convenient, is huge. However, that "beautiful thing" may be enough to push the work ethic of a good teacher to its limits, for example having to explain a concept multiple times during one class period as opposed to once.

Student and teacher access to learning objects may be more problematic than expected. With the widespread use of personal technologies, one might take student access to online resources for granted. However, depending on the file format of the learning objects, they may or may not be accessible to all devices. In addition, if the learning objects are to be created by the teacher, access to the software and expertise needed to capture and publish the lessons may prove discouraging.

History is possibly the most difficult obstacle to overcome, while also providing the needed motivation to undertake such a radical change in instructional practice. It is no secret that those of us in education were good students. We learned to teach from our teachers, even those we had in college. Changing the way teachers and students approach "school" will require reprogramming years of experience. However, when the possibilities associated with the flipped method are realized, that reprogramming should prove to be worth the effort.

Unfortunately, the current study does not provide support for wide-scale implementation of the flipped method of instruction. Since so few students opted to participate in the study, Mr. Cooper was obligated to teach the non-participants in the

traditional method. As a result, each flipped class participant was exposed to the traditional method of instruction as well as the flipped. This led to perhaps the most unfortunate flaw of the study, a flaw in the implementation of treatment. However, Shadish, Cook and Campbell (2002), offer that our results may be characteristic of the effects of this treatment if it is implemented wide-scale as a matter of policy, because the treatment implementation will be imperfect. Consequently, results similar to our findings may not be uncommon in wide-scale implementation of the flipped method of instruction.

CHAPTER IV

EXECUTIVE SUMMARY

To examine the benefits, shortcomings, perceptions, and academic results of the flipped classroom model while using technology as a supporting tool, a traditional high school computer applications course was "flipped" so that direct instruction occurred prior to class time. Microsoft Word, Excel and PowerPoint were the topics covered in the twelve-week class. The focus of the study was on the impact of the method of classroom instruction on student academic achievement, student and teacher questions asked during class, as well as student and teacher perceptions of course format. The purpose of this summary is to provide findings for each of the five research questions as well as recommendations based on those findings. Before discussing findings, a discussion of the strengths and limitations of the study is appropriate.

Strengths

The flipped method of instruction is a course delivery method. Flipping a class means covering content prior to students attending class, freeing class time for collaborative learning projects. Strengths of the method include: meeting the needs of diverse learners, taking advantage of the community of learners in classrooms, allowing students to own when they learn new content and providing opportunities for individualized instruction. The hypothesis was that these strengths would allow for increased student achievement, positive student and teacher perceptions, and an increased cognitive level of questions asked in the flipped environment.

A switching replications design was used that involved one teacher, Mr. Cooper (pseudonym) and two groups of students. The groups were in a traditional classroom setting for one unit of study and a flipped classroom environment during a second unit of study. While one group participated in the flipped classroom environment, the other group experienced the traditional classroom (Figure 1). At the conclusion of the initial unit of study, the groups switched. According to Trochim and Donnelly (2008), this is one of the strongest experimental designs, because it addresses the issue of denying the program to participants through random assignment. A qualitative component of the study included a series of field observations and interviews with the teacher regarding his perception of the process. According to Creswell (2008), combining both techniques provides a better understanding of the research problem than either method by itself.

Data collection techniques proved to be a strength of the study. Using the Certiport Internet and Computing Core Certification (IC3®) exam to capture pre and posttest scores prior to and following the units of study provided a reliable and valid instrument to measure academic achievement. The survey conducted to capture student perceptions was adapted from a separate study measuring the efficacy of blended teaching methods.

Limitations

As originally designed, the course did not include a homework requirement. The addition of a homework requirement created conditions that were not favorable for successful project implementation. Due to the research protocol, approved by the University Office of Human Subjects Protection, students were required to opt-in to the study. The addition of class requirements not only discouraged participation but also

convinced two students to drop out of the study after implementation. In addition, many parents were not interested in accepting responsibility for the laptop computer and did not opt-in to the study.

Academic Achievement

No significant difference was found between pre and posttest scores of students who did and did not participate in the flipped classroom approach. It is the opinion of the co-investigators that this is not a result of the flipped method of instruction, but rather a failed attempt at the flipped method of instruction. Since very few students chose to participate in the study, Mr. Cooper was obligated to teach the class using traditional methods. Therefore, not only were the students in the flipped class exposed to the traditional class procedures, they did not fully embrace the flipped class expectations.

