FLIPPED LEARNING IN A MIDDLE SCHOOL CLASSROOM: ANALYSIS OF THE INDIVIDUAL AND GROUP LEARNING SPACES

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ABSTRACT

Flipped learning is a pedagogical approach that promotes collaboration by using technology to "flip" traditional direct instruction. Instructional content is delivered outside of class in the individual learning space (online) and the group learning space (classroom) is used to engage in collaborative activities. Flipped learning shifts the teacher's role toward facilitation. Research on flipped learning is limited, in that studies are mostly conducted in secondary and postsecondary classrooms. My study investigated a middle school classroom – focusing on a 6th grade social studies course using flipped learning and age-appropriate strategies. Participants were from an all-girls private school in Hawai'i. I used mixed methods to investigate student perception and knowledge construction. For perception, data was collected through a Likert-type survey. For knowledge construction, content analysis was applied to student interactions during a Computer-Supported Collaborative Learning (CSCL) activity. Findings suggest (1) flipped learning benefits average achieving students while (2) supporting a correlation between performances and effort. Findings also support (3) the use of technology-based content in middle school; (4) the application of multimedia learning theory (MLT) and direct instruction strategies to the individual learning space; and (5) the use of CSCL activities and teacher regulation in the group learning space. My findings may also support research that claims CSCL activities benefit all-girl groups. Future research should focus on the design of learning spaces in different K-12 environments, including single-gender classrooms and humanities courses.

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CHAPTER 1. INTRODUCTION

For the past several years, flipped learning has received considerable attention in professional and media outlets (Davis, 2012; Fitzpatrick, 2012; Mazur, 2009; Sams & Bergmann, 2013). Flipped learning is a pedagogical approach that maximizes group learning in a classroom by using technology to "flip" traditional direct instruction. In flipped learning, instructional content is delivered outside of class (individual learning space) and class time is used to engage in collaborative activities (group learning space) (Bishop & Verleger, 2013; FLN, 2014). Flipped learning alters the classroom dynamic and shifts the teacher's role toward facilitation, allowing for differentiated instruction to meet the needs of individual students (Bergmann & Sams, 2012; Hamdan, McKnight, McKnight, & Arfstrom, 2013; Jensen, Kummer, & Godoy, 2015; Sams & Bergmann, 2013).

Like most trends in education, flipped learning is not new. Based on the student-centered ideas of Dewey, flipped learning is like the traditional college seminar: content is introduced outside of class (reading) and then investigated in class (discussion). In flipped learning, content introduction is simply enhanced by technology (Hertz, 2012; Roach, 2014). The current concept of flipped learning was pioneered as the "classroom flip" for an upper level college course (Baker, 2000). It was later renamed "the inverted classroom" and used in a macroeconomic college course (Lage & Platt, 2000; Lage, Platt, & Treglia, 2000). Over the succeeding decade, variation of flipped learning and its components were studied, including "the reverse classroom," vodcasting, screencasting, and lecture capture (Richardson, 2010a). Today, Bergmann and Sams, chemistry teachers from Colorado, are credited as originators (Tucker, 2012). Since "flipping" their classrooms in 2007, the approach has been promoted by popular examples like Khan

Academy and authors like Daniel Pink, propelling it to the forefront of education (Evans, 2012; Pink, 2010; Sparks, 2011).

Statement of the Problem

The popularity of flipped learning has come with criticism. Some question flipped learning's reliance on lectures for content delivery, while others highlight its ineffectiveness for students without technology access (Amaral, 2013; Berrett, 2012; Kay, 2012; Koller, 2011). Others cite a lack of data based research (DeSantis, Van Curen, Putsch, & Metzger, 2015; Goodwin & Miller, 2013; Hamdan et al., 2013; Jensen et al., 2015; Talbert, 2012). While research on components of flipped learning, such as video lectures, analyze student attendance, usage, and satisfaction, few concurrently study the individual and group learning spaces (Day & Foley, 2006; Jensen et al., 2015; Pursel & Fang, 2012). Also, most studies are at the postsecondary level, analyzing college students and professors. Drysdale, Graham, Spring, and Halverson (2013) reviewed over 200 related dissertations and theses and found only eight percent were conducted in K-12 educational settings. While postsecondary research often supports use of video lectures and other components, it does not directly benefit a growing number of K-12 teachers integrating flipped learning. Middle school education, in particular, is being exposed to flipped learning yet under researched (DeSantis et al., 2015; Kronholz, 2012; Sherman, Sanders, Kwon, & Pembridge, 2009).

Purpose

The purpose of my mixed methods study was to investigate flipped learning in a middle school classroom. Both the individual and group learning spaces were included. Since research on technology in middle school is best conducted through established pedagogical principles

such as those promoted by the Association for Middle Level Education (Downes & Bishop, 2015), I analyzed flipped learning by integrating sound research methodology with middle school appropriate strategies.

Research Questions

Knowledge construction in the group learning space and perception in the individual learning space was studied concurrently. Each research question was designed to depend on different data strands. Such an embedded mixed methods approach allows for independent research questions (Creswell & Plano Clark, 2011).

- What are middle school students' perceptions of the individual learning space?
- How do middle school students construct knowledge in the group learning space?

Significance of the Study

While comprehensive studies of flipped learning are lacking, several have significantly influenced the design of my study (Table 1). Each analyzes flipped learning or components thereof. Strayer (2007) compared flipped learning to traditional instruction in an undergraduate statistics course and suggested further studies on different student groups. Musallam (2010) analyzed screencasting in high school, but only cognitive load in the individual learning space – recommending further research on instructional time in the group space. Johnson and Renner (2012) studied high school students and called for research specifically in a one-to-one classroom with teachers already, or willingly, implementing flipped learning, not by outside researchers in an experimental manner. As a teacher-researcher, Chipps (2013) found flipped learning effective in high school calculus using a learning management system – suggesting studies on different learning styles. Despite these studies, K-12 education lacks research on

technology-based learning (DeSantis et al., 2015; Drysdale et al., 2013; Sherman et al., 2009), specifically comprehensive studies on flipped learning that include analysis of the individual and group learning spaces in middle school.

Table 1. Influential research related to flipped learning

Author, year	Participants	Data Collection	Findings	Suggestions
Day & Foley, 2006	public university undergraduate coed computer course	surveys course grades	Students had higher grades and more positive attitude.	Design online lectures according to multimedia principles.
Strayer, 2007	private university undergraduate coed statistics course	surveys observations reflections interviews	Students preferred and experienced more collaboration.	Study different student groups.
Musallam, 2010	private high school coed chemistry course	pretest-posttest	Higher scores on assessments.	Evaluate use of classroom time.
Johnson & Renner, 2012	public high school coed computer course	surveys observations interviews pretest-posttest	Considered a "failed attempt" at studying flipped learning by authors.	Study teachers using flipped learning to benefit students, not just for research purposes. Also, study in an established one-to-one environment.
Chipps, 2013	charter high school coed calculus course	surveys observations reflections interviews exam scores	Students felt they learned more and preferred flipped learning in future classes.	Use learning management system designed for course. Study different learning styles.

Several suggestions are addressed by my study. Firstly, both the group and individual learning space will be analyzed. Secondly, participants are middle school students in a social studies course. Most studies on flipped learning involve high school or undergraduate science, technology, engineering, and mathematics (STEM) courses. Thirdly, the setting is an established flipped learning course in a one-to-one classroom with a learning management system. As the

teacher, I implemented flipped learning for several years to meet the unique needs of the course and learning styles in the school. Ultimately, my study hopes to provide insight on flipped learning in middle school, and benefit as many teachers and students as possible.

Conceptual Framework

Flipped learning consists of two learning spaces: an individual space with instructional content enhanced by technology and a group space or collaborative learning environment (Bishop & Verleger, 2013; FLN, 2014). Didactic differences between the individual and group space require integrating theories to conceptualize flipped learning. In my study, both a cognitive and constructivist learning theory are used. Figure 1 diagrams the core theoretical support for each space while corresponding layers represent significant features of the space. Research on flipped learning suggests content in the individual learning space be designed according to multimedia principles (Day & Foley, 2006). Based on extensive research in educational psychology, Multimedia Learning Theory (MLT) provides a framework in which to design instructional content (Mayer, 2009). In the group learning space, flipped learning encourages use of collaborative activities (Bergmann & Sams, 2012). Investigating small group interactions, while distinguishing collaborative from individual learning, Computer-Supported Collaborative Learning (CSCL) theory provides a framework in which to analyze collaboration (Stahl, 2005, 2013b; Stahl, Koschmann, & Suthers, 2006). CSCL techniques are used to identify knowledge construction or learning through content analysis of collaborative activities (Beers, Boshuizen, Kirschner, & Gijselaers, 2005; Van der Meijden, 2005).

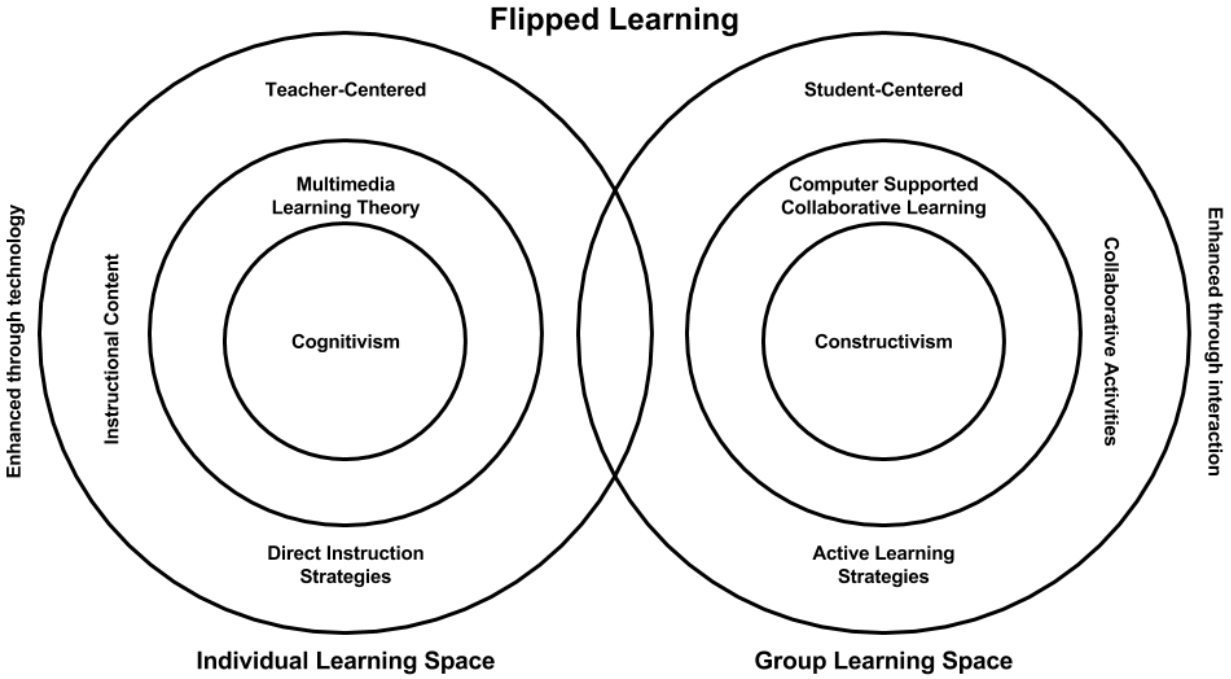

Figure 1. Conceptual framework

Multimedia learning is learning from a combination of text, images, audio, and video; and multimedia instruction is presenting words and images to foster learning (Mayer, 2009). As a cognitive theory, multimedia learning is not exclusive to computer-based environments. In fact, research supports use of all effectively designed multimedia, including traditional print-based and technology enhanced instruction. Researchers assert learning is dependent on psychological activity (Clark & Mayer, 2008). Therefore, content designed on multimedia principles will stimulate cognitive activity and promote learning (Mayer, 2009). Regardless of technology, learning fundamentals do not change. In flipped learning, properly designed instructional content enhances the individual space and promotes learning that can be built upon in the group space.

Flipped learning promotes collaboration in the group learning space. Collaborative learning involves social interaction of learners resulting in understanding. Analyzing how technology facilitates collaborative learning has developed into the constructivist theory of

CSCL. In CSCL, collaboration means working together on a task, and is clearly distinguished from cooperation, or dividing a task. In true collaboration, the group learns together. CSCL does not consider learning a strictly psychological activity, but instead identifies learning as a social construct (Stahl, 2005; Stahl et al., 2006). Naturally, such learning is best analyzed through observations of student interaction. CSCL studies examine small groups, however, are cautious not to extrapolate findings to individuals or society (Stahl, 2012). Instead, researchers make a consorted effort to study collaborative learning within its distinct context, analyzing what is called "group cognition." Stahl (2013) explains:

> The term group cognition was coined to stress the goal of developing a post-cognitive view of cognition as the possible achievement of a small group collaborating so tightly that the process of building knowledge in the group discourse cannot be attributed to any individual or even reduced to a sequence of contributions from individual minds. (p. 12)

In CSCL, collaborative learning is not a collection of individual learning. Thus, qualitative methods are best suited to gather data, including observations, field notes, audiovisual recordings, and content analysis. Tools such as pretest-posttest are limited in collaborative learning, since they measure individual acquisition of knowledge. Test scores do not reflect collaborative learning or group knowledge construction. Long-term assessments show collaborative learning takes more time to reveal itself in learners, however, is more significant and salient when it does (Kapur, 2008; Stahl, 2013a). CSCL studies have also found that less structured collaborative activities can actually produce positive learning outcomes, even though students may initially fail (Kapur & Kinzer, 2009).

Knowledge construction is considered the result of collaborative learning in CSCL. In this context, learning is complex and "in permanent processes of construction and reconstruction

by the participants and under the influence of multiple interconnected factors" (Onrubia & Engel, 2009, p. 1257). However, instances of knowledge construction can be identified through analysis of collaborative learning activities (Beers et al., 2005). As Schwartz (1999, p. 16) states, knowledge is constructed through "generative mental and physical activities" in collaborative environments and "typically involves linguistically mediated communication." Analyzing such communication and documenting how changes in student perspectives develop into group knowledge construction is pivotal to studying collaboration (Puntambekar, 2006). CSCL methodology can also identify and prioritize particular levels of knowledge construction in groups (Shukor, Tasir, Van der Meijden, & Harun, 2014; Van der Meijden, 2005). While collaboration can be studied in laboratory and natural learning environments, CSCL principles are best studied with teacher involvement in existing course curriculum (Looi & Chen, 2010).

Flipped learning inherently lends itself to multimedia and collaborative learning. By shifting direct instruction to the individual space, the group space is opened for collaboration. Instructional content based on MLT principles promotes learning in the individual space. Learning generated from this content-driven and teacher-centered approach creates a foundation on which collaborative, student-centered activities can build. In the group space, CSCL principles help identify occurrences of knowledge construction in collaborative activities. By adhering to foundational theories, each learning space can be effectively studied; providing a comprehensive and unique view of flipped learning.

Summary of Methodology

My study is influenced by methodology, findings, and suggestions of research on flipped learning (Table 1). As a result, it is designed using proven data collection instruments to address voids in the literature. In line with suggestions, my study includes atypical participants with

different learning styles (middle school students), instructional content based on multimedia principles, and was conducted in an existing flipped learning one-to-one laptop classroom. My research design analyzed the individual and group learning spaces while maintaining middle school best practices. Ultimately, producing implication for practice in the classroom.

An embedded mixed methods design was used to address the research questions (Creswell, 2014). To answer each question, quantitative and qualitative data was collected and analyzed through compatible methodologies. Student surveys provided quantitative data on student perception of the individual space and overall learning experience. In the group space, analysis of interaction in collaborative activities yielded qualitative data. Participants were 35 middle school students from Hawai'i. Students were enrolled in a 6th grade social studies course divided into two classes or sections. Approval and consent for participation (Appendix A, B, C) was acquired from students, parents, the school, and the University of Hawai'i Institutional Review Board (Appendix D). Data collection was designed to address the research questions. Quantitative data collection occurred upon completion of the unit through an attitudinal survey instrument (Appendix E). Qualitative collection consisted of audio recordings of student collaboration. All quantitative data was analyzed for patterns using Google Sheets, Microsoft Excel, and VassarStats (Lowry, 2015). Qualitative analysis included transcription, coding, and categorizing data based on CSCL concepts and themes (Shukor et al., 2014; Van der Meijden, 2005).

Role of the Researcher

My role was teacher and researcher. Over the past five years, I developed my middle school course within a flipped learning pedagogical approach. I have been both the course designer and teacher. Various instructional strategies have been implemented and adjusted to

benefit my students. Through trial and error, I have curated content and structured an effective unit of study based on learning objectives prescribed in the curriculum. My experience with the course benefitted my role as a researcher. Moreover, my rapport and familiarity with participating students allowed for more meaningful interactions. I understand a study should not usually be conducted at a site in which I, the researcher, has "vested interests" (Creswell, 2014). Nevertheless, my study was predicated on suggestions from available research on flipped learning. Therefore, by conducting research in my classroom, I am hoping to avoid a "failed attempt" like studies conducted in courses for purely experimental purposes by outside researchers (Johnson & Renner, 2012, p. 72). Of course, my knowledge of students, curriculum, and flipped learning influenced the study. However, being a teacher-researcher is empowering, allowing people to connect pedagogical and philosophical purpose to their class (Blakemore, 2012; Iliško, Ignatjeva, & Mičule, 2010).

Limitations

My teacher-researcher dual role may convolute findings. Like all educational researchers, there are preexisting values and cultural understandings that epistemologically influence studies (Frank, 2013; Siegel, 2006). My understanding of the course and students may bias my interaction during certain collaborative activities. Also, my role as teacher may influence students to produce attitudinal data that does not accurately reflect their opinion. Furthermore, the size and uniqueness of participants will limit a generalization of findings. Lastly, the social studies course studied includes a contentious state history. Passionate opinions on the subject may conflict with a curriculum mandated by state-standards, influencing student perception.

Definition of Key Terms

Various definitions of flipped learning exist in media and educational research. My study uses a definition promoted by the Flipped Learning Network (FLN), an organization dedicated to helping teachers successfully implement flipped learning (FLN, 2014). The language developed by the FLN has been accepted and modified by researchers to fit needs of specific studies (Chen, Wang, Kinshuk, & Chen, 2014). Other closely related definitions place more emphasize on "computer-based" instruction outside the classroom (Bishop & Verleger, 2013). My study uses the following terms and definitions.

Flipped learning. A pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where educators guides students as they apply concepts and engage creatively in the subject matter.

Individual learning space. A learning environment in which direct instruction and teacher-centered content is enhanced through technology. The individual learning space is completely and exclusively online and computer-based.

Group learning space. A learning environment in which student-centered collaboration is enhanced through active strategies and group interaction. The group learning space is supported by computer-based tools but is not exclusively online.

Summary

Flipped learning continues to gain recognition as teachers use the pedagogical approach at all levels of education. Numerous anecdotal studies and articles note the positive impact of flipped learning. However, there is little K-12 research, especially in middle school. In addition,

current research rarely studies the individual and group learning spaces concurrently. Therefore, the objective of my study was to effectively implement flipped learning, while observing and documenting effects on collaboration and perception. Designed in accordance with research suggestions, proven data collection methods were used.

The conceptual framework is based on the cognitive theory of Multimedia Learning and the constructivist theory of Computer-Supported Collaborative Learning. Flipped learning is naturally geared toward these pedagogical approaches; relying on instructional design outside the classroom and collaboration inside. Previous research does not analyze flipped learning in its entirety, only certain components or student opinions. While survey data was incorporated into my research, findings were combined with qualitative data to provide a cohesive analysis.