However, the study did bring about findings that would not have been realized in its absence. The recent curriculum management audit noted that JCPS was lacking in a way to determine "student prior mastery of target standard….without this data, teachers may waste students' time on content already mastered" (Phi Delta Kappa International, p. 269). Two students passed the IC3® exam during the pretest, prior to any instruction. Perhaps those two students would have been better served by another class placement. Further investigation is needed in this area.

Teacher Questions

The hypothesis of the study was that teacher questioning would change. Since the class time would be more project-oriented, it was predicted that the teacher would use more open-ended and deeper questions. According to the twelve observations, the questioning strategy did not change significantly. The number of higher-level questions

actually decreased in the flipped sessions. The number of lower level questions posed by the teacher also decreased in the flipped sessions, suggesting that the flipped classes were spent with more student oriented, project time. The results also suggest that simply flipping the class will not result in a change in teacher questioning strategy. Teacher questioning strategy is a domain that might warrant targeted professional development, mentoring, and modeling.

Student Questions

Students asked more questions in the traditional classroom. Since students worked in groups in the flipped classroom, the questions may have been asked to partners and gone unnoticed by the observers. In addition, the use of the video tutorials by students in the flipped environment may have provided answers to questions asked by those not in the flipped class.

Teacher Perceptions

The teacher in this study offered perspective on the flipped method. Through a series of interviews, Mr. Cooper revealed that the flipped method was sound pedagogy. He especially found value in the screen casts. The screen casts helped the students who were struggling readers, because they no longer needed to rely solely on the textbook for skills instruction. He also stated that some students were using the screen casts for a reference. Some adjustments for future implementation would be advisable. He pointed out that transitioning to the flipped method in a course that traditionally does not require homework was a challenge.

Student Perceptions

Student perceptions of the flipped class experience were as varied as the students.

No significant difference exists between pre and post survey results; there is no quantitative evidence to support student satisfaction with the flipped class experience. However, open-ended responses and observations provided multiple opportunities to see glimpses of promising student perceptions.

Lessons Learned

We offer seven observations which may guide future flipped class implementations:

- The expectation of spending time doing homework should be clear.
- A flipped class implementation does not have to be "all or nothing."
- Students do not automatically prefer cooperative group work, nor do they intuitively know how to work in a group successfully.
- Teachers do not have to create all of their own content for a flipped class.
- Lecturing is not bad pedagogy, but it should not be the primary or sole means for instruction.
- Pre-testing in K-12 classes warrants further study.
- Students respond to multiple means of representation.

Next Steps

Future research on determining the efficacy of the flipped method of instruction should only be conducted when teachers realize the need for drastic change in instructional practice and are willing to tackle the drawbacks associated with time, student work ethic, personal work ethic, technology access and history. The flipped method would compliment a future study on mobile device usage, 1 to 1 computer implementations, or individual learning programs.

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Table 1

Select Flipped Class Implementations

Reference	Lage, M., Platt, G., & Treglia, M. (2000)	Baker, J. (2000)	Gannod, G., Burge, J, Helmick, M. (2007)	Strayer, J. (2007)	McKinney, D., Dyck, J.L., & Luber, E.S. (2009)	Toto, R., & Nguyen, H. (2009)	Bergmann, J. & Sams, A. (2009)	Dunn, J. (2011, December 5)	Dunn, J. (2011, December 5)	Dunn, J. (2011, December 5)
Level and Discipline	College Business	College Computer Programming	College Computer Programming	College Mathematics	College Psychology	College Engineering	Secondary Science	Secondary Chemistry	Secondary Math	Elementary Math
Study Design	Student perception survey	Student perception survey	Pre and post survey, SGID, rubrics for evaluation	Mixed methods, highly qualitative	Pre and post test, quasi experimental	2 surveys, correlated with learning style inventory	N/A	N/A	N/A	N/A
Results	Favorable student perception	Favorable student perception	Favorable student perception	Negative student perception, high level of cooperation and innovation, no academic effect provided	Favorable outcome on post test, participants listened to lecture multiple times	Favorable student perception	Increased student interaction, increased achievement	Increased collaboration, students work at own pace, 37 teachers at school flip for at least one unit	Increased math scores	Students accelerated, working at different paces "school board is giddy"