A dual role as teacher and researcher has positive and negative effects on results of any educational study. However, research suggests that teacher involvement with design and implementation of studies produces more positive results for students. Through mixed methods, flipped learning's influence on collaboration and perception was investigated. More importantly, evidence supporting flipped learning in middle school was identified.

To understand flipped learning, as well as the individual and group spaces, Chapter 2 outlines history, theoretical principles, and strategies of the pedagogical approach. Middle school education and teaching with technology is also discussed. In Chapter 3, the methodology and research design is expounded. Chapter 4 includes the design of learning spaces. Chapter 5 includes a full analysis of gathered data and Chapter 6 will provide a comprehensive discussion of that data. Appendices will include survey instruments and other implements used during the research process.

CHAPTER 2. REVIEW OF LITERATURE

As educators implement flipped learning, its potential and lack of research based evidence has become apparent (Herreid & Schiller, 2013). While numerous articles highlight flipped learning's impact on engagement and student-teacher interaction, few studies provide legitimate data as support (Goodwin & Miller, 2013). Like other trends in educational technology, a majority of data is reported by news agencies and not researchers (Barth, 2013). While studies on flipped learning exist, they rarely analyze the individual and group learning spaces concurrently (Jensen et al., 2015). Moreover, most studies inconsistently use direct measurements to assess performance (Pursel & Fang, 2012). As a growing number of K-12 teachers implement flipped learning, criticism and the need for research is increasing (Ash, 2012; Drysdale et al., 2013; Wright, 2012).

Educational research is expected to provide practicing educators with knowledge and techniques to achieve learning objectives. However, research should not be viewed as instructions for educators; instead it should be viewed as knowledge that "enables educators to approach problems they have in a more intelligent way" (Biesta & Burbules, 2003). As suggested in Chapter 1, flipped learning constitutes an individual learning space enhanced by technology and a group learning space enhanced by collaboration (Bishop & Verleger, 2013; FLN, 2014). My study analyzed both learning spaces while participating in and observing the teaching and learning experience.

To identify literature that benefits practitioners, I developed a simple classification structure (Figure 2). Research that includes both spaces as well as the teacher-learner experience is considered most beneficial (Bishop & Verleger, 2013). Studies and articles were categorized

accordingly, incorporating existing research not directly related to flipped learning. For example, educational psychology research on cognitive load relates to the individual space and CSCL studies on small groups relate to the group space. Also, research on affective data in technology-based environments was included as part of the teaching and learning experience. To better understand flipped learning, this chapter covers significant research, theoretical principles and strategies of the learning spaces, literature on teacher experience using technology, and perspective on middle school education to address the learning experience of participants.

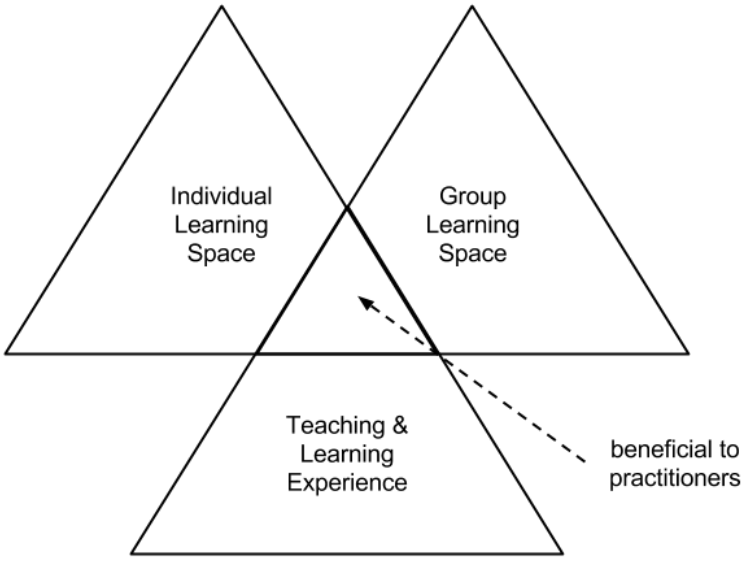

Figure 2. Classification structure for research studies related to flipped learning

Flipped Learning

Since the inception of audiovisual recording, educators have praised its potential as a teaching tool. In 1913, Thomas Edison claimed, "Books will soon be obsolete [and it will be] possible to teach every branch of human knowledge with the motion picture" (Saettler, 1967). Two decades later, in his book The Educational Talking Picture, Frederick Devereux stated, "No development in education since the coming of the textbook has held such tremendous

possibilities" (Devereux, 1933). Edison and Devereux realized the prospects of delivering content through audiovisual recording. However, in those days, the production and dissemination of content was costly and labor intensive. The audiovisual instruction movement continued through the 1940s and 1950s, evolving into instructional television. New terminology and the computer chip created the field of educational technology in the 1970s and 1980s (Reiser, 2001). The personal computer led educators to speculate on the possibility of combining software and video technology to produce interactive multimedia instruction (Mazur, 1991). At the time though, still budding technology could not meet practicality (Bonwell & Eison, 1991).

Today, however, using technology and producing content is easy. Teachers use computers, learning management systems, websites, YouTube, Google, social media, Smart Boards, iPads and numerous technologies to develop content and classrooms only dreamt about by Edison and Devereux. Flipped learning is a result of the 21st century tools available to teachers. These tools have been combined with techniques traditionally used by English professors, who have always expected students read novels and be prepared to analyze in class (Berrett, 2012). Simply put, flipped learning is a traditional technique enhanced by technology to engage the modern learner (Roach, 2014).

History

Rooted in John Dewey and student-centered learning, flipped learning is a blend of direct instruction and constructivism (Bergmann, Overmyer, & Wilie, 2011; Hertz, 2012; Jensen et al., 2015). The current approach was first presented as the "classroom flip" in 2000. Baker's basis for implementing was that new technology "would provide a way for faculty to present 'lecture' material, but that the shift in method of delivery would open up classroom time for teaching and learning strategies that emphasized the role of the learner in a cooperative environment." It was

first used in upper-level undergraduate courses in graphic design and communications. Baker's initial conclusions were positive, noting how distance-learning technologies such as threaded discussions and online quizzes, could benefit face-to-face courses. Moreover, he concluded that content was not diminished by increasing collaboration and active learning in the classroom (Baker, 2000).

Later that year, the approach was relabeled "the inverted classroom" and praised for its flexibility to address different learning styles without increasing class time or sacrificing content (Lage et al., 2000). Implemented into an undergraduate microeconomics course, students were provided access to lectures outside the classroom through a variety of methods, including videotaped lectures, voiced over PowerPoint presentations, and printed PowerPoint slides. Traditional textbook readings were also provided and students were expected to prepare with the material before class. In-class sessions began with questions and clarification on the lecture. Hands-on activities were designed that corresponded to the lectured content. Group work and review assignments were also used. The authors note that "the inverted classroom" increased student responsibility which required additional resources be provided by the instructor. Furthermore, like Baker's "classroom flip," distance-learning technologies such as interactive quizzes and chat rooms were used to enhance and engage students.

These initial studies on flipped learning did not use student performance as a direct measurement of effectiveness. Both Baker (2000) and Lage et. al.(2000) assessed the effectiveness of their respective approaches through Likert-type scale questionnaires. Data from such survey questions is strictly attitudinal and only reflects the perception of the participants. Baker (2000) only acquired data from students, whereas Lage et. al (2000) acquired data from both students and instructors. Interestingly, data from Lage et. al (2000) showed gender

differences. Female students perceived flipped learning with more satisfaction and claimed it had more educational value than male students. Also, both instructors claimed higher female student participation in class. Lage et. al (2000) postulates that flipped learning may be more effective for female students who generally prefer collaborative learning environments and concrete experiences to abstract concepts. However, such claims have not been substantiated by research.

To this day, limited research has been conducted on flipped learning (Drysdale et al., 2013; Jensen et al., 2015). Over the past decade, changing technology has given flipped learning and its components various names, including "the reverse classroom," vodcasting, screencasting, and lecture capture (Richardson, 2010b). Research has been conducted, but few on the individual and group learning spaces concurrently (Jensen et al., 2015; Pursel & Fang, 2012). Beginning in 2007, Colorado teacher's Jonathan Bergman and Aaron Sams implemented flipped learning into their high school chemistry courses (Bergmann & Sams, 2012). Their initial success has defined the present conception of flipped learning. From here, its popularity has grown exponentially. Educational publications and media outlets have promoted organizations like Khan Academy, while influential authors like Daniel Pink have praised the model (Evans, 2012; Pink, 2010; Sparks, 2011). As the popularity of flipped learning grows, researchers continue studying its effectiveness.

Research Studies

Flipped learning has gained notoriety in multiple research areas, including educational psychology, instructional design, and technology. There are hundreds of related articles, dissertations, and masters theses (Drysdale et al., 2013). One related area in particular is the study of instructional lectures, a method often claimed as ineffective (Ash, 2012; Kay, 2012; Koller, 2011). Pennsylvania State University analyzed approximately fifty research articles on

the recording and dissemination of online lectures (Pursel & Fang, 2012). Every study was conducted in postsecondary environments and most examined students' learning experiences. The variables identified in these studies included, student performance, attendance, satisfaction, and usage. Almost all data was gathered from student surveys. As the authors note, such data is valuable, especially in a new research area. However, they recommended future research concentrate on grade-based student performance. Furthermore, only one article included research on "lecture capture" in the individual learning space and activities in the group learning space.

Day and Foley (2006) analyzed the individual and group learning spaces concurrently, producing findings and suggestions significant to the development of flipped learning. Their study was conducted at the Georgia Institute of Technology in a human-computer interaction course. They studied online lectures and in-class learning activities. The quasi-experimental study used grade-based data to determine student performance. A control and experimental group of 18 and 28 students respectively were graded on various assignments throughout a semester. Assignments included homework, projects, and examinations. Online lectures consisted of PowerPoint slides and a coinciding video of the instructor. Students in the experimental group viewed online lectures and completed homework assignments outside of class, whereas the control group viewed live lectures in class and completed homework outside.

Interestingly, since the online lectures inherently provided more in-class time to the experimental group, the researchers eliminated the time so performance differences could not be attributed to more "required time on task." Therefore, seven of twenty-five 80-minute in-class sessions were canceled for the experimental group. Even with such an attempt to control variables, the experimental group out performed the control group on all assignments. Not only did the experimental group earn higher grades, but students had a more positive attitude of the

course then the control group. Moreover, the experimental group ranked online lectures the most useful element of the course, above in-class activities and readings. Gender differences were not accounted for, however, it was provided that only 6 female students participated.

In the study, all in-class activities were purposely designed to be hands-on and collaborative. Unlike passive learning that takes place during lectures, the authors state that active learning includes "problem solving, discussion, presentation, and other learning-by-doing activities." Collaboration in the group space is a critical component of flipped learning. Also, "explicit motivation" to view online lectures was identified. Motivating students to view online content is critical to flipped learning and can be addressed through several methods, including embedded questions, checking notebooks, and blogging (Bergmann & Sams, 2012). Day and Foley (2006) used specific homework assignments that coincided with online lectures. As a result, students were motivated to watch online lectures in order to complete assignments and better their course grade. Assessments or pre-class assignments in the individual space can lead to productive group space discussions and more responsible students (Laman, Brannon, & Mena, 2012).

Although experimental design is challenging in a natural classroom environment, researchers can attempt to maintain variable control, as evident in the Day and Foley (2006) study. However, designing research to account for both flipped learning spaces is difficult. This has resulted in research addressing only components or learning spaces separately. For example, online lectures in the individual learning space have been addressed. Studies show that students consistently find online lectures appealing and perceive them as effective learning tools (Brecht & Ogilby, 2008). Student reasons vary from study to study, but usually include the innate

portability, pace, and replay capabilities that online lectures bring to a course (Foertsch, Moses, Strikwerda, & Litzkow, 2002; Kay, 2012; Pursel & Fang, 2012; Yule, 1996).

To better understand student response to online lectures, Musallam (2010) conducted a dissertational study on screencasting. Screencasts differs slightly from online lectures in that only audio and onscreen activity is visible; not the instructor or classroom (Richardson, 2010b). The study's purpose was to analyze intrinsic cognitive load. Cognitive load is a educational psychology term fundamental to multimedia learning and refers to the cognitive processes in which learners engage content (Mayer, 2009). In a coed private high school chemistry course, students were randomly assigned to an experimental and control group. Prior to class, the experimental group viewed an introductory video on the chemistry concept to be covered in class. The video was approximately 11 minutes long and viewed by students on computers in a laboratory setting 15 minutes before class began. The control group did not view the video and just attended class. In class, the teacher conducted a 50-minute lecture on the chemistry concept. The study used pretest-posttest to assess student performance and differences between the control and experimental groups. In-class learning activities were not analyzed. The study found, however, students who viewed the video prior to class on average scored higher than students who did not. Of the 62 student participants, 21 were female, however gender differences were not accounted for.

Strayer's (2007) dissertation attempted to analyze both the individual and group learning spaces. The study analyzed the effects of flipped learning in an undergraduate statistics course at a private coed university. Like Day and Foley (2006), this study was longitudinal in that it took place throughout an entire semester. However, the study did not use grade-based performance, instead it analyzed student experiences. Two sections of a statistics course were defined as the

experimental and control groups. The experimental group was introduced to content outside of class through an online tutoring system. In class, this group would participate in collaborative learning activities. The control group received content through a traditional lecture format. Quantitative and qualitative data was gathered through multiple methods. The study found the experimental group preferred and experienced more collaboration in the classroom. However, they were less satisfied with the structure of the learning environment and how it "orients them toward course content." Strayer's extensive analysis of student interviews and surveys resulted in several practical recommendations for implementing flipped learning. He recommends providing students with multiple modes to access content in the individual learning space. He also suggests in-class activities be "step-by-step" structured, especially for lower level courses. Furthermore, he emphasizes the need for students to reflect on learning in order to connect it to course content.

Johnson and Renner (2012) attempted to analyze flipped learning using grade-based performance. Their dissertational study examined flipped learning in a public high school computer applications course. Two classes served as the control and experimental groups in a switching replication design study. Of the 26 students half were female, but analysis of gender differences was not made. A pretest-posttest was used to identify "acquisition of knowledge" in participants. Classroom observations, teacher interviews, and Likert-type scale survey questions were used to gather qualitative data on perception and interaction. The control group spent class time completing online tutorials and worked on a course project for homework. The experimental group completed the online tutorials for homework and worked on the same course project during class. The overall quantitative findings indicated no benefits to using flipped learning.

However, the authors claim flipped learning was not properly implemented. Several reasons were attributed to this "failed attempt." In particular, the participating teacher was chosen by an outside party and asked to alter their instructional practice for the study. Hence, the authors recommend future studies use willing instructors who are genuinely implementing the flipped learning to meet the needs of their course. Also, the study found issue with school provided laptops and suggests flipped learning be studied in an established one-to-one environment. Conversely, qualitative findings supported the use of lecture as a pedagogical option in the individual learning space. More importantly, the study noted that flipped learning should and will vary according to content, teacher personality, and course.

Chipps (2013) effectively implemented flipped learning into an advanced calculus course at a charter high school. There were 72 student participates, including 30 females, but no analysis of gender differences. Two classes were designated as the experimental and control groups. The control group received in-class lectures and completed practice problems for homework. The experimental group watched instructional videos for homework and worked in problem solving groups in class. Test scores and surveys were used to gather data. Use of a standardized calculus readiness exam allowed each group to be subdivided by ability for statistical purposes. Students were identified as low, middle, or high level. Their progress was measured against these categories. Flipped learning was particularly effective for students in the middle level, as they outscored students in the middle level of the control group. Problem-based learning studies have shown similar results for middle level or average-achieving students (Belland, 2010). Moreover, the experimental group felt they learned more and preferred flipped learning for future classes. The researcher suggests future studies on the suitability of flipped learning for "flexible" learning styles.

Research on flipped learning continues to evolve. Affective findings continually show high student satisfaction (Touchton, 2015) while the approach finds success is traditionally lecture-based courses such as engineering and medical education (Laman et al., 2012; Sherbino, Chan, & Schiff, 2013). Parallels with other teaching strategies, such as Just-in-Time Teaching (Novak, 2011), are becoming apparent while variations of flipped learning are also being developed (Chen et al., 2014). The flipped-mastery model combines traditional mastery learning with new technology and has proven effective in high school chemistry courses (Bergmann & Sams, 2012). Advantages of flipped learning have been seen "when attempting to instill higher-order learning behaviors and outcomes in students" (Redekopp & Ragusa, 2013). It has been suggested that combining case study teaching and flipped learning would enhance STEM courses (Herreid & Schiller, 2013). The CLIC model uses cinematic lectures to deliver content and integrates active learning in the classroom. A pilot study in an undergraduate biology course suggested that cinematic lectures had more of an impact on student performance than in-class activities (Marcey, 2011). Such findings place more importance on the design of technologically enhanced content in the individual learning space.

Multimedia Learning Theory

Flipped learning relies on introducing content through technology (Bergmann & Sams, 2012). Most often content is introduced as online lectures. Online lectures can take several forms, including video lectures, screencasts, vodcasts, or a combination thereof. The exact definitions of these forms vary according to sources (Richardson, 2010b). Individual studies usually provide their own unique definitions. Regardless of semantics, there are specific design characteristics of online lectures that make them more effective. Identifying these characteristics

and designing content accordingly can enhance their instructional effectiveness and the understanding of how people learn (Mayer, 2008).

Research suggests designing online lectures according to multimedia learning principles improves flipped learning (Day & Foley, 2006). However, few studies have been conducted on specific characteristics of online lectures and the effects they have on learning outcomes (Kay, 2012). One study did compare student engagement with vodcasts and screencasts (Walker, Cotner, & Beermann, 2011). Vodcasts were defined as designed presentations that include animation, voiceover, images, music, and other video segments. Where as "class captures" or screencasts were recordings of the teacher's projector output and voice. The findings showed students favored vodcasts over screencasts and students who viewed the vodcasts performed better on tests. These performance differences were attributed to the vodcasts being more aligned with principles of multimedia learning.

Multimedia refers to a combination of text, images, audio, and video. Mayer (2009) defines multimedia learning as learning from words and picture, and multimedia instruction as presentations involving words and pictures that are intended to foster learning. The cognitive theory of multimedia learning is not unique to computers or online environments and can also reference the use of images in textbooks. Multimedia learning studies have produced results supporting commonly held assumptions such as pictures and text help students learn better than just text. Educators have long recognized the effectiveness of multimedia, however, the theory has provided research-based results supporting multimedia use in education (Mayer & Moreno, 2002; Mayer, 2002).

Principles

At the core of multimedia learning is an understanding of how people learn. As an offshoot of cognitive load theory, it supposes certain cognitive processes occur in the human mind that lead to meaningful learning (Mayer, 2009). Cognitive load refers to the processing of information in short-term memory. Cognitive load is divided into three types: extraneous processing, essential processing, and generative processing. Properly managing these processes is the goal of effective multimedia instruction. Educational psychologists have identified 12 principles of effective multimedia instruction (Mayer & Moreno, 2003; Mayer, 2002, 2009). Each principle aligns with a cognitive load function: reducing extraneous processing, managing essential processing, and fostering generative processing. Theoretically, the more principles a multimedia presentation aligns with, the more learning effective it will be.

Five principles have been identified for reducing extraneous load: the coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles (Mayer, 2009). In laymen terms, these principles support the idea that people learn better when extra words, pictures, and sounds are excluded. Also, people learn better from graphics with narration, when cues are used, and when words are shown simultaneously with pictures. These principles, while not directly cited, are reinforced by educators using flipped learning (Bergmann & Sams, 2012). Key recommendations for teacher created videos in flipped learning include, “don’t waste students’ time,” “add annotations/callouts,” and zoom to “declutter” the screen.

Three principles have been identified for managing essential processing; the segmenting, pre-training, and modality principles (Mayer, 2009). These principles support the ideas that people learn better when a lesson is segmented and when the names of main concepts are previously know. Suggestions for creating effective videos in flipped learning are closely aligned

with these principles, including and most obviously “keep it short” (Bergmann & Sams, 2012). Segmented instruction is effective in lowering cognitive load, but does not always benefit high prior knowledge learners (Ayres, 2006).

Four principles have been identified for fostering generative processing; the multimedia, personalization, voice, and image principles (Mayer, 2009). These principles support the idea that people learn better from words and pictures, and when a human person narrates a presentation in a conversational style. Also, it discourages using the speaker’s image on the screen. Flipped learning video recommendations that align include, “animate your voice,” “create with another teacher,” and “add humor” (Bergmann & Sams, 2012).

Related Research

A majority of multimedia learning studies are conducted in a laboratory setting (Mayer, Fennell, Farmer, & Campbell, 2004; Mayer & Moreno, 2002, 2003; Mayer, 2002, 2009). Even though participant groups are sometimes large, studies are often short and assessment is immediate (Sung & Mayer, 2012). Transferring such laboratory studies to the classroom environment is precarious and findings are inconsistent (Brown, 1992; Day & Foley, 2006). Studies on acquisition of complex concepts find no significant learning difference between text-only and text-video (Luyben & Warden, 2009). While studies on skill and terminology acquisition show video to be more effective (Armstrong, Idriss, & Kim, 2011). Findings are fairly consistent on student engagement and positive attitude toward multimedia, however, the reliability of quantitative performance data is insufficient (Kay, 2012). Comparably, qualitative data shows multimedia accentuates learning styles and the individual learning experience (Brecht & Ogilby, 2008; Homer, Plass, & Blake, 2008). Furthermore, research suggests students be

provided with various learning methods and technological options with which to engage information (Jackson, Gaudet, McDaniel, & Brammer, 2009; Strayer, 2007).

Learning is dependent on psychological activity (Clark & Mayer, 2008). Therefore, productive psychological engagement underlies any effective instructional strategy. This applies to actively involved discussions and passive lectures. Active or passive behavior is insignificant in the learning process, as long as psychological stimulation occurs. If multimedia presentations are designed to cognitively stimulate the minds of students, effective learning can occur. Like instructional strategies in the traditional classroom, effective multimedia instruction needs to be evidence-based. The fundamentals of learning do not change with different technology. It is the instructional design that contributes to cognition (Mayer, 2009).

Direct Instruction

Direct instruction is rooted in behaviorism and entails categorizing learning into small tasks and goals, designing activities for mastery, providing feedback, and sequencing structured learning experiences (Magliaro, Lockee, & Burton, 2005). Direct instruction is effective with conceptually difficult material and requires teachers with extensive content expertise (Magliaro et al., 2005; Rymarz, 2013). As a behavioral-based model, direct instruction contends learning is a universal process that can be triggered through certain behaviors or activities. While variations have developed, the basic model includes three parts: an introduction, a lesson, and practice. Supporters claim this structured approach aligns with Gagne's instructional events and makes it ideal for technology integration (Magliaro et al., 2005).

Instructive strategy, particularly direct instruction, is considered an effective approach for teaching social studies (Schug, 2003). In particular, middle school social studies students have

increased achievement when using direct instruction (Fleetwood, 2013). Middle school students have also shown to prefer online direct instruction in a "relatively passive format" (Kay, 2013). In some middle school math studies, direct instruction does not increase performance as well as computer-assisted instruction (Cornelius, 2013), but in others traditional direct classroom instruction has increased student achievement more than technology-based curriculums (Mertes, 2013). Direct instruction of vocabulary words has shown to improve reading comprehension in middle school students learning English (Gámez & Lesaux, 2015).

Computer-Supported Collaborative Learning

Sfard (1998) describes learning in terms of two metaphors: acquisition and participation. Acquisition metaphor is understood as the mind acquiring knowledge and participation metaphor is participating in a group constructing knowledge. Acquisition learning parallels Piaget's mental schemata, whereas participation learning aligns with Vygotsky's proximal development (Sfard, 2009). Each metaphor for learning guides teachers, students, and educational research. Sfard (1998) asserts both metaphors are necessary, but warns of overreliance on one. For research purposes, a combination of metaphors is suggested based on the data desired (Sfard, 1998, 2009).

Collaborative learning takes place when learners develop understanding through social interactions. Studying technology and how it facilitates collaborative learning constitutes the field of Computer-Supported Collaborative Learning (CSCL) (Koschmann, 1993; Stahl, 2006a; Roschelle & Teasley, 1995; Looi & Chen, 2010; Stahl, 2013b, 2013c). CSCL studies distinguish collaboration from cooperation. Cooperation is subdividing a task among partners, whereas collaboration is working together on a task. Individual students do the learning in a cooperative environment. In a collaborative environment, the group does the learning (Stahl et al., 2006). A

collaborative approach shifts learning from solely psychological to a social and cultural construct (Stahl, 2005).

Individual learning takes places in collaborative environments; yet, collaborative learning is not just a collection of individual learning. While apparently contradictory, Stahl (2005) explains, "both the individuals learned as a result of the group learning, and the group could only learn by ensuring that the individuals learned." Thus, there are aspects or "phenomena" distinctive of collaborative learning, such as shared meaning and knowledge convergence (Looi & Chen, 2010; Stahl, 2005; Stahl et al., 2006). Usually however, collaboration is studied as a variable on individual learning. Research that tests students before and after collaboration, without analyzing the collaboration itself, is not properly assessing collaborative learning. While useful in certain circumstances, pretest-posttests are limited in that they analyze only individual acquisition and do not accurately assess learning during collaboration (Stahl, 2012; Stahl et al., 2006). Also, immediate individual pretest-posttest may not reveal underlying learning that took place during collaboration. Long-term assessments show group members demonstrate more learning than on immediate tests. CSCL studies claim collaborative learning takes longer to register in an individual's mind but is deeper and more meaningful when it does (Kapur, 2008; Kapur & Bielaczyc, 2012; Stahl, 2013a).

Research Methods

Through analysis of collaborative activities, studies have identified certain concepts unique to the CSCL methodology. For example, the idea of "productive failure" in which less structured collaborative environments force students to struggle and possibly fail. Yet, this process holds a "hidden efficacy" and is actually a "productive exercise in failure" that produces positive learning outcomes (Kapur & Kinzer, 2009). Such findings are discerned through content

analysis of student collaboration. Since CSCL relies on discourse between students as "the basic mediator of collaborative learning," analysis of transcribed online communication and conversations is most common (Onrubia & Engel, 2009). However, CSCL research is not confined to the "online communication medium" and can include content analysis of face-to-face collaboration supported by a computer (Stahl et al., 2006).

Group knowledge construction is also identified and analyzed in CSCL studies (Puntambekar, 2006). The construction of knowledge is the result of learning according to CSCL (Shukor et al., 2014). This concept of learning is extremely complex and multifaceted, involving a constant process of constructing and reconstructing individual thoughts and perspectives (Onrubia & Engel, 2009). Technology-based communication tools, such as a learning management systems or website, can be used to facilitate and structure knowledge construction (Beers et al., 2005; Stahl, 2006b). Instance of knowledge construction are evidence of collaborative learning and team problem solving.

Collaborative learning can best be observed through analysis of small group interactions over short periods of time (Stahl et al., 2006). Small groups are ideal environments in which to study collaborative learning. However, Stahl (2012) cautions not to extrapolate small group findings to the psychology of individual learners or to society as a whole. Instead, analyze them within their unique context. Qualitative data collection, particularly interaction or conversation analysis, is effective in assessing collaborative learning (Stahl, 2012). Data collection can be done with various tools, including observations, field notes, video recordings, or other technologies. Also, CSCL researchers insist collaborative tasks in natural classrooms should be designed with teachers and integrated into preexisting curriculum (Looi & Chen, 2010).

Research on Teacher Facilitation

Teacher facilitation in the group learning space is important for effective flipped learning (Bergmann & Sams, 2012). Facilitation helps guide students and regulate the learning process in the classroom. In CSCL activities, regulation can come from the external level (teacher), collective level (group), or individual level. Romero and Lambropoulos (2011) explain how effective regulation in CSCL environments fosters knowledge construction.

> At the knowledge perspective, the level of external regulation should be designed with the objective of a progressive transfer from the external regulation towards the internal regulation abilities, allowing the learners' to focus on the knowledge construction and convergence and to develop their self and co regulation of learning abilities. Considering the complex conditional factors within authentic learning contexts, the educators are needed to adjust this level of external regulation within the duration of the learning activities to avoid both the excess of external regulation (overregulation) and the lack of it (underregulation) at the individual and collective level. (p. 323)

At the college level, teacher support in CSCL has shown to produce "constructive exchanges and coordinated interactions necessary for the creating of new knowledge" while encouraging small groups to adopt regulative strategies led by individuals, the group, or a combination thereof (Mukama, 2010). CSCL research on learning outcome shows differences between groups despite consistent structure of activities, meaning teacher support is necessary to foster knowledge construction (Hämäläinen, 2012).

Active Learning

Proponents of flipped learning encourage use of active learning strategies (Bishop & Verleger, 2013; Hamdan et al., 2013). Research shows flipped learning is "a viable way to facilitate" active learning and "using active learning in the flipped approach can increase student learning" (Jensen et al., 2015). The effectiveness of active learning and student-centered strategies are well supported by research (Michael, 2006). Collins and O'Brien (2003) define active learning as follows:

> The process of having students engage in some activity that forces them to reflect upon ideas and how they are using those ideas. Requiring students to regularly assess their own degree of understanding and skill at handling concepts or problems in a particular discipline. The attainment of knowledge by participating or contributing. The process of keeping students mentally, and often physically, active in their learning through activities that involve them in gathering information, thinking, and problem solving. (p. 5)

Active learning can be more broadly defined as engaging students, developing skills, high-order thinking, and self-reflection (Bonwell & Eison, 1991). Active learning shifts education from teacher-centered to student-centered (Center for Faculty Excellence, 2009). Peer teaching, discussions, simulations, and games are techniques central to active learning (Bonwell & Eison, 1991). While often synonymously promoted with collaborative learning, active learning includes engaging the individual in the learning process (Bonner, 2010; Kotru, Burkett, & Jackson, 2010). Active learning strategies integrated with technology fosters collaborative learning (Fleming, 2008). Even without the support of computers or other technology, small group techniques are effective in various courses at different educational levels, including pair-share, buzz groups, and three-step interviews (Center for Faculty Excellence, 2009). Moreover,

active learning strategies increase student engagement, motivation, and retention (Bachelor, Vaughan, & Wall, 2012).

At the middle school level, active learning is developmentally appropriate for adolescent students who need intellectually, socially, and physically engaging activities (Edwards, 2015). Leading middle school education organizations promote active learning (AMLE, 2010) and it is being incorporated into middle school teacher-education programs to better prepare educators to use active learning in the classroom (Ellerton, 2013). Also, studies have shown success with combining active and reflective learning strategies in middle school (McCoy, 2013). Inquiry-based learning, technology, an active learning strategies have shown to increase middle school student reading achievement (Lara-Alecio et al., 2012). Specific social networking technologies have also shown promise at the middle school level (Taranto, Dalbon, & Gaetano, 2011).

Middle School Education

The Association for Middle Level Education (AMLE, 2010) emphasizes the developmental importance of the young adolescent educational experience. Education and learning during the transitional years of 10 to 15 years old should be rooted in research and best practices. During this time, the thinking pattern of middle schools students is changing as evidenced in the questions and ideas they express. As AMLE (2010) states, students "reveal new capacities for thinking about how they learn, for considering multiple ideas, and for planning to carry out their own learning activities." Despite this cognitive growth, middle school students still need concrete learning experiences.

AMLE (2012) has developed characteristics for successful curriculum, instruction, and assessment in middle school. They claim "planned" curriculum standards are "based on

assumptions about the commonality of the needs and interests" of students. Since individual student differences are at their most apparent in middle school, no "planned" curriculum can account for all the variables in a classroom. Instead, AMLE suggests middle schools examine the "experienced" curriculum. Regardless of standards, the individualized learning experience of each student is the only curriculum actually being implemented. Thus, the middle school experience must ensure each student has opportunities to achieve success.

Technology and Motivation

An successful middle school requires educators proficient in technology who purposely integrate technology with effective middle school strategies (Downes & Bishop, 2015). Although problem solving and 21st century skills are often identified as major objectives, research on technology use in middle school is widely varied and inconsistent (AMLE, 2010, 2012; Park et al., 2004; Sherman, Sanders, Kwon, & Pembridge, 2009). In a middle school history course, student achievement improved with the use of multimedia instructional software to augment textbook and lecture material (Kingsley & Boone, 2008). Boster, Meyer, Roberto, Inge, and Strom (2006) found the use of instructional videos enhanced middle school student performance in social studies. Also, instructional videos proved effective in middle school mathematic courses (Boster et al., 2007). Barak and Asad (2012) used computers and project based learning to integrate middle school level STEM concepts and found a clear increase in learner motivation.

Recently, the role of motivation in technology-supported learning environments has been discussed (Mayer, 2011, 2014). Multimedia learning research claims motivational and emotional factors impact learning (Leutner, 2014; Moreno, 2006). Such research, however, is based on postsecondary learners and the findings may not translate to K-12 schools (McTigue, 2009). High-school studies have shown correlation between performance and self-efficacy in students

(Kim, Park, Cozart, & Lee, 2015). In middle school studies, motivation and engagement have shown to increase within technology-supported learning environments (Godzicki, Godzicki, Krofel, & Michaels, 2013). Studies have shown 'digital native' students do not always have experience with technology and research can be misleading (Wang, Hsu, Campbell, Coster, & Longhurst, 2014). Ability of technology savvy students is often overestimated as motivation in the classroom (Helsper & Eynon, 2010; Housand & Housand, 2012; Koutropoulos, 2011). Jacobs (2013) asserts technology is not inherently motivating and motivation can only occur when students experience competency, individualize their learning, and connect to a larger community.

Differentiation and Assessment

To optimize middle school student achievement, various instructional strategies and learning opportunities need to be provided. An effective learning experience accentuates diversity of student ability, skills, and knowledge. Moreover, middle school students need to be provided with multiple outlets for which to demonstrate their understanding (Brodhagen & Gorud, 2012). Referred to as differentiated instruction, this strategy requires teachers employ different approaches for individual students to meet the various learning needs in a classroom. It effectively uses the best educational practices to maximize understanding and provide students with appropriate learning skills (Wormeli, 2006). Based on the readiness, interest, and learning style of particular students, teachers can differentiate through content, instruction, assignments, the classroom environment, and assessment (Tomlinson & Moon, 2013).

AMLE (2010) defines assessment as "the process of describing a student's progress toward an objective," and clearly distinguishes it from "evaluation" which puts a "value or judgment" on student work. Both are necessary to determine the effectiveness of a strategy,

curriculum, or school, however, assessment incorporates more of the learning process. At the middle school level, assessment should center on progress and not competition or grades. Also, reflection and self-evaluation of work, encourages the development of cognitive skills necessary in young adolescents (Thompson & French, 2012). Assessment must be a natural part of the learning process through which teachers monitor student progress, providing differentiation when needed, and guide each student toward a desired objective (Tomlinson & Moon, 2013).

Teaching with Technology

The individual learning space requires teachers rely heavily on technology to introduce content. There are various ways to utilize technology in the individual space, and teachers comfortable using technology have an easier time with flipped learning (Bergmann & Sams, 2012). Also, effective flipped learning is best produced by teachers willing using the approach to benefit their students (Strayer, 2007). Therefore, teachers using flipped learning need a broader understanding of learning and technology. Introducing content for homework and engaging students in class is not a novel concept. In fact, it is a time-tested model of teaching. However, using multimedia technology to introduce content is relatively new. Historically, the technology available to educators has directly influenced their pedagogy (Saettler, 1967). Prior to the availability of textbooks, content introduction was confined to the classroom. The advent of the textbook allowed for class time to go from transcribing to engaging students in discussion (Strayer, 2007). Using technology to enhance instructional content should be understood in context with the history of education and learning technology.

Technologies common in today's classrooms were once innovations destined to transform education. None have ever lived up to the hype, but some have found acceptance. However, this

has not come without resistance. Most technology, including textbooks, blackboards, television, and the computer were in some form resisted but eventually accepted in education. Today's resistance to Google or Wikipedia is no different. Such resistance is not unfounded and cannot be dismissed. Socrates himself feared writing would replace man's memory, and in a sense he was correct. Nevertheless, understanding technology's role in education makes implementation of new technologies and strategies more manageable (Mishra, Koehler, & Kereluik, 2009).

Teachers often dismiss technology as requiring too much time to learn, causing more harm than good, or being too technical instead of instructional (Mishra et al., 2009). Such concerns are not contemporary. In his 1841 teaching manual, The Black Board in the Primary School, Josiah Bumstead quotes a committee member asked if his school has blackboards: "'No.' he replied; 'it is of no use to get them. If we had black-boards, we have no teachers that can use them to advantage.'" Such an excuse could easily be heard today about the iPad. However, in our rapidly changing world, such excuses are no longer acceptable. While using specific technology is okay, teachers must embrace a wider framework of technology integration. As Mishra et al. (2009) explains, an effective modern teacher must have "flexibility of thought, a willingness to tolerate ambiguity, and a willingness to experiment with how technology can best be used to teach subject matter in powerful ways."

Implementation Models

Effective technology implementation comes from sound theory and evidence-based practices (Clark & Mayer, 2008). Effective teachers understand the power and influence they have over students and instruction (Tanabe, 1998). They implement technology to meets the needs of students and use techniques based on established learning theories, such as Gardner's Multiple Intelligences (Gardner, 1983, 1999; Jackson et al., 2009). In addition, effective teachers

recognize their limitations and strengths within the emerging Technological Pedagogical Content Knowledge (TPACK) framework, while identifying their degree of technology integration within the Substitution Augmentation Modification Redefinition (SAMR) model (Mishra & Koehler, 2006; Puentedura, 2013; Schmidt et al., 2009). Other models have also been designed to guide technology implementation in the classroom.

Shulman (1986) first postulated the concept of pedagogical content knowledge (PCK) and stressed its importance in successful teaching. PCK is not just an awareness of pedagogy and content; but a deep understanding of teaching and the ability to help students learn specific content. With the introduction of new educational technology, Mishra and Koehler (2006) expanded PCK to include an additional domain of technology (T) related knowledge and skills. TPACK has since become an influential framework for understanding teachers and technology integration (Schmidt et al., 2009; Voogt, Fisser, Pareja Roblin, Tondeur, & Van Braak, 2013). TPACK is currently used in teacher education programs to promote basic self-efficacy and technology use in new teachers (Abbitt, 2011; Angeli & Valanides, 2013).

For more experienced teachers, professional development programs emphasize specific TPACK domains, including technological pedagogical knowledge (TPK) and technological content knowledge (TCK) (Niess, 2013). Some suggest clarification or clearer "conceptual distinctions" are needed between the various TPACK domains (Shinas, Yilmaz-Ozden, Mouza, Karchmer-Klein, & Glutting, 2013). While teachers generally grasp the TPACK framework, they struggle to forge it in practice. For example, high school teachers implementing a podcasting project exhibited TPK, but lacked TCK to facilitate effective content learning with the podcast. The same study suggests teachers, specifically social studies teachers, use both universal TK as well as tools and resources designed or fit for their specific subjects (Swan & Hofer, 2011).

TPACK has also been effective when applied to middle school classrooms (Wetzel & Marshall, 2012).