Table 2

Themes from Observations

Observed Action	Traditional	Flipped
Teacher instructional command or statement	47	26
Teacher low level question	27	17
Teacher to individual student instructional interaction	19	10
Teacher open ended or active learning question	19	6
Teacher rhetorical question	19	5
Teacher praise, positive statement	17	3
Teacher grade/assessment related motivational comment	15	16
Teacher non-instructional command	6	2
Student instructional question	24	19
Student off task action	23	26
Student response	20	17
Student to student academic interaction	8	18
Student to teacher non instructional question	4	4
Student to student non academic interaction	3	4

Table 3

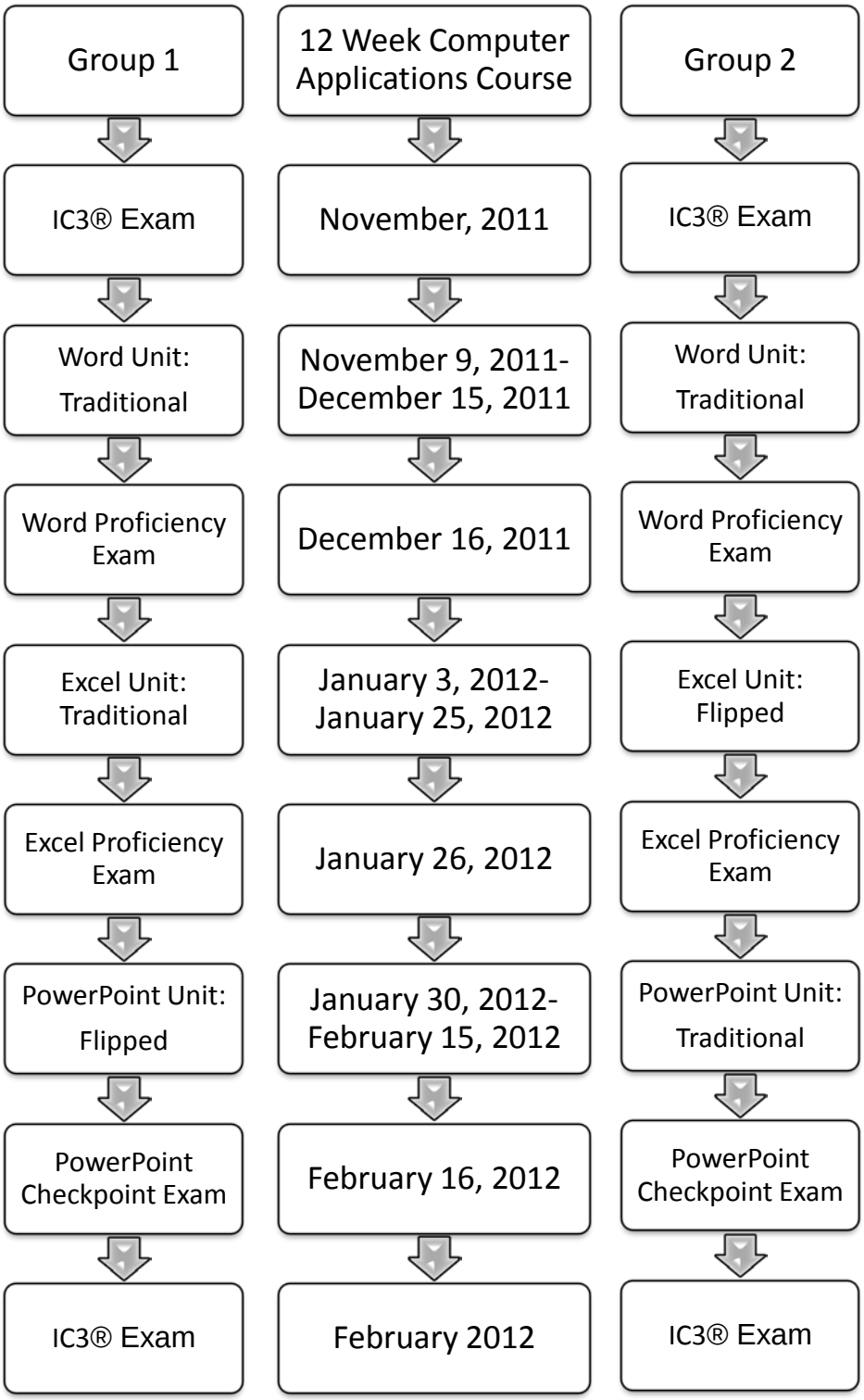
Participant Demographics

	Group 1 – Flipped PowerPoint				Group 2 – Flipped Excel			
	M	SD	n	%	M	SD	n	%
Gender			9				17	
Female			5	55.6			8	47.1
Male			4	44.4			9	52.9
Race								
Minority			4	50.0			10	58.8
Nonminority			4	50.0			7	41.2
Status								
Non-ECE			9	100.0			14	82.4
ECE			0				3	17.6
Grade								
9			6	66.7			12	70.6
10			2	22.2			1	5.9
11			1	11.1			4	23.5
12			0				0	
Days Absent	5.67	4.29			6.77	5.54		
GPA	2.53	.93			2.61	1.02		

Note. One student in Group 1 did not disclose race

Appendix A

Trimester Timeline of Units and Assessments



Appendix B

Student Perception of Instruction Questionnaire (SPIQ)

Questions	Strongly Agree	Agree	Not Agree or Disagree	Disagree	Strongly Disagree
Q1. I communicated a lot with other students					
Q2. I had more communication with the instructor					
Q3. I had to work harder this course.					
Q4. I found that I learned a lot in this course.					
Q5. The learning activities (e.g. assignment and projects) I worked on deal with real life applications and information in this course.					
Q6. The availability of content course materials, communication, and assessment tools helped me improved my learning.					
Q7. I applied my out-of-class experience and learn from its practical applications.					
Q8. I explored my own strategies for learning.					
Q9. I needed technical assistance for this class.					
Q10. Availability and access to technical support and resources helped me improved my learning.					
Q11. I would choose to take another hybrid course.					
Q12. Overall, I considered taking this hybrid course.					
Q13. Which part of the course you liked most that helped you improved learning? __a. Availability and access to online content and course materials __b. Enhanced communication using email, online discussion, assignment dropbox __c. Online testing and evaluation __d. Evaluation, feedback using the quiz and grade tools. __e. Ease of use of the Web environment __f. In-class group discussion __g. Group collaboration __h. Working on the assignments and class work by myself. Others, please indicate					
Q14. Please provide suggestions for improvement or comments about the delivery of the course using hybrid format.					

Note. Used with permission. Araño-Ocuaman, J. (2010). *Differences in student knowledge and perception of learning experiences among non-traditional students in blended and face-to-face classroom delivery* (Doctoral dissertation).

Appendix C

Student Perception of Instruction Questionnaire (SPIQ) – Pre-Survey

Questions	Strongly Agree	Agree	Not Agree or Disagree	Disagree	Strongly Disagree
Q1. For the past four weeks in this class, I communicated a lot with other students.					
Q2. For the past 4 weeks in this class I talked with Mr. Cooper	Every day	3 x a week	2 x a week	1 x a week	Never
Q3. For the past 4 weeks, I have had to work hard in this course.					
Q4. I have learned a lot in this course so far.					
Q5. The assignments and projects I have worked on in this course deal with real life applications and information.					
Q6. The availability of course materials, communication, and assessment tools helped me improve my learning.					
Q7. For the past 4 weeks, I have applied my out-of-class experiences and learned from practical applications.					
Q8. For the past 4 weeks, I have explored my own strategies for learning.					
Q9. Over the past 4 weeks, I have needed technical assistance for this class.					
Q10. For the past 4 weeks, availability and access to technical support and resources has helped me improve my learning.					
Q11. I would choose to take another course like this one.					
Q12. I like the daily routine in this class.					
Q13. Which of the following have helped you improve your learning experience for the past 4 weeks? (you may pick more than one) __a. Availability and access to online content and course materials __b. Enhanced communication using email, online discussion, assignment dropbox __c. Online testing and evaluation __d. Evaluation, feedback using the quiz and grade tools. __e. Ease of use of the Web environment __f. In-class group discussion __g. Group collaboration __h. Working on the assignments and class work by myself					
Q14. What other aspects of this course have helped improve your learning for the past 4 weeks?					
Q15. Please provide suggestions for how to improve this course, or any other general comments about the course.					