The SAMR model was created to analyze technology integration in various learning environments (Candace M, 2013; Puentedura, 2013). As the acronymic name suggests, there are four levels to the model: Substitution, Augmentation, Modification, and Redefinition. The Substitution level implies new technology replaces old, while the task remains the same. At the Augmentation level, the same task is completed but with improvement from technology. At the Modification level, the technology redesigns parts of the task. Redefinition is the pinnacle of the model, at which new tasks are created using the technology. As a model, SAMR represents the technological enhancement and transformation of learning. Moreover, it allows teachers to conceptualize tasks without having the technology dictate instruction (Jacobs-Israel & Moorefield-Lang, 2013).

Related technology-based educational frameworks are also used. The Technology Integration Matrix (TIM) was designed for educators and educational institutions to evaluate technology integration (Allsopp, Hohfeld, & Kemker, 2007). Kim, Hannafin, and Bryan (2007) developed a framework for teaching and learning with inquiry-based tools. Jimoyiannis, Tsiotakis, Roussinos, and Siorenta (2013) created a framework for effective implementation of Web 2.0 technology. Each framework represents an educators need to conceptualize teaching, learning, and rapid technology change (Mishra et al., 2009).

Efficacy and Attitude

Within all successful learning environments is a sense of community and caring. A strong student-teacher relationship promotes learning in students and efficacy in teachers (Collier, 2005). However, teachers in positions of power establish these relationships. Power relations

begin with a state of conflicting interests (Burbules, 1986). Teacher interest and student interest are an example of conflicting interests and power. In the classroom, teachers have control of the instruction delivered to students. Tanabe (1998) describes this as “power-over.” Teachers have power over their students because students are dependent on the teacher.

A 1990s United States Congressional study found three out of four schools had access to technology, yet a substantially low number of teachers regularly used technology (Congress of the US, 1995). Almost 20 years later, even with technology standards and increased access, research shows limited technology use in the classroom (Georgina & Hosford, 2009; Kiranli & Yildirim, 2013; Paraskeva, Bouta, & Papagianni, 2008; Penuel, 2006). Teachers often cite a lack of time and training as reasons for not implementing technology (Eristi, Kurt, & Dindar, 2012; Holland, 2005; Lepi, 2013; Mishra et al., 2009).

Studies have identified attitude toward technology as an indicator of technology use in the classroom (Hung & Hsu, 2007; Shoffner, 2009). A teacher’s attitude toward technology is sometimes in direct opposition to the implementation of technology (Holland, 2005). Viewing technology as an additional task, not integral to curriculum, is a barrier to implementation. Also, a teacher’s attitude does not always coincide with their practice. Older teachers have been shown to integrate more technology than younger teachers, even though younger teachers have a more positive attitude of technology (Hung & Hsu, 2007). As Liu and Szabo's (2009) claim, “Teachers may think and perform differently in terms of technology integration in the classroom.” Professional development and teacher modeling have shown to increase positive attitude toward technology use (Kim, 2008).

Summary

Flipped learning has potential to impact all levels of education, including K-12. However, as flipped learning evolves, a need for research is clear. Studies have identified the initial strengths of the approach and suggestions for future research. MLT provides guidelines for instructional content in the individual space, while CSCL supports collaborative activities in the group space. Successful implementation of flipped learning relies heavily on the teacher's ability and willingness to integrate technology into the existing curriculum while using learner appropriate strategies. The participants require that I understand the importance of middle school education. Adolescent development peaks during these years, and the educational experience of students must reflect an appreciation for this formative age. An effective middle school environment can be established through differentiation, personalized instruction, multiple assessments, and properly integrated technology.

As the literature shows, there are multitudes of factors influencing my study. In the next chapter, these factors are integrated into the research design and methodology.

CHAPTER 3. METHODOLOGY

My study's purpose was to investigate flipped learning in a middle school classroom. I analyzed student perception of instructional content in the individual learning space and knowledge construction in collaborative activities in the group learning space. My classroom was used because I purposefully implement flipped learning and utilize best middle school teaching practices. My study was tailored to the research questions and learning needs of students. Analyzing the individual and group learning spaces concurrently helped develop a comprehensive view of flipped learning. My study's research design and conceptual framework are thoroughly explained in this chapter.

Research Design

Researchers live in a complex world and align with certain philosophies in order to perceive and understand that world (Mason, 2002). As a social science, educational research produces proposals and recommendations meant to guide educational policy and practice (Clark, 2011). Often viewed as means to an end, research in education is criticized for its relevance and quality of evidence-based practices (Biesta, 2007). In particular, educational technology research is criticized for lack of "methodological robustness" and the field is encouraged to expand its use of methods (Bulfin, Henderson, Johnson, & Selwyn, 2014).

Mixed Methods

In education, mixed methods research is recognized as a third paradigm between quantitative and qualitative (Johnson & Onwuegbuzie, 2004). This paradigm is best suited for educational research because of the various social, cultural, and political background issues that

influence studies (Johnson, 2009). The mixed methods approach uses the strength of each paradigm to complement their inherent weakness. By examining "two distinct strands" of data with separate questions, collection, and analysis processes, inferences connecting the strands can be made (Creswell & Tashakkori, 2007). Sandelowski (2000) emphasizes the importance of maintaining different qualitative and quantitative data gathering and analysis techniques in order to properly connect findings later at the interpretation level. Synthesizing qualitative and quantitative methods at different research levels is necessary for insight not produced by single method studies (Heyvaert, Maes, & Onghena, 2011).

Purposes for mixing methods vary and overlap, however, most studies are conducted to "gain complementary views about the same phenomena" or to develop a "complete picture" of the event being studied (Zachariadis, Scott, & Barrett, 2013). Collins et al. (2006) have formulated four rationales for using a mixed methods approach; participant enrichment, instrument fidelity, treatment integrity, and significance enhancement. Participant enrichment includes the recruitment and optimization of the sample group through mixed methods. Instrument fidelity is the rationale that results from the process to "maximize the appropriateness and/or utility of the instruments used in the study." This rationale also applies to studies in which the researcher is an instrument. Treatment integrity is the combining of qualitative and quantitative methods to test the reliability of a treatment or intervention. Significant enhancement includes using quantitative and qualitative data to strengthen or amplify the interpretation of mixed data. Each rationale can come before, during, or after a study is conducted and the rationales have been shown to influence research in mathematics and special education (Collins et al., 2006; Ross & Onwuegbuzie, 2012).

Methods in Studies on Flipped Learning

Heyvaert et al. (2011) claim a study's research questions and available literature are the ultimate indicators for using mixed methods. Expanding on previous research is also a common reason for combing qualitative and quantitative methods (Zachariadis et al., 2013). In the available research on flipped learning, there are a variety of qualitative, quantitative, and mixed methods studies (Bishop & Verleger, 2013; Pursel & Fang, 2012). Early research tends to be quantitative, using survey data of student and instructor perceptions (Baker, 2000; Lage et al., 2000). Initial use of flipped learning in traditional subjects, such as law or medicine, have yielded qualitative narratives based on educator experience (Slomanson, 2014; Sherbino et al., 2013). Quantitative studies have been conducted on the instructional content in the individual space (Dollar & Steif, 2009; Musallam, 2010). Most research on flipped learning can be categorized as a case or comparative study. Each type has benefits but finding are limited due to the various "potential causative mechanism" in a particular study (Jensen et al., 2015). However, such is the reality of educational research (Biesta, 2007)

Published studies on flipped learning show researchers rely more on quantitative methods, using opinion-based surveys and performance data (Bishop & Verleger, 2013). Such studies identify effects on variables such as learning, satisfaction, and usage; however, frequently lack direct measures and are "dominated by perception data" from self-reporting participants (Pursel & Fang, 2012). For example, Foertsch, Moses, Strikwerda, and Litzkow (2002) identified effects of flipped learning on the "usefulness, convenience, and value" of an undergraduate course through year-long surveying. While perception data supports flipped learning, there were no performance measures included. Other studies complement perception data with performance indicators gathered through assessment (Laman et al., 2012; McLaughlin et al., 2014; Schultz,

Duffield, Rasmussen, & Wageman, 2014). Moravec, Williams, Aguilar-Roca, and O'Dowd (2010) used student surveys and exam data to show increased performance and high satisfaction with instructional content.

Of the several thesis and dissertational studies conducted on flipped learning, all have utilized a mixed approach. Strayer (2007) used qualitative collection and analysis methods, including observations, reflections, and interviews to triangulated findings with quantitative survey data. Johnson and Renner (2012) used observations and interviews in conjunction with a pretest-posttest and survey data; this switching replication study also employed case study methodology. In a controlled study, Chipps (2013) used a mixed methodology of surveys, exams, and interviews. Day and Foley (2006) gathered course grades and surveys, as well as conducted interviews, showing flipped learning to be "more educationally effective and enjoyable" than the traditional approach. The Day and Foley mixed methods study is significant for its analysis of instructional content in the individual learning space, activities in the group learning space, use of grade-based performance measures, and semester length (Bishop & Verleger, 2013; Pursel & Fang, 2012). This research demonstrates the usefulness of mixed methods when studying flipped learning or variations thereof.

Modification to Methods

In flipped learning, the individual and group learning spaces lend themselves well to mixed methods. The target variables for my study were knowledge construction and perception. Using qualitative and quantitative methods, the integrity of both target variables was preserved throughout my research. Treatment integrity is a common rational for using mixed methods (Collins et al., 2006). Each variable was distinguished methodologically to better connect findings (Sandelowski, 2000). Mixed methods were used to produce complementing views that

built on previous studies. Such reasons are familiar to mixed methods researchers (Zachariadis et al., 2013). Qualitative and quantitative findings intensify each other, strengthening the overall interpretation. Enhancement of findings is also conventional in mixed methods studies (Collins et al., 2006).

Flipped learning is commonly studied with a mixed approach (Chipps, 2013; Day & Foley, 2006; Johnson & Renner, 2012; Strayer, 2007). Therefore, my study was designed with quantitative and qualitative methods necessary to address the research questions and analyze the learning spaces inherent to flipped learning. The variables (perception and knowledge construction) were aligned with a particular question and analysis process. An embedded design was used to collect data, analyze data, and interpret findings (Figure 3). Embedded design uses multiple data sets to answer multiple research questions. This is different than a convergent design that uses qualitative and quantitative methods to address the same question. Commonly, embedded design happens when qualitative data is inserted to answer a secondary research question (Creswell, 2014; Creswell & Plano Clark, 2011).

My study analyzed middle school students' perceptions of instructional content in the individual learning space and knowledge construction in collaborative activities in the group learning space. Attitudinal surveys and course grades helped identify perception and instructional content was analyzed through Multimedia Learning Theory (MLT) principles. Using recordings of collaborative activities, knowledge construction was analyzed through Computer-Supported Collaborative Learning (CSCL) techniques.

Conceptual Framework

The conceptual framework merges theories and strategies that correspond to respective learning spaces (Figure 1). Flipped learning is composed of two spaces: the individual learning

space and group learning space. Both are fundamentally rooted in different theories. From an educational perspective, there are three fundamental learning theories: behaviorism, cognitivism, and constructivism (Schunk, 2014). In learning design, these paradigms shift with time and new technologies (Cooper, 1993; Ertmer & Newby, 2013). Analysis of instructional content in the individual space was based on the cognitive approach of MLT (Mayer, 2009). Whereas analysis of knowledge construction in the group learning space was based on the constructivist approach of CSCL (Stahl, 2005, 2013b; Stahl et al., 2006). By distinguishing the learning spaces, theoretical support for flipped learning can be discerned.

Participants and Context

Participants

Participants were 35 sixth grade students from a private middle school in Hawai'i. The students ranged from 11 to 12 years of age. Students were enrolled in a required social studies course divided into two sections of 18 and 17. Section placement was based on scheduling factors at the beginning of the school year. Informed consent was acquired from all participants through a signed form (Appendix C). Informed consent from parents and guardians was also acquired (Appendix A). Eleven-year-old students completed an orally scripted consent form as required by the University of Hawai'i Institutional Review Board (Appendix B). All measures were taken during data collection and analysis to keep the identity of participants anonymous. This includes the use of random code numbers instead of student names. However, Mason (2002) emphasizes the reality of informed consent in research:

> Recognizing that fully informed consent may be impossible always to achieve puts researchers in a powerful and highly responsible position, and means that they have a

greater, not a lesser, duty to engage in a reflexive and sensitive moral research practice. (p. 82)

My study was conducted in middle school, an area that traditionally includes students aged 10 to 15 years (AMLE, 2010). The developmental importance of these years cannot be understated and all precautions were taken during research to ensure student security. In middle school, use of proven teaching practices, age appropriate instructional strategies, and relevant assessment methods are of utmost importance. Student learning differences are most pronounced during middle school, and care must be taken to recognize the individual learning experience of each student. A planned curriculum with standards and objectives cannot be rigid and opportunities for success must be made available for all students (AMLE, 2012).

Study Setting

The setting was a K-12 private school. The average class size ranges from 25 to 40 students per grade. The school has existed in Hawai'i for approximately 150 years. The school has had a one-to-one laptop program for 16 years. Owning a MacBook Pro or MacBook Air laptop is a requirement for attending 5th through 12th grade. A school-wide high-speed wireless network and Internet access at the home of each student makes integration of technology easier than most schools. This is fortunate for teachers integrating technology-based strategies such as flipped learning. Also, a technology-affluent population nullifies a common critique of flipped learning; that it is ineffective for students and schools lacking internet access and technology (Amaral, 2013).

Instrumentation and Procedures

My mixed methods study targeted middle school student perception of instructional content in the individual learning space and knowledge construction in collaborative activities in the group learning space. Collectively, knowledge construction and perception constitute the participant learning experience. Quantitative data was gathered through an attitudinal survey and course grades. Qualitative data was gathered through audio recordings. Each data strand allows for independent research questions in the embedded design (Creswell & Plano Clark, 2011). Having separate questions, collection, and analysis processes allows quantitative and qualitative findings to be better linked during interpretation (Creswell & Tashakkori, 2007; Sandelowski, 2000).

In my research design, data strands contain a question, a collection and analysis process, and interpretation (Figure 3). By definition, a mixed methods study includes at least one qualitative and quantitative strand (Creswell & Plano Clark, 2011). Based on the learning spaces, research questions and variables, two strands were used in an embedded mixed methods research design. All mixed methods studies integrate their qualitative and quantitative data at some point in the research process. In my study, data integration was during interpretation. Creswell and Plano Clark (2011) clearly state, "All mixed methods designs should reflect on what was learned by the combination of methods in the final interpretation." The quantitative strand was embedded into the qualitative strand, complementing qualitative findings and the larger investigation of flipped learning in a middle school classroom. Items in the attitudinal survey included variables related to flipped learning, including the individual space, the group space, course content, motivation, confidence, effort, and instructional design characteristics.

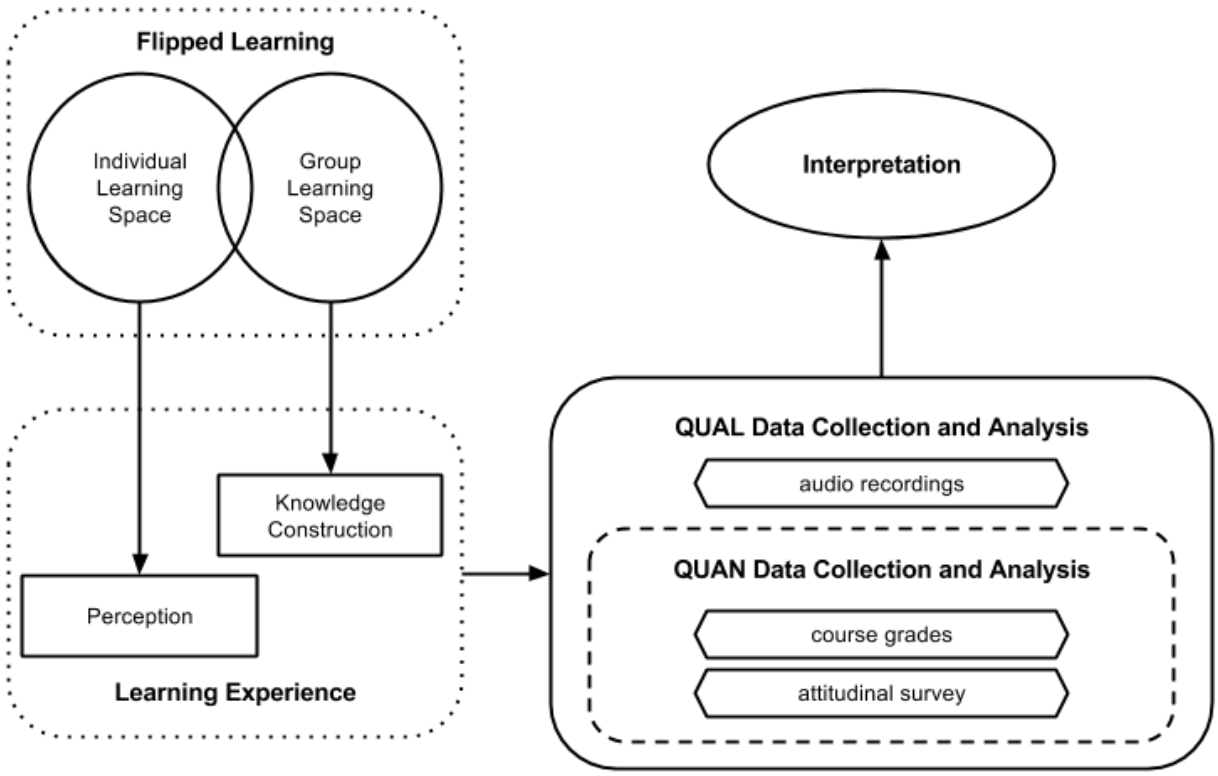

Figure 3. Research design process

Data Collection and Analysis

Data was collected in May 2015. Three instruments were used for the qualitative and quantitative strands. Attitudinal surveys were used to collect student perceptions of instructional content in the individual learning space. The attitudinal survey also solicited perceptions of other variables pertaining to flipped learning. Course grades were collected to correlate survey data on perception. Audio recordings were collected to identify knowledge construction in collaborative learning activities in the group learning space. Data collection and analysis will be explained according to qualitative and quantitative types. In Chapter 5, findings will be discussed within the respective learning spaces.

Qualitative Data

Students were studied in the natural classroom setting participating in collaborative activities. Qualitative researchers believe they should view a phenomenon in context and immerse themselves in it (Trochim & Donnelly, 2008). Observation is a traditional qualitative research instrument that is not without issues and must be used appropriately to connect research questions with specific variables for which it is looking (Mason, 2002). In my study, the desired variable was group knowledge construction. In context of CSCL, this does not mean observing individual learning, but observing knowledge construction or learning moments that do not and could not have occurred individually, but only within the group context in which they were observed (Stahl, 2005).

Collection. Audio recordings are similar to observations. However, having the ability to listen, re-listen, and analyze a moment in time is fundamentally different than field notes and artifacts from observations. Video recordings would have provided more information, however, due to the age of participants, only audio recordings were used as recommended by the University of Hawai'i Institutional Review Board. As teacher-researcher, instances of collaborative learning and knowledge construction are not always recognizable through observation. Reviewing audio helped uncover moments difficult to observe and record in a live classroom setting. Audio recording allows teacher-researchers to move away from being the participant observer (Trochim & Donnelly, 2008). Furthermore, recording is a powerful tool that helps teachers analyze and reflect on their teaching, while increasing depth of thought on related issues and knowledge of education (Kong, 2010; Tripp & Rich, 2012).