Appendix D

Student Perception of Instruction Questionnaire (SPIQ) – Post-Survey

Questions	Strongly Agree	Agree	Not Agree or Disagree	Disagree	Strongly Disagree
Q1. During this last unit, I communicated a lot with other students.					
Q2. During the last unit, I talked with Mr. Cooper	Every day	3 x a week	2 x a week	1 x a week	Never
Q3. During the last unit, I have had to work hard in this course.					
Q4. I have learned a lot in this course so far.					
Q5. The assignments and projects I have worked on in this course deal with real life applications and information.					
Q6. The availability of course materials, communication, and assessment tools helped me improve my learning.					
Q7. During the last unit, I have applied my out-of-class experiences and learned from practical applications.					
Q8. During the last unit, I have explored my own strategies for learning.					
Q9. During the last unit, I have needed technical assistance for this class.					
Q10. During the last unit, availability and access to technical support and resources has helped me improve my learning.					
Q11. I would choose to take another course like this one.					
Q12. I like the daily routine in this class.					
Q13. Which of the following have helped you improve your learning experience during the last unit? (you may pick more than one) __a. Availability and access to online content and course materials __b. Enhanced communication using email, online discussion, assignment dropbox __c. Online testing and evaluation __d. Evaluation, feedback using the quiz and grade tools. __e. Ease of use of the Web environment __f. In-class group discussion __g. Group collaboration __h. Working on the assignments and class work by myself					
Q14. What other aspects of this course have helped improve your learning during the last unit?					
Q15. Please provide suggestions for how to improve the flipped classroom experience, or any other general comments about the course.					
Q16. Did the flipped classroom meet your expectations? If so, did you like the opportunity, and why? If now, why not, and what could be changed to make it better?					

Appendix E

Summary of Variables Used in Research Questions and Analyses Performed

Research question	Independent variable	Control variable or covariate	Outcome variables	Analysis method
Does the implementation of the flipped classroom model increase student acquisition of knowledge of Microsoft Office applications?	Course delivery method: Traditional or Flipped	Multiple choice pretest of content knowledge in Microsoft Word, Excel, PowerPoint	Multiple choice posttests of content knowledge in Microsoft Word, Excel, PowerPoint	Independent-samples *t* tests
How do the types of questions asked by teachers differ in traditional versus a flipped classroom setting?	Course delivery method: Traditional or Flipped	NA	List of questions asked by teacher in class	Qualitative analysis resulting in categories that emerge after coding teacher questions
How do the types of questions asked by students differ in traditional versus a flipped classroom setting?	Course delivery method: Traditional or Flipped	NA	List of questions asked by students in class	Qualitative analysis resulting in categories that emerge after coding student questions
How do teacher perceptions of learning experiences differ in a traditional versus flipped classroom setting?	Course delivery method: Traditional or Flipped	NA	Written summaries of teacher comments in response to open-ended questions.	Qualitative analysis of teacher comments in response to open-ended questions
How do student perceptions of learning experiences differ in a traditional versus flipped classroom setting?	Course delivery method: Traditional or Flipped	NA	Student responses to Likert scale items on Student Perception of Instruction Questionnaire (SPIQ)	Paired-samples *t* tests

Appendix F

Mr. Cooper's Flipped Computer Applications Classroom
Parent and Student Consent and Technology Loan Agreement

Students:

We have the opportunity to participate in a program evaluation which will allow you to take a laptop home for the purpose of doing your homework for this class. We will be doing the same work we would have been doing anyway, but you will also be doing some of the work at home so you have time in class to work with other students during class time. Some things you will be doing that the other IC3 classes won't be doing is creating projects and completing anonymous surveys. I will give you grades for your work just like I would have anyway, but Mr. Renner and Ms. Johnson will also be looking at your work. Your names won't be on anything they look at, so they won't know who did what. You will also see them in the room periodically, but they won't be writing down your names, they will only be listening to what is being said and writing some of it down.

Parents & Students:

The program we have the opportunity to be involved with is based on the Flipped Classroom model, and will be viewed by the state of Kentucky (as well as the nation) as a model of one way online learning may benefit our students. Part of this program, as you know, will involve doing work outside of class. Since this class is based entirely on technology use, a laptop will be loaned to you for the purpose of completing the nightly/weekly assignments. So what I need for you to commit to is completing the nightly/weekly assignments on the provided laptop, as well as being careful with the equipment so that at the completion of the trimester it can be returned in the condition as it was loaned. Internet access has been disabled on the computers, so you will receive a thumb drive for the purpose of turning in completed assignments.

If you have any questions, now or throughout the program implementation, please feel free to contact Lisa Johnson at XXX-XXXX, or Jeremy Renner at XXX-XXX-XXXX any day prior to 10:00 at night. (you don't have to tell your name)

I hope you think this is as wonderful of an opportunity as I do! -Mr. Cooper

Please keep the top of this form for your records. (Please respond by November 30)- - -
- - - - - - - -

By signing below, you agree to complete the nightly/weekly homework assignments:

Student: _____ Parent: _____

By signing below, you agree to return the laptop in the condition it was given to you:

Student: _____ Parent: _____

Sign below if you do not wish to participate in the Flipped Computer Applications Class:

Student: _____ Parent: _____

Appendix G

Parental Consent Form

You are invited to allow your child to voluntarily participate in a research study entitled *The Flipped IC-3 Classroom.* This investigation involves assessing how technology can help student learn in more depth than traditional teaching in the classroom. Your child was selected as a possible participant because your child is in the age range and location we are interested in studying. We ask that you read this form and ask any questions you may have before agreeing to have your child in this study.

The purpose of this study is to determine the benefits of a teaching method called The Flipped Classroom. Your student will spend class time doing involved projects while in class, and receive direct instruction using video tutorials while outside of the class. They will also spend time doing the opposite: receiving instruction while in class and completing projects outside of class.

If you agree to have your child in this study, your child will be asked to complete a short anonymous questionnaire about the amount of time spent viewing the videos, and his/her attitude about the learning.

Each child participating in this study will receive classroom instruction that is designed to benefit the child. This potential benefit is the improved ability to learn at a deeper level by taking advantage of technology. No foreseeable risks are identified.

The records of this study will be kept private. Questionnaires will ask for basic demographic information, but no name will obtained. All records and consent forms will be kept secure along with results for 3 years after the completion of this study. All records may be inspected by the Jefferson County Public Schools and the Institutional Review Board of the University of Louisville (502-852-6956). In the event that the results of this study are published, your child's identification will not be revealed.

Your decision whether or not to allow your child to participate is voluntary and will not affect you or your child's current or future relations with Study High School. Furthermore, you and your child may also discontinue participation at any time.

The lead researcher conducting this study is Dr. Joseph Petrosko, Professor at the University of Louisville. You may ask any questions by calling Dr. Petrosko at 852-xxxx or by contacting Dr. Marco Muñoz at the JCPS Research Office (485-xxxx) or XXXX, principal at Study High School at 485-xxxx.

By signing below, you acknowledge that you have received a copy of this consent form for your family records.

Signature of Parent _____ Date _____
Student Name _____

CURRICULUM VITAE

NAME: Lisa W. Johnson

ADDRESS: 502 Wood Road
Louisville, KY 40222

DOB: Louisville, Kentucky – November 2, 1972

EDUCATION & TRAINING:

B.A., Mathematics
Bellarmine College
1994

M.Ed., Secondary Education: Counseling
Western Kentucky University
1998

M.Ed., Education: Instructional Technology
University of Louisville
2001

AWARDS: National School Board Association "20 to Watch" Educator
October, 2009

PUBLICATIONS: Where students don't study…they teach.
February, 2009 SIGHC Newsletter

NATIONAL MEETING PRESENTATIONS:

"The 180 Degree Classroom: Where Students Don't Study…They Teach"
The 2010 Global Education Conference

"The 180 Degree Classroom: Where Students Don't Study…They Teach"
The 2009 ANGEL Users Conference

"Global Viewers in the Math, Science, and Social Studies Classroom"
The 2007 National Educational Computing Conference

"Math Lesson Study"
The 2007 ANGEL Users Conference

"Virtual Real-writing-ality"
The 2006 ANGEL Users Conference

INVITED
PRESENTATIONS: Technical Learning Institute
Lower Hudson Regional Information Center
November, 2011

CURRICULUM VITAE

NAME: Jeremy D. Renner

ADDRESS: 502 Wood Road
Louisville, KY 40222

DOB: Würzburg, Germany- May 31, 1974

EDUCATION
& TRAINING: B.S., Elementary Education
University of Evansville
1996

M.Ed., Education: Instructional Technology
University of Louisville
2004

EMPLOYMENT
HISTORY: Jefferson County Public Schools, Teacher
1999-Current

Concordia University Online, Instructor
2011-Current

University of Louisville, Adjunct Instructor
2004-2006

AWARDS: National School Boards Association “20 to Watch” Educator
2008

PUBLICATIONS: Online Learning; Sharing and Caring
Cable in the Classroom June 2009

A-Z Cool Tools [eBook]
http://issuu.com/jrenner1/docs/cooltools3

Tablet Talk [Professional blog]
http://tablettalk.info

NATIONAL MEETING PRESENTATIONS: ANGEL User's Conference 2007 & 2008

National Tech Prep Conference 2007

National Educational Computing Conference 2008

PROFESSIONAL SOCIETIES: International Society for Technology in Education (ISTE)

Jefferson County Teachers Association (JCTA)