CSCL research requires extensive content analysis of learner interactions to identify knowledge construction (Van der Meijden, 2005). Therefore, audio recordings are an appropriate

data source to identify knowledge construction in collaborative activities in the group learning space. However, the time-consuming transcription and analysis process limit the amount of interactions that can be reasonably included in a study. This is a reason CSCL studies typically focus on learner interactions in discussion forums (Onrubia & Engel, 2009) and other asynchronous environments (McArdle & Bertolotto, 2012). CSCL is similar to ethnomethodology, it that research is grounded in data and "analysis is often micro-analytic, examining a brief episode in great detail" (Stahl, 2010). In some cases, fleeting moments of knowledge construction, no more than two minutes in length, can be thoroughly examined and dissected (Looi & Chen, 2010).

The group space was divided into stations with computer-based support. There were five separate stations, each with a different collaborative task for students to complete. Stations were designed according to standards prescribed by the social studies curriculum. The particular unit being studied covered the history of Hawai'i. At the station on late nineteenth and early twentieth century immigration to the islands, students used a MacBook Pro computer to navigate an instructional website. The website was created specifically for the course and incorporated specific design principles (Merrill, 2013). Group space design is discussed further in Chapter 4. As students used the computer, Quicktime Player software collected audio recordings. Specific consent for audio recording was acquired from all participants and parent-guardians (Appendix A, B, C).

Analysis. Analyzing audio recording using CSCL techniques is a labor-intensive process that includes extensive reviewing, transcribing, and coding. Several weeks of recording students working on the Hawaiian immigration station yielded a large amount of data. I reviewed the audio recordings for those of the best quality. Data sampling or reducing is common when

analyzing qualitative data (Chi, 1997). In all, three complete group sessions were successfully recorded in their entirety. Each recorded session consisted of students communicating and collaborating while using the website on Hawaiian immigration. Of the three successfully recorded sessions, one was fully transcribed. In this particular group session, three students completed the entire collaborative activity in the group learning space over a span of two 75 minutes class periods. The final recording was approximately 90 minutes and produced over 700 lines of text. It took one individual approximately 7 hours to transcribe. The transcription was then coded using CSCL techniques.

To identify knowledge construction, content analysis was applied to the transcript of the target group's audio recording. Content analysis is a proven research technique in social sciences (Krippendorff, 2013) and CSCL in particular (Shukor et al., 2014). The transcription was coded using a modified scheme developed by Van der Meijden (2005) for evaluating knowledge construction in asynchronous and synchronous CSCL environments (Table 2). I chose this scheme because of it applicability and flexibility. The scheme was created because available models provided "little information on the types of learning activities performed by students in primary and secondary education" and Van der Meijden (2005) needed a scheme applicable to different environments and tasks. The scheme categorizes cognitive, affective, and regulative contributions of group members. Cognitive refers to thinking processes, regulative refers to redirecting group effort, and affective refers to emotional remarks. Other studies have used the scheme to identify knowledge construction in CSCL environments, as well as distinguish high-level and low-level cognitive contributions (Shukor et al., 2014).

Table 2. Coding scheme for analyzing knowledge construction in the group learning space

Collaborative Contributions		High-Level
Cognitive: asking questions		
CHV1	Asking questions that do not require an explanation (facts or simple questions)	
CHV2	Asking questions that require an explanation (comprehension or elaboration)	✔
CHVER	Verification or asking for agreement	
Cognitive: giving answers		
CHG1	Answering without explanation	
CHG2	Answering with explanation (using arguments or by asking a counter-question)	✔
Cognitive: giving information		
CI1	Giving information (an idea or thought) without elaboration	
CI2	Giving information (an idea or thought) with elaboration	✔
CIT	Referring to earlier remark/information	
CIE	Evaluating the content (summarizing/concluding)	
AN	Accepting contribution of another participant without elaboration	
AY	Accepting contribution of another participant with elaboration	✔
NAN	Not accepting contribution of another participant without elaboration	
NAY	Not accepting contribution of another participant with elaboration	✔
Affective		
A	Positive, neutral, or negative emotional reaction to another participant or with regard to the task	
Regulative		
RV	Planning, monitoring, and evaluation of the task or group process	
RINS	Instructing; one participant instructs another participant	
Teacher facilitation		
TR	Teacher support is requested by one or more of the participants	
TI	Teacher provides instruction to one or more of the participants	
Rest		
AND	Non-task-related remarks, unfinished sentences, or interactions that did not fall into any other category	
READ	Participants reading instructional content text aloud	

Segmenting is an essential step when analyzing transcribed verbal data because each segments constitute a unit of analysis to be coded (Chi, 1997). In all, 428 segments were identified in the transcription of the group learning space. Two coders were used for reliability

purposes. Each coder applied the adopted scheme to the target group's transcript. Based on the scheme, segments were coded as cognitive, affective, or regulative. Five cognitive contributions are identified as high-level (CHV2, CHG2, CI2, AY, NAY). Coding sessions were conducted independently. Coding was then compared, contrasted, and discussed until agreement on proper code was reached. Van der Meijden's (2005) scheme was designed for online discussions, so I added codes to identify teacher facilitation that organically occurs in a live classroom setting. Teacher facilitation sub-codes includes being requested (TR) by participants and providing instruction (TI). A sub-code was also used to distinguish participants reading content aloud to the group (READ). Both coders agreed upon 343 of the 428 segments, resulting in 80.10% inter-coder agreement, which is slightly lower than other comparative studies (Paulus, 2007; Shukor et al., 2014; Van der Meijden, 2005). While comprehensive, there are limitation to such descriptive methodology as Stahl (2010) claims:

> If we focus on finding examples of how members accomplish effective learning, we may miss abundant examples of how they also fail to do so. Yet in order to find that something is not there, we need to have an idea of what we are looking for. (p. 27)

Quantitative Data

Students were studied during an eight-week social studies unit. During that time, large amounts of data were produced. Attitudinal survey and course grades were primary sources of quantitative data. Course grades included homework and final unit grades. The survey was used to collect participant perception of several variables related to flipped learning. Quantitative analysis targeted the individual and group learning spaces, as well as participant motivation, confidence, and effort.

Course grades. Day and Foley (2006) showed flipped learning impacts grade-based performance, including assignments, tests, projects, and final course grades. For my study, course grades were included to categorize students and correlate with perception data. Specific consent to use course grades was acquired by all participants as per policy of the University of Hawai'i Institutional Review Board. Course grades represent a cumulative average that students earned while working on the Hawaiian history unit in social science during the fourth quarter of the academic year. For my course, grades are calculated as follows: 25% homework; 25% stations; 25% projects: 25% preparation. While not exclusively reflective of student performance, course grades provided a measurement by which students can be grouped for statistical purposes. Partitioning of students based on performance data is a techniques used in other studies on flipped learning (Chipps, 2013). For my study, students were divided into three groups (top, middle, low) according to their course grades.

Collection. Likert-type scale surveys are popular instrument in studies on flipped learning (Jensen et al., 2015; Pursel & Fang, 2012), even though evidence shows Likert-type scale questions are not reliable enough to make conclusions on certain constructs (Gliem & Gliem, 2003). Regardless, a Likert-type scale survey was used to gather data in my study. A combination of 5 and 4-point items were included. I used Google Forms to administer the survey after completion of the unit. Participants rated their level of agreement with statements pertaining to flipped learning, including effectiveness of instructional content. Other items pertained to effort and confidence. Use of negatively worded phrases for internal consistency were not used (Barnette, 2001). As a scaling method, what is being measured must be defined before the scale is developed (Trochim & Donnelly, 2008). My study borrows an acceptable research definition of perception.

> Perception is a mode of apprehending reality and experience through the senses, thus enabling discernment of figure, form, language, behavior, and action. Individual perception influences opinion, judgment, understanding of a situation or person, meaning of an experience, and how one responds to a situation. (Given, 2008, p. 606)

The Likert-type survey consisted of 50 line items. Some items were conditional. For example, certain items on instructional content could not be answered. Participants who did not complete a particular type of homework assignment were exempt from statements about said type. For this reason, instructional design findings are discussed separately. As a result, 28 line items divided into three categories were used (Table 3). Six items pertained exclusively to the individual learning space, seven to the group learning space, fourteen to the overall learning experience, including content, motivation, confidence, and effort. Course grades were used to divide participants into a top, middle, and low groups. Basic statistical analysis was used to identify significant statistical differences between groups.

Table 3. Attitudinal survey line items

Individual Learning Space
1. Homework assignments were easy to access. **2.** Homework assignments helped me learn. **3.** Homework assignments made class more interactive. **4.** Homework assignments increased my interest in the unit. **5.** I felt challenged by the homework assignments. **6.** Homework assignments were helpful when completing stations in class.
Group Learning Space
7. Stations helped me to understand topics in the unit. **8.** I participated in class discussions. **9.** I worked with classmates on stations. **10.** Classmates helped me with stations **11.** Mr. Winter helped me with stations. **12.** I asked questions in class. **13.** I felt challenged by the stations. **14.** When working on stations, I understood what I had to complete.
Learning Experience
15. Social Science is my favorite class.

16. Unit 04 was a good learning experience.
17. I had to work hard in Unit 04.
18. I learned a lot in Unit 04.
19. I put my best effort into Unit 04.
20. I felt motivated to explore content and topics in Unit 04.
21. I utilized a variety of resources to explore topics in Unit 04.
22. I worked hard even when I was not interested in topics.
23. I was excited about the topics in Unit 04.
24. I felt challenged to think more about topics.
25. How confident did you feel after completing homework assignments but before stations?
26. How confident did you feel after completing homework assignments and stations?
27. Describe the amount of effort you put in during your time outside of class.
28. Describe the amount of effort you put in during your time in class.

Analysis. Quantitative data was collected to address the research question on perception in the individual space, as well as provide supplemental data for qualitative findings in the group space. Basic data analysis revealed perceptions of participating middle school students. As Clason and Dormody (1995) reveal, "It is not a question of right and wrong ways to analyze data from Likert-type items. The question is more directed to answering the research questions meaningfully." To answer for perception, the data was integrated with course grades for correlation purposes. Intergroup perceptions were compared between high, middle, and low performing students.

Interpretation

Using mixed methods is common when investigating flipped learning. Quantitative and qualitative data was analyzed independently. Survey data on perception helped identify correlation between performance and instructional content in the individual space. Transcribed audio recordings of collaborative activities helped identify knowledge construction in the group space. Findings were interpreted in alignment with the conceptual framework, supporting the cognitive theory of multimedia learning and the constructivist theory of Computer-Supported Collaborative Learning guided the interpretation process.

Student preference for instructional content was correlated with performance to identify differences. Statistically significant findings provided support for certain design principles and high performing groups. Findings were interpreted to support certain design principles used in the individual learning space. Knowledge construction was identified to provide support for effective collaborative activities in the group learning space. Findings were interpreted to support collaboration, teacher facilitations, and group cognition. Overall, interpretations provide a better understanding of flipped learning, particularly in the middle school classroom.

Summary

Flipped learning, when enhanced through technology and meaningful collaboration, has shown to be an effective approach (Chipps, 2013; Day & Foley, 2006; Strayer, 2007). Support, however, is limited at the middle school level. As a result, my mixed methods study targets flipped learning in a middle school classroom, including both the individual and group learning spaces. Each space is fundamentally supported by different learning theories, strategies, and approaches. My study investigates both spaces through two variables: perception and knowledge construction. Each variable has been studied in flipped learning and CSCL studies. My data collection and analysis techniques adapted methods from the literature to focus on an understudied group being exposed to flipped learning. Middle school students' perception of instructional content in the individual learning space was collected through an attitudinal survey. Content knowledge construction was analyzed through audio-recorded interactions of collaborative activities in the group learning space. Particular emphasis was placed on the conceptual structure of flipped learning and how to best study its impact on students.

CHAPTER 4. LEARNING SPACES

Flipped learning is composed of two integral but inherently different learning spaces. The individual space is an online environment that provides direct instruction (Bishop & Verleger, 2013; FLN, 2014). As a teacher-centered space, students access created and curated content in the form of recorded lectures, instructional videos, and other online tools (Bergmann & Sams, 2012; Jensen et al., 2015). The individual space is supported by cognitive learning theories which emphasize psychological activity and "learning by viewing versus learning by doing" (Clark & Mayer, 2008, p. 5). To best support flipped learning, the instructional design of content in the individual space should be based on multimedia learning principles (Day & Foley, 2006).

The group space is a classroom environment where students engage in collaboration and interactive learning activities (Bishop & Verleger, 2013; FLN, 2014). As a student-centered space, teachers provide guidance through active learning strategies, including problem solving and redirection (Hamdan et al., 2013; Jensen et al., 2015). The group space is supported by collaborative learning theories which emphasize group construction of knowledge and "learning-as-participation" (Sfard, 2009, p. 55). To best support flipped learning, collaborative learning in the group space should be purposeful, identifiable, and distinguishable from cooperative learning (Stahl, 2006a).

Individual Learning Space

In the individual learning space, learners engage content designed or curated by the teacher. The individual space is intended to help learners develop foundational knowledge that can be built upon or applied in the group learning space (Jensen et al., 2015). The individual

space is often facilitated through technology (Bishop & Verleger, 2013). Instructional content can have multiple forms, including online lectures, videos, interactive websites, and traditional readings. To be effective, it has been suggested that content in the individual space align with multimedia learning principles (Day & Foley, 2006). For meaningful learning depends on properly designed content that produces cognitive activity (Mayer, 2009).

A teacher-centered approach underlies the individual learning space. Wong-Fillmore defines teacher-centered as not facilitating but organizing class activities and directing students with "complete control" (as cited in Deen, 1991). Schug (2003) asserts teacher-centered "implies a high degree of teacher direction and a focus on academic tasks." Teacher-centered includes direct instruction strategies, such as the use of presentations and lectures. Traditional teacher-centered courses have content-based curriculum (Chandler, 1999). As the "source and dispenser of knowledge," teachers emphasize facts, skills, and proficiency to meet objectives in teacher-centered classes (Polly, Margerison, & Piel, 2014).

Cognitivism is at the core of the individual learning space. Cognitivism emerged from earlier behaviorist learning theories (Ertmer & Newby, 2013). In flipped learning, the individual space utilizes cognitivism through direct instructional strategies to deliver content. Jensen et al. (2015) refer to this space as the "content attainment phase" in which students gain conceptual understanding to apply during the "concept application phase" or group space. As Brame (2013) explains, flipped learning uses different process in each learning space.

> Students gain first exposure to new material outside of class, usually via reading or lecture videos, and then use class time to do the harder work of assimilating that knowledge, perhaps through problem-solving, discussion, or debates. In terms of Bloom's revised taxonomy, this means that students are doing the lower levels of cognitive work (gaining

> knowledge and comprehension) outside of class, and focusing on the higher forms of cognitive work (application, analysis, synthesis, and/or evaluation) in class, where they have the support of their peers and instructor. (p. 1)

This does not imply, however, that flipped learning is a fully cognitive approach. For the endgame is unquestionably constructivist, aiming to create an enriching and collaborative group learning space. Yet, to attain this ideal group space, the individual space must provide content through teacher-centered and direct instruction strategies. The cognitive underpinnings of the individual space free time for quality collaboration in the group space. Ultimately, flipped learning is a constructivist approach that is integrally dependent on cognitive methods to foster genuine learning experiences in the classroom.

Instructional Content

Content in the individual learning space was created and curated for the unit on Hawaiian history. Instructional content in the individual space is referred to as homework. For a unit, students are required to complete ten homework assignments. Each assignment is numerical and uniquely named. For example, Homework #01 was titled Western Arrival and focuses on the arrival of European explorer to Hawai'i. Instructions are hosted online using the Canvas learning management system (LMS). Canvas is design by the educational technology company Instructure and had been implemented school-wide at the time of my study. Figure 4 shows a screenshot of the LMS interface and homework design. Students must progress and complete assignments sequentially. All homework assignments include options from which students can choose. Certain options align better with principles of multimedia learning than others.

Since my study was designed to avoid implementing flipped learning as an experimental researcher (Johnson & Renner, 2012), while utilizing middle school best practices (AMLE,

2010), students were provided instructional content options in the individual space. As a result, student perception of instructional content varies according to their choices. For some line items in the attitudinal survey, students had to acknowledge they did not complete a particular option. This shrinks the already small participant size of my study, further restricting an extension of findings. However, by not limiting options, my study adheres to best practices in flipped learning (Bergmann & Sams, 2012) while valuing the young adolescent learning experience (Downes & Bishop, 2015; McEwin & Dickinson, 2012).

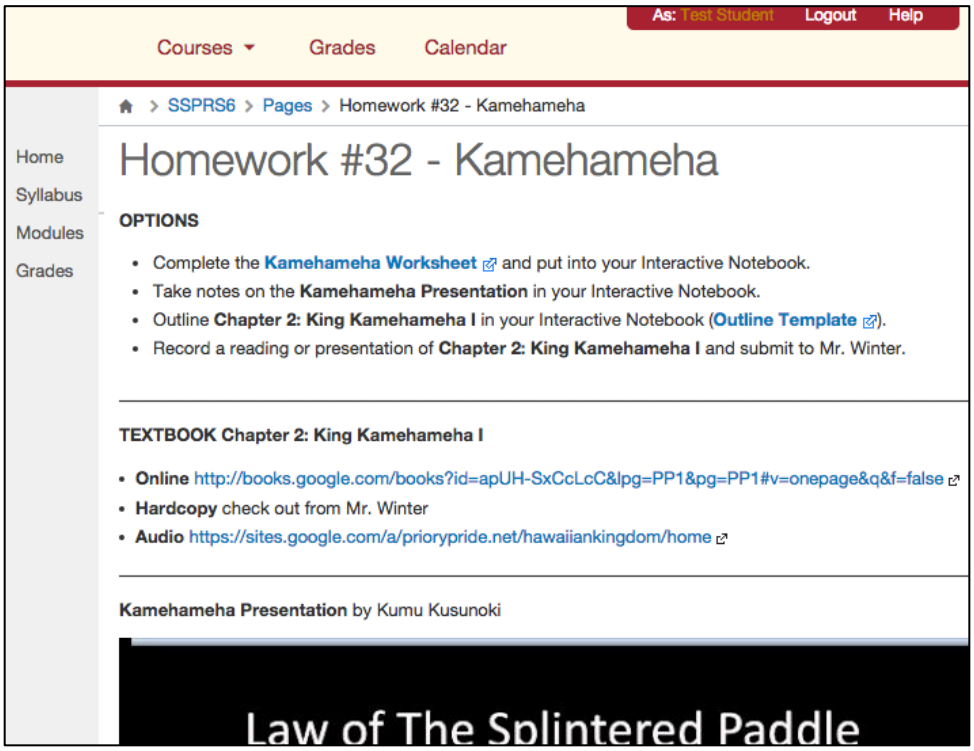

Figure 4. Screenshot of instructional content interface in the individual learning space

There were four instructional content options in the individual learning space. 'Guided note-taking' requires using a textbook to complete worksheets with fill-in-the-blank or missing words and phrases. 'Reading-outlining' requires using the textbook to traditionally outline chapters by identifying important parts. 'Creating content' requires using textbook content and presenting it in a different format, such as presentations, audio recordings, and posters. 'Direct

note-taking' requires watching a narrated screencast and transcribing the information. Direct-note-taking is the option traditionally associated with flipped learning (Bergmann & Sams, 2012) and most aligned with multimedia learning principles. Each narrated screencast was designed specifically for my social studies course and purposefully incorporates MLT principles, including reducing extraneous lode, managing essential processing, and fostering generative processing (Mayer, 2009). Content for narrated screencasts was adapted from a middle school textbook on the subject (Potter, Kasdon, & Rayson, 2003).

As participants progressed through the unit completing homework assignments, instructional content options were collected. This collection was strictly for group statistical purposes and individual student choices were not analyzed. Since there were 35 participants in my study and each was required to complete 10 homework assignments, a total of 350 units of data were collected. Analysis helped identify the homework option most used by participants when engaging instructional content in the individual space. Also, participants who used the direct note-taking option were asked to rate the effectiveness of design variations in the instructional content. These included narration and transcription differences.

Group Learning Space

The group learning space is rooted in constructivism (Bishop & Verleger, 2013). By incorporating collaborative, student-centered, and active learning strategies, the group space builds a constructivist environment atop the cognitive foundation of the individual space. There is bedrock of research and literature solidifying constructivism as a viable learning theory, including the landmark works of Vygotsky, Piaget, and Dewey. A relationship between constructivist theory, collaborative learning environments, and technology supported activities exists in educational research (Alzahrani & Woollard, 2013). Flipped learning exemplifies this

relationship, using traditional theory with technology to promote collaborative learning (Bishop & Verleger, 2013).

To understand the collaborative environment of the group learning space, a CSCL framework was employed. Stahl (2013) clarifies collaborative learning is not based on a single theory but guided by a diversity of theories. In particular, CSCL separates itself from other collaborative learning theories and technology assisted theories by shifting the focus of analysis from individual students to the group. Learning outcomes are not measured through individual assessment before or after collaboration, but instead are analyzed through group interaction during contexts in which they occur. Despite its abstract and qualitative nature, the importance of group meaning or learning constructed by the group is essential to CSCL.

> [G]roup meaning is [not] just some kind of statistical average of individual mental meanings, an agreement among pre-existing opinions, or an overlap of internal representations. A group meaning is constructed by the interactions of the group's individual members, not by the individuals on their own. It is an emergent property of the discourse and interaction. It is not necessarily reducible to opinions or understandings of individuals. (Stahl, 2005, p. 80)

Collaborative activities in the constructivist group space were analyzed for group meaning. According to CSCL, analysis of students in small groups yields evidence of collaborative learning. All collaborative activities were designed through a learning management system and included additional computer-based support to meet the definition of CSCL (Stahl, 2006a). Using computer-based systems in promoting collaboration through "intersubjectivity" or the ability for people to understand each other is encouraged in CSCL research (Stahl, 2012). In particular, through content analysis of collaborative interactions, knowledge construction can be

identified through CSCL methodology (Beers et al., 2005; Onrubia & Engel, 2009; Puntambekar, 2006; Shukor et al., 2014).

Distinguishing the spaces inherent to flipped learning allowed for a better understanding of the whole pedagogical approach (Figure 1). This conceptual framework allowed for the use of mixed methods, while aligning research questions with methodology. Quantitative data gathered through attitudinal surveys identified student perception of MLT principles in instructional content. Qualitative data gathered through audio recording identified knowledge construction in a CSCL environment. While employing best middle school practices, my study was able to effectively implement and document flipped learning in a middle school classroom.

Collaborative Activities

In my classroom, the group learning space is divided into sections or stations (Figure 5). Each station is a separate activity designed for small groups of students to complete collaboratively while meeting specific learning objectives prescribed by curriculum. Every station includes an area for three or four students, a computer-based device, and materials needed to complete the activity (Figure 6). There are both group and individual requirements for completing a station. Instructions are provided to students through a learning management system. Students progress through stations independently working within different groups at each station. Stations do not have to be completed sequentially and students can choose from available stations. Work at stations is documented individually in interactive notebooks and through creation of a group product.

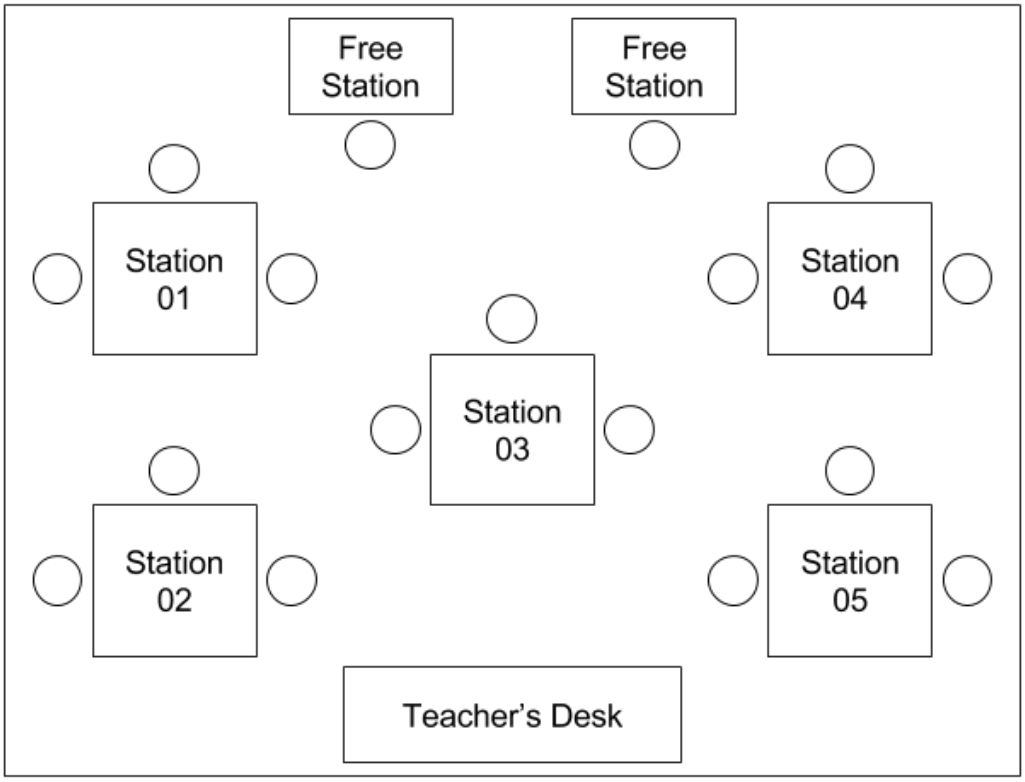

Figure 5. Floor plan of the group learning space

There are four units in the 6th grade social studies curriculum: one for each quarter of the academic year. Every unit consists of ten homework assignments to be completed in the individual learning space and ten stations to be completed in the group learning space. Due to classroom size restraints, there are only five stations available to students during a class session. Free stations provide space for students to work when others stations are occupied. Also, free stations help with differentiation and classroom management. As students complete stations and the unit progresses, new stations are introduced to the group space. All stations are numerical and uniquely named. For example, Station 01 was titled Captain Cook and focused on mapping the explorer's journeys to Hawai'i. As the teacher, I monitor and facilitate students as they work on stations in class. I provide clarification and guidance as necessary. I also promote collaboration by encouraging peer-to-peer interaction. Providing a variety of activities in the

station format allows students to engage in multiple instructional approaches and learning experiences – an effective strategy in middle school (Brodhagen & Gorud, 2012).

Figure 6. Photos of students completing collaborative activities in the group learning space

Since data collection occurred during the fourth quarter of the school year, my social studies course was studying a unit on Hawaiian history. The collaborative activity analyzed was on immigration to Hawai'i in late 1800s and early 1900s (Station 07: Stories). This station was designed for students to investigate immigration through a website specifically made for my course. Content for the website was adapted from a high school textbook on the subject (Menton & Tamura, 1999). The website was originally a project created in an instructional design course

at the University of Hawai'i during Spring 2015. The course instructor was also developer of the instructional principles on which my website design was based (Merrill, 2013). The website is publically available online (http://etec750assignment.weebly.com). While guiding students step-by-step, the design gradually incorporates content and continually assesses progress. It follows the instructional event process of presentation, demonstration, and application. The social studies content covered by the website includes the following topics: differences between migration, immigration, and emigration; factors of migration; push and pull factors. Students also read fictionalized first-hand accounts of immigrants who came to Hawai'i. The group product includes completion of a large paper-based chart documenting students' learning experience.

CHAPTER 5. FINDINGS

Flipped learning is composed of two integral but inherently different learning spaces. The individual space stems from cognitive learning theory, employing teacher-centered techniques and direct instruction strategies (enhanced through technology) to deliver content. The group space stems from constructivist learning theory, employing student-centered techniques and active learning strategies (enhanced through interaction) to engage in collaboration. Each space was studied separately, using independent research questions and both qualitative and quantitative data analysis. Mixed methods are common in educational research, especially in studies related to flipped learning. Grades and survey data were collected to investigate flipped learning in general and the individual space in particular. CSCL content analysis targeted knowledge construction in the group learning space. Not all findings are exclusive to the individual or group space, but better reflect the overall learning experience. In Chapter 6, findings will be interpreted in respected learning spaces and collectively for flipped learning in a middle school classroom.

Perception

To address the research questions on middle school students' perceptions of the individual learning space, course grades and survey data were collected. Analysis and correlation of this data helped identify the participant's perception. Attention was placed on content aligned with multimedia learning principles, including narrated screencasts. Homework assignments were tabulated as participants progressed through the unit. Groups based on course grade ranking were created to statistically analyze survey data.

Instructional Content

Participant had four instructional content options in the individual learning space. As explained in Chapter 4, the social studies unit required students to complete ten homework assignments, each of which included four options. Since there were 35 participants, 350 assignments were recorded during the unit. By far, the most completed option was direct-note-taking with 80% (280) of total assignments. Creating-content constituted 9% (31), guided-note-taking constituted 6% (22), and 5% (17) of assignments were incomplete.

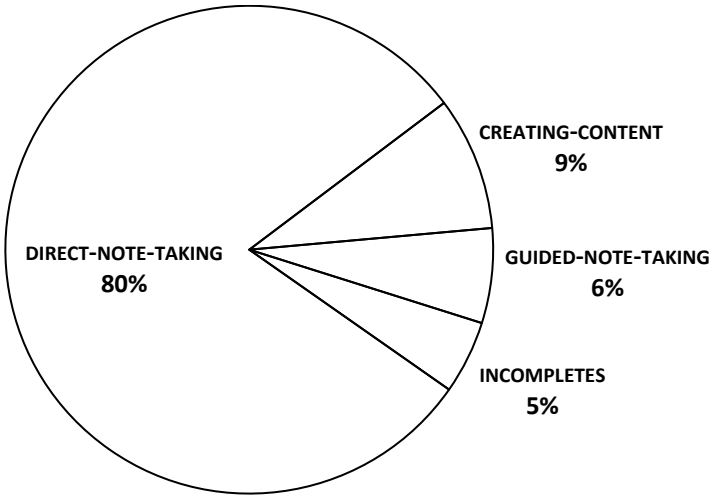

Figure 7. Instructional content completed by participants in the individual learning space

Course Grades

Despite grade inflation as a well documented phenomenon (Godfrey, 2011; Pattison, Grodsky, & Muller, 2013), students were ranked (1 to 35) according to course grade. Course grades are based on a 100-point scale. Course grades ranged from 78 to 100. Median course grade was 91 and the mean was 89.85. Students were divided into three groups (Figure 8): low (three deviations to the left of mean); middle (three deviations within mean); and high (three deviations to the right of mean). A similar grouping technique using standardized test scores was used in research on flipped learning (Chipps, 2013).

The top 11 students (31.2%) were categorized as high-performers. High-performers had a mean of 95.54 and median of 95. The next 13 students (37.1%) were categorized as middle-performers. Middle-performers had a mean of 90.38 and median of 91. The bottom 11 (31.2%) students were categorized as low-performers. Low-performers had a mean of 82.45 and median of 80. Using statistical analysis, groups were correlated with perception data from the survey.

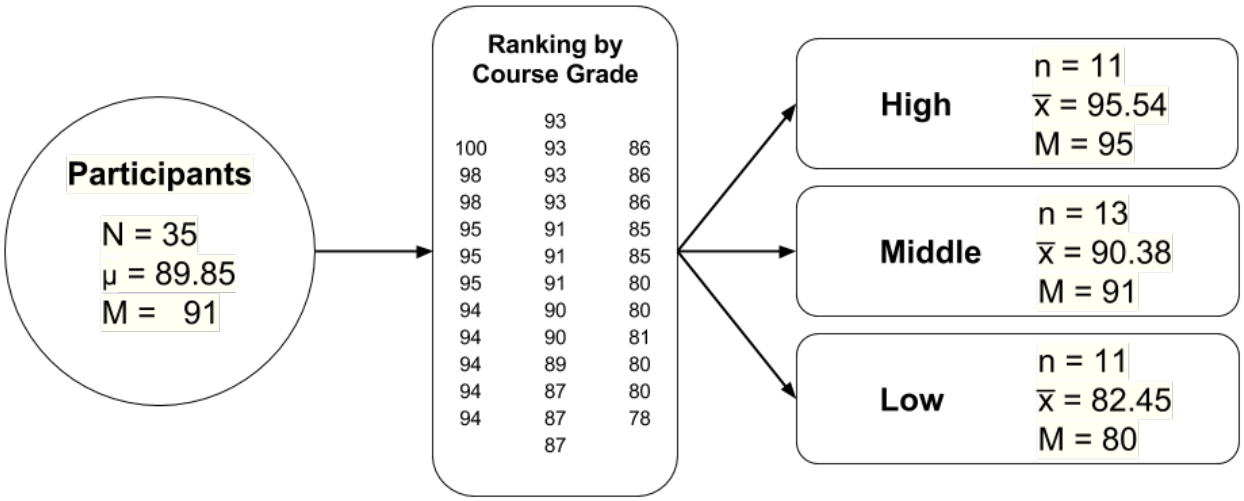

Figure 8. Participant performance groups based on course grade ranking

Attitudinal Survey

Participants responded to a combination of 5-point and 4-point Likert-type scale items. Items targeted the experience of participants in a flipped learning social studies unit (Table 3). Perception in the individual learning space and knowledge construction in the group space were the target variables of the research questions. Some survey items pertained exclusively to a learning space. Others pertained to participants' general learning experience. Performance groups based on course grades were correlated with survey data. Statistical significant difference between performance groups was determined by one-way ANOVA. Post hoc Tukey HSD (honest significance difference) tests were used to verify the significance standard ($p < 0.05$).

Six survey items pertained exclusively to the individual space. No significant differences were found. When asked if taking notes in the individual space made the group space more interactive (item 3), the 11 participants in the top performance group had an average response of 4.55 (SD = 0.69); the 13 participants in the middle performance group had an average response of 3.77 (SD = 1.01); and the 11 participants in the low performance group had an average response of 3.82 (SD = 0.60). However, post hoc analyses using Tukey HSD criterion for significance indicated no significant differences between groups, $F(2,32) = 3.33$, $p = 0.048$. Interestingly, the lowest response (M = 2.77, SD = 1.17) came when participants were asked if they felt challenged by the instructional content in the individual space (item 5). Despite middle performers feeling more challenged than low and top performers, there were no significant differences between groups, $F(2,32) = 1.69$, $p = 0.200$.

Seven survey items focused specifically on the group learning space. One significant difference was found. When asked if collaborative activities were understood in the group space (item 14), the participants in the top performance group had an average response of 4.45 (SD = 0.69); the participants in the middle performance group had an average response 4.08 (SD = 0.64); and the participants in the low performance group had an average response of 3.64 (SD = 0.81). Post hoc analyses using the Tukey HSD criterion for significance indicated top performers responded significantly higher than low performers, $F(2,32) = 3.65$, $p = 0.037$.

Fourteens items were related to the participant learning experience. Five were determined to be statistically significant. When asked to rate how hard they worked (item 17), the top pgroup averaged a 4.27 response (SD = 0.65); the participants in the middle performance group averaged a 4.46 response (SD = 0.52); and the low performance group averaged a 3.55 response (SD = 1.13). Post hoc analyses using the Tukey HSD criterion for significance indicated middle

performers responded significantly higher than low performers, $F(2,32) = 4.29$, $p = 0.022$. When asked if their best effort was put forth (item 19), the participants in the top group had an average response of 4.73 (SD = 0.47); the participants in the middle group had an average response of 4.31 (SD = 0.63); and the participants in the low group had an average response of 3.45 (SD =1.04). Post hoc analyses indicated middle performers responded significantly higher than low performers, $F(2,32) = 8.41$, $p = 0.001$. When asked if they worked hard even when not interested (item 22), the participants in the top group had an average response of 4.91 (SD = 0.30); the participants in the middle group had an average response of 4.38 (SD = 0.65); and the participants in the low group had an average response of 3.55 (SD = 0.82). Post hoc analyses using the Tukey HSD criterion for significance indicated top and middle performers responded higher than low performers, $F(2,32) = 13.13$, $p < 0.001$.

When asked to rate their effort in the individual space (item 27), the top group had an average response of 3.73 (SD = 0.47); the participants in the middle group had an average response of 3.31 (SD = 0.48); and the participants in the low group had an average response of 2.82 (SD = 0.60). Post hoc analyses using Tukey HSD indicated top performers responded significantly higher than low performers, $F(2,32) = 8.49$, $p = 0.001$. Findings were similar when ask to rate effort in the group space (item 28). Participants in the top group had an average response of 3.91 (SD = 0.30); the middle group averaged a 3.39 response (SD = 0.51); and the low group averaged a 3.27 response (SD = 0.79). Post hoc analyses indicated top performers responded significantly higher than low performers, $F(2,32) = 4.05$, $p = 0.027$. In addition, when asked if they 'liked' or 'did not like' taking notes in the individual learning space and participating in activities in the group learning space, all participants reported they 'liked' it.

Content Design

Participants who completed direct-note-taking in the individual space rated the effectiveness of instructional content design variations. Five items in the survey specifically targeted direct note-taking using a 4-point Likert-type scale (Table 4): 88% of participants who completed direct note-taking rated presentations with one teacher narrating as moderately to highly effective; 66% rated co-teacher narration as moderately to highly effective; 60% rated student narration as slightly effective to not all effective. When asked about transcription, 68% rated handwriting and 91% rated typing as moderately to highly effective.

Table 4. Attitudinal data on direct note-taking in the individual learning space

Line Item	1	2	3	4
Video presentation with one teacher narrating	9%	3%	**47%**	41%
Video presentation with two teachers narrating	10%	27%	30%	**33%**
Video presentation with student narrating	8%	**52%**	32%	8%
Taking notes on video presentation (handwritten)	14%	18%	27%	**41%**
Taking notes on video presentation (typed)	6%	3%	**55%**	36%

Knowledge Construction

Identifying knowledge construction during collaborative activities in the group learning space address the research question. CSCL content analysis techniques were used to identify knowledge construction. In the group learning space, completion of an entire collaborative activity by three students was audio recorded and transcribed. Cognitive contributions of the students were coded using a modified scheme designed for online discussions (Van der Meijden, 2005). In all, 428 segments were identified and coded. Segments are specific units of meaning in the transcribed text (Chi, 1997; Shukor et al., 2014). Each segment represents a cognitive, affective, or regulative contribution to group collaboration.

Cognitive contributions constituted 43.7% of total coded segments. Regulative constituted 22.7% and affective constituted 8.2%. Teacher facilitation constituted 7.0%, while "non-task-related remarks" (AND) and "reading instructional content text" (READ) constituted 18.5 % of total coded segments. Of the 97 segments coded as regulative contributions, 70.1% were sub-coded as "planning, monitoring, and evaluation of the task or group process" (RV), and 29.9% were sub-coded as "instructing" (RIS). Generally, regulative contributions occur in clusters and involve members monitoring the group process (RV) while instructing each other (RIVS). In monitoring the group process, students often direct and redirect the focus of the group.

Student 3: We've got to figure out this one.

Student 2: We already did. It's Korea.

Student 3: No! Step three.

Student 1: No, we skipped step two. Wait, let's read the whole thing.

Teacher facilitation in the group space is essential to effective flipped learning (Bergmann & Sams, 2012). Of the 30 segments coded as teacher facilitation, 56.7% were sub-coded as "teacher support is requested" (TR), and 43.3% were sub-coded as "teacher provides instruction" (TI). In the coded sequence, 73.3% of teacher facilitation segments were within three segments of a regulative contribution.

Teacher: Work together and go question by question.

Student 3: Let's completely read the questions this time. Ok?

Student 2: An immigrant can always be considered a migrant?

Student 1: Wait.

Student 2: No.

Students 1 and 3: Wait!

Coding sequences also show a relationship between teacher facilitation segments and high-level cognitive contributions. Of the 66 segments coded as high-level contributions, 28.7% were within three segments of teacher facilitation. Interestingly, teacher facilitation segments appeared less frequently as the collaborative activity progressed while high-level contribution stayed consistent. Also, of the 35 segments coded as affective or "positive, neutral, or negative emotional reaction" (A), 37.1% were within three segments of high-level cognitive contributions.

Teacher: Remember, a migrant is a person who moves from one place to another. I moved from New Jersey to Hawai'i. That makes me what?

Students 1, 2, and 3: Migrant!

Teacher: Yes, migrant. Does it make me an immigrant?

Students 1, 2, and 3: No!

Student 2: Does it make me an emigrant?

Students 1, 2, and 3: No!

Student 2: Ooooh!

Teacher: So a migrant is not always an emigrant or an immigrant.

Collaborative Learning

Knowledge construction is evidence that collaborative learning is taking place (Beers et al., 2005). Cognitive contributions are the "thinking activities that students use to process learning content and attain learning goals" (Van der Meijden, 2005). Cognitive behaviors are indicators of knowledge construction in CSCL environments (Shukor et al., 2014). Of the 187 segments coded as cognitive contributions, 22.5% were sub-coded as "asking questions," 38.5% were sub-coded as "giving answers," and 39.0% were sub-coded as "giving information." Figure 9 shows the distribution of all cognitive contribution sub-codes. A graphical display of findings

is shown to improve the understanding of researchers in particular and research methodology at large (Onwuegbuzie & Dickinson, 2008). Clearly, “answering without explanation” (CHG1) was used most with 51 coded segments and ”accepting contribution of another participant with elaboration” (AY) was used least with 4 coded segments.

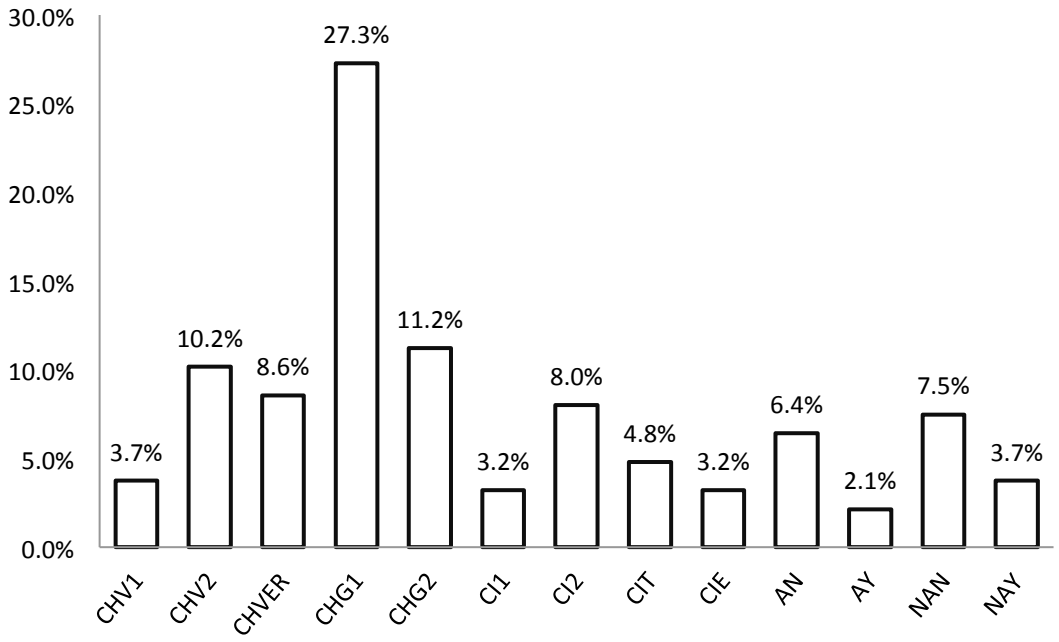

Figure 9. Distribution of knowledge construction in the group learning space

There were 13 codes within the three subcategories of cognitive contribution: 8 at the low-level and 5 at the high-level of knowledge construction. Overall, of the 187 segments coded as cognitive contributions, 64.7% were low-level and 35.3% were high-level. Of the 121 coded as low-level, “answering without explanation” (CHG1) constituted 42.1%, “verification or asking for agreement” (CHVER) constituted 13.2%, “not accepting contribution of another participant without elaboration” (NAN) constituted 11.6%, and “accepting contribution of another participant without elaboration” (AN) constituted 9.9%. Other low-level cognitive codes constituted less than 7.5% each, including “Referring to earlier/remark” (CIT), “asking questions

that do not require an explanation" (CHV1), "giving information without elaboration" (CI1), and "evaluating content" (CIE).

A little over a third of segments coded as cognitive contributions were sub-coded as high-level. Of the 66 segments coded as high-level, "answering with explanation" (CHG2) constituted 31.8%, "asking questions that require an explanation" (CHV2) constituted 28.8%, "giving information with elaboration" (CI2) constituted 22.7%, "not accepting contribution of another participant with elaboration" (NAY) constituted 10.6%, and "accepting contribution of another participant with elaboration" (AY) constituted 6.1%. High-level cognitive contributions tended to cluster together in coding sequences. Typically they occurred during the application stage of the instructional event process (Merrill, 2013) and involved banter between all three students.

Students 1: Which is a political factor of migration? Oh! Education.

Student 2: War.

Student 3: Unemployment.

Student 2: No wait. Political is the government.

Student 3: But I think that the government...

Student 2: Can I try mine? Hah!

Student 1: Wait, but why is it war?

Student 2: Because the political part of the country can declare war.

Student 3: Ok, next. Which is an economical factor of migration?

Student 2: Lets think in an economic way.

Student 1: Maybe this could be education.

Student 3: It's unemployment 'cause money is economic. Watch this! Bam! Got it right!

Summary

Quantitative findings show top and middle performing students report working harder than low performing students. Specifically, middle performing students report giving their best effort more than high and low performers. Also, quantitative findings reveal participants' preference for instructional content and design features in the individual learning space. In the group space, interactions in collaborative activities were found to be generally at the low-level of knowledge construction. Through qualitative analysis, an emerging relationship between teacher facilitation, regulative contributions, and high-level cognitive interactions was discerned. A more thorough discussion of these findings and their implications will be discussed in Chapter 6.

CHAPTER 6. DISCUSSION AND CONCLUSIONS

The individual and group learning spaces are rooted in fundamentally different learning theories. However, flipped learning provides a framework in which each space's strengths and weaknesses are complementary. Cognitive principles, instructionally designed content, and use of direct instruction strategies contribute to an effective individual space; while constructivist principles, collaboratively designs activities, and use of active learning strategies contribute to an effective group space. Effective learning spaces are essential to properly implementing flipped learning. Research in effective environments is more reflective of the student experience and better represents flipped learning as a pedagogical approach. Experimental design and researcher interventions do not always accurately portray flipped learning in a natural setting (Day & Foley, 2006; Johnson & Renner, 2012). As teacher-researcher, I established an effective middle school classroom using flipped learning. Due to limited research in middle school (Drysdale et al., 2013), it is common for studies on flipped learning to be conducted by teacher-researchers who report affective data (Jensen et al., 2015). Such studies provide practical suggestions for practitioners and benefit the student learning experience (Bergmann & Sams, 2012).

Mixing methods provides a complete view of a phenomenon (Zachariadis et al., 2013). In my study, I provide a complete view of flipped learning in the middle school classroom. I collected quantitative data on student perception and qualitative data on knowledge construction. By adhering to middle school best practices and respective learning spaces, my findings are limited. However, the conceptual framework and research design show flipped learning can be implemented and studied in a middle school classroom. Major findings as related to the learning experiences and learning spaces are discussed in this chapter.

Flipped Learning in Middle School

Middle school student perceptions in the individual space and knowledge construction in the group space were target variables. Interpretations of findings are discussed within the respective learning spaces. Findings related to motivation and effort, are included as part of the student learning experience. Studies related to flipped learning have analyzed similar self-reported affective variables, including student performance, learning, and satisfaction (Pursel & Fang, 2012; Touchton, 2015). Learning experiences, especially in middle school, should include age-appropriate tools and strategies to succeed (AMLE, 2012). Moreover, research in middle school should be designed and interpreted to include "the broader milieu of what is educationally effective with and responsive to young adolescents" (Downes & Bishop, 2015). Table 5 displays the related research and findings in my study.

Table 5. Alignment of findings with learning spaces and related research

Related Research	Findings
Learning Experience	
Kim, Park, Cozart, & Lee, 2015	Correlation between performance and perceived effort or motivation.
Chipps, 2013; Belland, 2010	Average achieving students significantly benefit from flipped learning.
Individual Learning Space	
Jacobs, 2013; Wang, Hsu, Campbell, Coster, & Longhurst, 2014	Technology-based instructional content is more appealing to middle school students.
Boon, Burke, Fore, & Hagan-Burke, 2006	Technology-based instructional content is preferred over textbook-based content in social studies classrooms.
Bergmann & Sams, 2012; Day & Foley, 2006; Mayer, 2009	Instructional content designed by multimedia learning principles is considered more effective.

Clark, Kirschner, & Sweller, 2012; Kay, 2013	Direct instruction is appropriate for and preferred by middle school students.
Group Learning Space	
Hämäläinen, 2012; Mukama, 2010; Romero & Lambropoulos, 2011	Teacher regulation of CSCL activities promotes knowledge construction.
Chen & Chen, 2012	Middle school student prefer CSCL activities in the classroom.
Asterhan, Schwarz, & Gil, 2012	Teacher regulation of CSCL activities in middle school classrooms is effective. CSCL activities in middle school classrooms significantly benefit all-girl groups.

Student Learning Experience

In my study, top and middle performers reported they 'worked hard' more frequently than low performers reported. Middle performer, in particular, claimed to have given their 'best effort' more than low and top performers. My findings support a correlation between performance and one's perceived effort. Other studies have identified correlations between self-efficacy and performance in online schools (Kim et al., 2015). My findings show this correlation may extend into flipped learning. Also, my findings suggest flipped learning may benefit student at middle performance levels. Students in average achieving groups have shown to perform well in flipped learning (Chipps, 2013) and problem-based learning environments in middle school (Belland, 2010). Student differences are at their most obvious in middle school (AMLE, 2012), so using an approach that allows average students to succeed may be beneficial.

Instructional Content in the Individual Space

Instructional content options were provided in the individual space. Three options used textbook content and the fourth option presented similar content in a narrated screencast designed using multimedia learning principals (Mayer, 2009). Direct note-taking from narrated

screencasts is usually associated with flipped learning (Bergmann & Sams, 2012) and can be effective if properly designed (Day & Foley, 2006). In my study, students overwhelmingly completed direct note-taking of screencast presentations (Figure 7). Creating content, the only other technology-based option, was in distant second. Interestingly, typing notes (a technology-based transcription method) when completing direct note-taking was considered highly effective by students. While technology is not inherently engaging (Jacobs, 2013) and 'digital native' students do not always have effective experiences (Wang et al., 2014), my findings suggest textbook-based instructional content with limited technology is less attractive to middle school students. While computer-based content has shown to increase performance more than traditional textbooks in social studies courses (Boon et al., 2006), my findings only relate to student preference in the individual learning space.

Variations on content design were rated for effectiveness by students who completed direct note-taking in the individual space. Screencast presentations included one teacher, co-teachers, or student narrations. Each variation aligned with generative processing principles of multimedia learning, including personalization, voice, conversational style, and did not include the narrator's image (Mayer, 2009). My finding suggest when completing direct note-taking, middle school students find screencasts narrated by one teacher more effective. This conflicts with suggestions from flipped learning practitioners to co-teach presentations (Bergmann & Sams, 2012), but supports teacher-centered direct instruction in middle school social studies courses (Fleetwood, 2013; Schug, 2003). It also supports that middle school students prefer direct instructional content designed and delivered in a passive format (Kay, 2013). This is backed by cognitive learning proponents, who contend direct guided instruction is best for inexperienced learners (Clark et al., 2012).

Collaborative Activities in the Group Space

Collaborative activities in the group learning space were investigated for knowledge construction. Content analysis was applied to a transcription of three students collaborating. Knowledge construction was identified using codes specifically developed for CSCL environments (Van der Meijden, 2005). Slight variations were made to accommodate teacher facilitation in the natural classroom setting. Findings show a third of student cognitive interactions during the collaborative activity were at the high-level of knowledge construction. Pattern analysis revealed a relationship between teacher facilitation, regulative contributions, and high-level cognitive contributions. My findings align with postsecondary CSCL research on teacher regulation of group collaboration (Hämäläinen, 2012; Mukama, 2010; Romero & Lambropoulos, 2011) while suggesting their application extends to middle school classrooms. Moreover, my findings support middle school CSCL research on student satisfaction (Chen & Chen, 2012) while adding to limited CSCL research on all-girl groups (Asterhan, Schwarz, & Gil, 2012).

Emerging Pedagogical Framework

Flipped learning combines contrasting theories, techniques, and strategies (Figure 1). The individual learning space is cognitive and teacher-centered – relying on direct instruction and technology. The group learning space is constructivist and student-centered – relying on collaboration and interaction. By defining flipped learning and the respective learning spaces, researchers can comprehensively study the pedagogical approach (Strayer, 2007) or related research can be applied to learning spaces (Musallam, 2010). The framework creates a general

understanding of flipped learning that is adjustable for different learner groups and educational levels. Figure 10 provides a simplified visual diagram of the learning spaces.

As a pedagogical framework, flipped learning can be applied by teachers and researcher to existing studies or used to design new ones. Similar technology-based frameworks already exists, including the popular SAMR model for integrating technology (Puentedura, 2013) and TPACK for identifying the knowledge needed to effectively teach with technology (Mishra & Koehler, 2006). Other lesser known models include the Technology Integration Matrix (TIM) for evaluating technology integration in the classroom (Allsopp et al., 2007), as well as frameworks for integrating inquiry-tools (Kim et al., 2007) and Web 2.0 technologies (Jimoyiannis et al., 2013). The development of such frameworks represents the need for educators to understand teaching and learning in context with rapidly changing technology (Mishra et al., 2009).

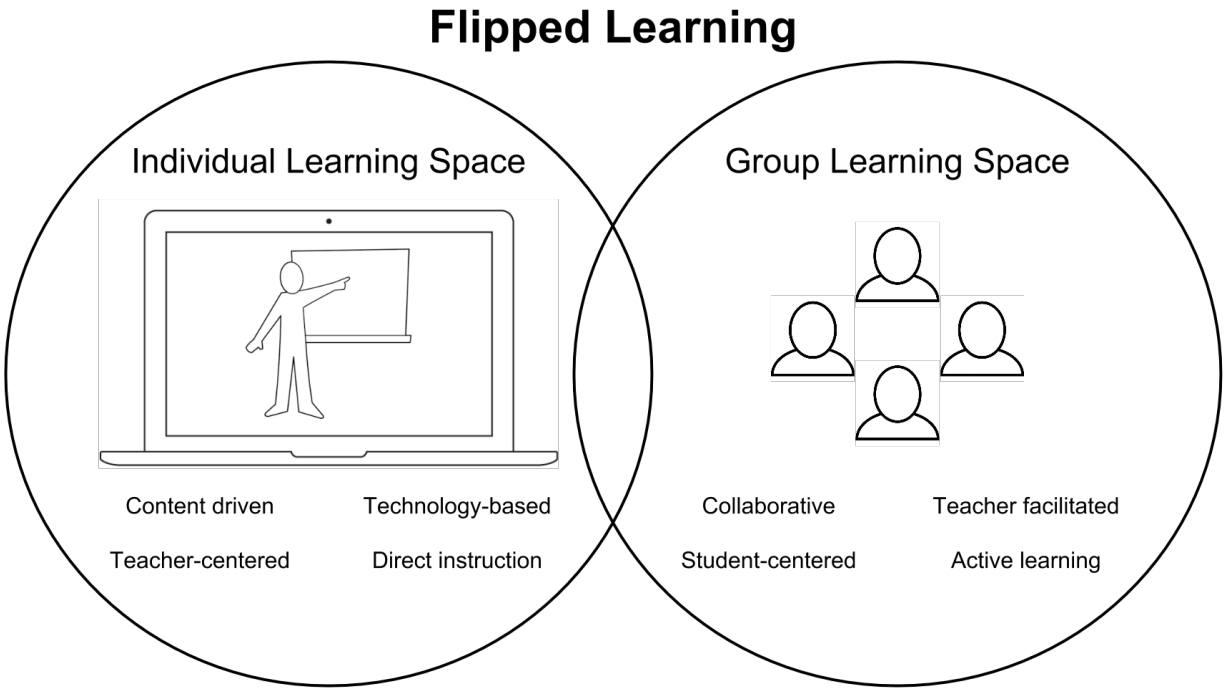

Figure 10. Information graphic of the individual and group learning spaces

Implications for Practice

My study provides support for using flipped learning in middle school. Technology-based learning in K-12 education is under studied (Drysdale et al., 2013) and my findings add to this limited research. While supporting flipped learning, my study also extends application of previous findings into the middle school classroom. Flipped learning is beneficial to average achieving students (Chipps, 2013) and if implemented with age-appropriate strategies can be effective. Especially in middle school, where disparity is most profound, a pedagogical approach that improves learning experiences for a majority of students is best practice (AMLE, 2010). My study was designed to influence middle school practice but can be adapted to lower or higher levels of education. The following implications have been extrapolated from the findings in my study and related research (Table 5).

Differentiate to Individualize the Learning Process

In my study, average achieving middle school students reported giving their best effort more than top and low achievers. Studies have shown a correlation between effort and performance in technology-based environments (Kim et al., 2015). Average achieving students in a course using flipped learning who report giving more effort will perform better than students who report giving less effort. Despite limited K-12 technology-related research (Drysdale et al., 2013; Jensen et al., 2015), flipped learning has shown to benefit average achieving students (Chipps, 2013). My findings suggest flipped learning as a pedagogical approach is ideal for middle school. Learning difference are profound in middle school (AMLE, 2012) and student success depends on differentiation of content, instructions, and assessment (Brodhagen & Gorud, 2012; Tomlinson & Moon, 2013; Wormeli, 2006). Flipped learning benefits a majority of

learners while providing an avenue for differentiation (Bergmann & Sams, 2012). By implications, effective flipped learning can benefit middle school students.

As a middle school teacher, I have witnessed the benefits of differentiation. By creating a flexible curriculum, content can be adjusted and personalizing to meet student needs. Effective flipped learning creates time and space to identify student strengths and weaknesses. During group space sessions, individual student check-ins allow for assessments of work from the individual space and progress on collaborative activities. This face-to-face communication between student and teacher is a result of the flipped learning paradigm. As a facilitator in the groups space and not a lecturer, the teacher has time to adjust and differentiate for each student, however, minor it may be. Differentiation can occur through various means, including content, process, product and environment (Tomlinson & Moon, 2013). These face-to-face meetings encourage students, especially average achieving students, to engage in the learning process. Teacher suggestions guide the student and help individualize the learning process. Individualized learning helps foster motivation (Jacobs, 2013), particularly in middle school (AMLE, 2012), increases effort, and ultimately improve performance.

Design Engaging Learning Spaces

My findings indicate a correlation between students' perceived effort and their performance in the course. Students who performed well were more likely to report putting in their best effort while low performers were less likely to report their best effort. The implications are to design learning spaces that motivate and maintain engagement. Logically, a motivated and engaged student is more likely to perform well and experience meaningful learning. To increase engagement, online learning research suggests regulating effort and cognition; claiming, "Such regulation happens more easily when students engage in learning tasks perceived as easy to

execute and interesting and enjoyable" (Kim et al., 2015, p.263). In environments such as the individual space, emotions and motivation has shown to impact learning (Leutner, 2014; Mayer, 2011, 2014; Moreno, 2006). Despite multimedia learning research sometimes being inapplicable to middle school (McTigue, 2009), technology-supported environments have shown to increase motivation and engagement (Godzicki, Godzicki, Krofel, & Michaels, 2013).

As explained, differentiation helps motivate students by individualizing the learning process. Such adjustments, however, will not be fully effective if learning spaces are not engaging. Learning spaces should be designed to maximize student interest in the subject matter. Learner-appropriate strategies should be utilized when implementing flipped learning. At the middle school level, active learning techniques in the group space and direct instruction techniques in the individual space are suitable. If applied properly, technology-based content can increase motivation is certain learners. Practically speaking, flipped learning and learning space designs can be adjusted to fit elementary, secondary, or post-secondary learners. Ultimately, it is the responsibility of the teacher, to use their expertise and knowledge to design engaging spaces.

Implement Technology-based Content and Tools

Middle school classrooms should include technology-based content. While not intrinsically motivating, learning can increase through experiences fostered through technology, including competency, individualization, and community connections (Jacobs, 2013). Students prefer technology-based content over textbooks (Boon et al., 2006) and flipped learning relies on technology, especially in the individual learning space. Providing technology-based content and tools will help engage students, increase motivation, and foster learning. Effectively implementing technology should be a priority of the classroom teacher. Research shows a lack of effective technology integration results in inconsistent technology use for students (Wang et al.,

2014). By adopting implementation models such as TPACK and SAMR, teachers can improve their instructional skills as well as engage students.

Utilize Multimedia Principles and Direct Instruction

Instructional content designed using multimedia principles can improve flipped learning (Day & Foley, 2006). In my study, students overwhelmingly preferred multimedia-designed content that used direct instruction strategies. Direct instruction is preferred by middle school students (Fleetwood, 2013; Schug, 2003) and benefits inexperienced learners (Clark et al., 2012). Direct instruction, in the form of online lectures and screencast videos, is commonplace in research related to flipped learning (Bergmann & Sams, 2012; Jensen et al., 2015; Pursel & Fang, 2012). Utilizing direct instruction in the individual space allows for collaboration in the group space. Practitioners using flipped learning should create or curate content that employs multimedia principles and direct instruction.

Design CSCL Activities with Teacher Regulation

Designing the group space is the ultimate benefit of flipped learning (Bergmann & Sams, 2012). Collaborative activities should integrate active learning strategies appropriate for middle school students (Edwards, 2015). Defined learning outcomes should be flexible to accommodate different group collaboration levels (Hämäläinen, 2012). Facilitation or teacher regulation during activities is necessary to promote group knowledge construction (Romero & Lambropoulos, 2011). A technology-based tool can support the group activity but is not necessary. As Mukama (2010) states, “The fact that learners are organized in small task-based groups mediated by a computer does not automatically imply interactions conducive for knowledge building.” It is ultimately the teacher’s role to facilitate collaboration and regulate learning. In flipped learning,

the group space is the apex of the pedagogical approach. Collaborative activities are where the most consequential and enduring learning takes place. By designing and facilitating effectively, students will reach learning goals and achieve success in the classroom

Use CSCL Activities in Middle School to Benefit Girls

Participants clearly preferred technology-based content and perceived it more positively. Studies show middle school students prefer and enjoy computer-supported collaborative learning in the classroom (Chen & Chen, 2012). While foreign studies investigate gender differences in blended environments (Abou Naaj, Nachouki, & Ankit, 2012; Padilla-Melendez, del Aguila-Obra, & Garrido-Moreno, 2013), single-gender studies in the United States are limited. Interestingly, early research on flipped learning saw increased satisfaction and participation for female students – suggesting it maybe more effective for females who generally prefer collaborative learning (Lage et al. 2000). More recently, CSCL environments have shown to benefit all-girls groups in middle school (Asterhan, Schwarz, & Gil, 2012).

Limitations

Limitations included bias related to my teacher-researcher role, participant size and uniqueness, and a contentious subject matter. While all researchers are epistemologically influenced in some form (Frank, 2013; Siegel, 2006), my researcher role may have influenced interactions during collaborative activities in the group space. Also, student responses to the attitudinal survey may have been influenced by my teacher role. The size and uniqueness of participants limits the extension of my findings. Obviously, there is limited application for research on 35 students in a social studies course at a private, single-gender, religious-affiliated, middle school in Hawai'i.

Recommendations for Future Research

Flipped learning requires future research in different K-12 learning environments. My study highlighted a need for research on middle school, social studies, and singe-gender classrooms. Also, both the individual and group learning spaces need to be investigated. While instructional content should be based on multimedia learning principles, learning effects should be studied in the context of flipped learning. Connections between instructional content in the individual space and collaboration in the group space should also be made. Research could be designed to follow knowledge construction from the individual space into the group space. Future research could also investigate learning management systems and characteristics that best deliver instructional content in the individual space. In the group space, sequential analysis of collaborative activities could identify patterns of interaction that best produce knowledge construction. Overall, flipped learning as a pedagogical approach need to be investigated at different levels of education and with various student populations.

Conclusions and Summary

My study supports using flipped learning in middle school while adding to limited research on technology-based K-12 education. Findings suggest previous research on flipped learning may be applicable to middle school students. For example, flipped learning has been found beneficial for average achieving students (Chipps, 2013). Analysis of perceptions in my study indicates benefits for average achievers could be applied. Helping average achievers is especially important in middle school, where learning differences require a pedagogical approach that improves learning experiences for a majority of students (AMLE, 2010). Other findings support design features of instructional content and collaborative activities.

Research on flipped learning should be extensive and applicable. My research design provides a framework through which flipped learning can be effectively implemented and studied. Affective research often produces positive responses about the learning experience (Pursel & Fang, 2012) and encourages practitioners to implement (Bergmann & Sams, 2012). Most studies, however, lack controlled quantitative data (Jensen et al., 2015) and descriptions of activities in learning spaces – research that has proven beneficial (Bishop & Verleger, 2013). Also, because research for experimental purposes can be ineffective and misinterpret the pedagogical approach (Johnson & Renner, 2012), studies should be designed using educationally effective and age-appropriate strategies (Downes & Bishop, 2015).

As pedagogy, flipped learning utilizes technology to shift direct instruction into the individual space, allowing the group space to be dedicated to collaboration. Research has shown the importance of design on the effectiveness of flipped learning. Instructional content and collaborative activities can be designed to increase engagement and learning. The role of the practitioner is to develop effective learning spaces using appropriate strategies. In my study, multimedia learning principles and Computer-Supported Collaborative Learning techniques helped establish an effective flipped learning classroom. An effective learning environment benefits students, teachers, and educational researchers. When properly implemented and studied, approaches such as flipped learning can be applied to best support teaching and learning.

APPENDIX A. PARENT/GUARDIAN CONSENT FORM

University of Hawai'i at Mānoa

Parental/Guardian's Consent for Child to Participate in Research Project:
Flipping the Middle School Classroom

My name is Joshua Winter. I am your child's 6th grade English and Social Science teacher at St. Andrew's Priory School. I also am a doctoral student at the University of Hawai'i at Mānoa, College of Education, Department of Learning Design and Technology. One requirement for earning my Ph.D. is to conduct a research project. The purpose of my research project is to evaluate flipped learning in a middle school class. I am asking your permission for your child to participate in this project. I also will ask your child if she agrees to participate in this project.

Project Description - Activities and Time Commitment: If your child participates, they will be participating in several research activities.

There will be two online multiple-choice quizzes on content covered during the Social Science unit on Hawaiian History and one online survey on your child's opinion of the unit: one quiz at the beginning of the unit, and one quiz and the survey at the end of the unit. Quizzes will take approximately 30 minutes of class time. The survey will take approximately 10 minutes of class time. These quizzes and survey will not affect your child's course grade and will be used only for research purposes.

Your daughter will also complete an audio-recorded reflection on the unit studied in Social Science. This audio recording will consist of three questions and will take approximately 5 minutes. Audio-recorded reflections provide an informal and more genuine opinion from students. For the purposes of this study, the honesty from students on their learning experience is extremely helpful. These reflections will not affect your child's course grade and will be used only for research purposes.

I will also observe and document your child's participation in class activities. These activities are a regular part of the 6th grade Social Science curriculum and include small group collaboration. Documentation will include my field notes, student work, and audio recordings. I will use these recordings to study student language and conversation on certain assignments. These observations will not affect your child's course grade and will be used only for research purposes.

With your permission, I will use your daughter's homework, grades, class assignments, and audio recordings to document the learning process. None of the information collected will be identifiable or linked directly to your child.

The purpose of my study is to evaluate the flipped learning model. The flipped learning model is a technique I have been using in my classes at St. Andrew's Priory School for the past four years. All of my students and most parents are familiar with it. Here is an accepted definition:

> *Flipped learning is an approach to maximizing classroom time by using technology to "flip" the traditional model of teaching so that lectures are offered outside of class, and homework is done in class. With teacher-created videos and interactive lessons, instruction that used to occur in class is now accessed at home, in advance of class. Class becomes the place to work through problems, advance concepts and engage in collaborative learning.*

If you would like to see a copy of surveys and assessments, please contact me via the phone number or email address at the end of this consent form.

Benefits and Risks: I believe there are no direct benefits to your child for participating in my research project. However, the results of this project might help me, other teachers, and researchers learn more about the flipped learning model. I believe there is no risk to your child in participating in this project.

Confidentiality and Privacy: During this research project, I will keep all data in a secure location. Only my University of Hawai'i advisor and I will have access to the data, although legally authorized agencies, including the University of Hawai'i Human Studies Program, have the right to review research records. When I report the results of my research project, I will not use your child's name or any other personally identifying information. If you would like a copy of my final report, please contact me at the number listed at the end of this consent form.

Audio Recordings: All audio recordings will be analyzed for specific language, but students will not be personally identified. Audio recordings will be stored on a secure computer during this study. Some recording may be used for presentation purposes but will not be made publicly available.

Voluntary Participation: Participation in this research project is voluntary. Your child (and you) can choose freely to participate or not to participate. In addition, at any point during this project, you can withdraw your permission, and your child can stop participating. I recognize that I am the researcher in this project and, at the same time, your child's teacher. Thus, I will ensure that your child's participation or non-participation in my research project does not impact her grades, or our teacher-student relationship at St. Andrew's Priory School.

Questions: If you have any questions about this project, please contact me, Joshua Winter, via phone (808) 532-2449 or email (jwinter@priory.net). You can also contact my advisor at the University of Hawai'i, Dr. Curtis Ho, at (808) 956-7771 or via email at (curtis@hawaii.edu). If you have any questions about your rights, or the rights of your child as a research participant, you can contact the University of Hawaiʻi, Human Studies Program, by phone at (808) 956-5007 or by email at (uhirb@hawaii.edu).

Signature(s) for Consent:

I give permission for my child to participate in the research project entitled, "Flipping the Middle School Classroom." I understand that, in order to participate in this project, my child must also agree to participate. I understand that my child and/or I can change our minds about participation, at any time, by notifying the researcher of our decision to end participation in this project.

Name of Child (print): _____

Name of Parent/Guardian (print): _____

Parent/Guardian's Signature: _____

My child has permission to be audio recorded for the purposes of this project.

YES _____ (initial one) NO _____

My child's homework, grades, and class assignments can be used for the purposes of this project.

YES _____ (initial one) NO _____

Date: _____

2

APPENDIX B. STUDENT CONSENT FORM (AGES 5-11)

University of Hawai'i at Mānoa

Permission to Participate in Research Project (ages 5 to 11):
Flipping the Middle School Classroom

TEACHER: *Please print your full first name, last name, and date on the lines below.*

STUDENT: NAME _____ DATE _____

TEACHER: *Hello student. This year you have been watching videos for homework in Social Science and English class. During class, we have been working in stations or on projects. This style of teaching is called "flipped learning" and many teachers around the world are using it in their classrooms. Do you understand what I have said thus far?*

STUDENT: YES, I understand. _____ (check one) NO, I do not understand. _____

TEACHER: *As you may know, I am not just your teacher, but I am a student at the University of Hawai'i working on my Ph.D. In order to earn my degree, I must complete a research project. My research project is on "flipped learning" and I am asking you to participate in my project. Do you understand what I have said thus far?*

STUDENT: YES, I understand. _____ (check one) NO, I do not understand. _____

TEACHER: *If you want to participate, you have to complete one survey and two quizzes in class. These quizzes and survey are similar to what we normally do in our English and Social Studies classes already. The quizzes will be at the start and end of the unit and will take about 30 minutes of class time. The survey will take about 10 minutes. These quizzes and survey will not hurt or help your grade. Also, I will not use your name or anything that identifies you. Do you understand what I have said thus far?*

STUDENT: YES, I understand. _____ (check one) NO, I do not understand. _____

TEACHER: *If you want to participate, the assignments you complete and grades you earn for Social Science will also be used in this study only. I will not use your name or anything that identifies you. If you want to participate, you will be observed during this study. I will observe and take notes on activities and group collaboration in class. Some group collaboration will be audio recorded. I will use these recordings to study your language and conversation with classmates on certain assignments. These observations and recordings will not hurt or help your grade. Also, I will not use your name or anything that identifies you. Do you understand what I have said thus far?*

STUDENT: YES, I understand. _____ (check one) NO, I do not understand. _____

TEACHER: *If you want to participate, you will be asked to complete an audio-recorded reflection on the Social Science unit. Your honest opinion as a student is very helpful to teachers. These audio recordings will not be posted online or shown to the public. These audio recordings will not hurt or help your grade. Also, I will not use your name or anything that identifies you. Remember, your participation is completely voluntary and anonymous. Do you understand what I have said thus far?*

STUDENT: YES, I understand. _____ (check one) NO, I do not understand. _____

TEACHER: *Please decide whether to participate in the research project entitled, "Flipping the Middle School Classroom" below. Remember, you can change your mind about participation, at anytime.*

STUDENT: YES, I choose to participate in the research project. _____

NO, I choose not to participate in the research project. _____

APPENDIX C. STUDENT CONSENT FORM (AGES 12-17)

University of Hawai'i at Mānoa

Permission to Participate in Research Project (ages 12 to 17):
Flipping the Middle School Classroom

Hello Student,

This year you have been watching videos for homework in Social Science and English class. During class, we have been working in stations or on projects. This style of teaching is called "flipped learning" and many teachers around the world are using it in their classrooms.

As you may know, I am not just your teacher, but I am a student at the University of Hawai'i working on my Ph.D. In order to earn my degree, I must complete a research project. My research project is on "flipped learning" and I am asking you to participate in my project.

If you want to participate, you have to complete one survey and two quizzes in class. These quizzes and survey are similar to what we normally do in our English and Social Studies classes already. The quizzes will be at the start and end of the unit and will take about 30 minutes of class time. The survey will take about 10 minutes. These quizzes and survey will not hurt or help your grade. Also, I will not use your name or anything that identifies you.

If you want to participate, the assignments you complete and grades you earn for Social Science will also be used in this study only. I will not use your name or anything that identifies you.

If you want to participate, you will be observed during this study. I will observe and take notes on activities and group collaboration in class. Some group collaboration will be audio recorded. I will use these recordings to study your language and conversation with classmates on certain assignments. These observations and recordings will not hurt or help your grade. Also, I will not use your name or anything that identifies you.

If you want to participate, you will be asked to complete an audio-recorded reflection on the Social Science unit. Your honest opinion as a student is very helpful to teachers. These audio recordings will not be posted online or shown to the public. These audio recordings will not hurt or help your grade. Also, I will not use your name or anything that identifies you.

Remember, your participation is completely voluntary and anonymous.

Thank you.
Mr. Winter

I choose to participate in the research project entitled, "Flipping the Middle School Classroom." I understand I can change my mind about participation, at any time.

Name (print): _____

Signature: _____

I give permission to be audio recorded for the purposes of this is project.

YES _____ (initial one) NO _____

I give permission for my homework, grades, and class assignments to be used for the purposes of this project.

YES _____ (initial one) NO _____

Date: _____

APPENDIX D. INSTITUTIONAL REVIEW BOARD APPROVAL

Office of Research Compliance
Human Studies Program

UNIVERSITY of HAWAI'I®
MĀNOA

March 30, 2015

TO: Joshua Winter
Principal Investigator
Learning Design & Technology

FROM: Denise A. Lin-DeShetler, MPH, MA
Director

SUBJECT: CHS #22895 - "Flipping the Middle School Classroom"

This letter is your record of the Human Studies Program approval of this study as exempt.

On March 30, 2015, the University of Hawai'i (UH) Human Studies Program approved this study as exempt from federal regulations pertaining to the protection of human research participants. The authority for the exemption applicable to your study is documented in the Code of Federal Regulations at 45 CFR 46.101(b) (Category 1).

Exempt studies are subject to the ethical principles articulated in The Belmont Report, found at http://www.hawaii.edu/irb/html/manual/appendices/A/belmont.html

Exempt studies do not require regular continuing review by the Human Studies Program. However, if you propose to modify your study, you must receive approval from the Human Studies Program prior to implementing any changes. You can submit your proposed changes via email at uhirb@hawaii.edu. (The subject line should read: Exempt Study Modification.) The Human Studies Program may review the exempt status at that time and request an application for approval as non-exempt research.

In order to protect the confidentiality of research participants, we encourage you to destroy private information which can be linked to the identities of individuals as soon as it is reasonable to do so. Signed consent forms, as applicable to your study, should be maintained for at least the duration of your project.

This approval does not expire. However, please notify the Human Studies Program when your study is complete. Upon notification, we will close our files pertaining to your study.

If you have any questions relating to the protection of human research participants, please contact the Human Studies Program at 956-5007 or uhirb@hawaii.edu. We wish you success in carrying out your research project.

1960 East-West Road
Biomedical Sciences Building B104
Honolulu, Hawai'i 96822
Telephone: (808) 956-5007
Fax: (808) 956-8683

APPENDIX E. STUDENT SURVEY

Edit this form

Student Survey - Unit 04: Hawaiian History

* Required

Please rate the effectiveness of the following homework options in contributing to your learning. *

	I did not complete this homework option	Not at all effective	Slightly effective	Moderately effective	Highly effective
VIDEO presentation with one teacher narrating.					
VIDEO presentation with two teachers narrating.					
VIDEO presentation with student narration.					
Taking notes on VIDEO presentation (handwritten).					
Taking notes on VIDEO presentation (typed).					
Completing the worksheet using the ONLINE textbook.					
Completing the worksheet using the HARDCOPY textbook.					
Completing the worksheet using the AUDIO textbook.					
Reading ONLINE textbook and taking notes (handwritten).					
Reading ONLINE textbook and taking notes (typed).					
Reading HARDCOPY					

textbook and taking notes (handwritten).					
Reading HARDCOPY textbook and taking notes (typed).	○	○	○	○	○
Listening to AUDIO textbook and taking notes (handwritten).	○	○	○	○	○
Listening to AUDIO textbook and taking notes (typed).	○	○	○	○	○
Creating an AUDIO recorded reading.	○	○	○	○	○

Please rate your level of agreement with the following statements about Unit 04. *

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
Social Science is my favorite class.	○	○	○	○	○
Unit 04 was my favorite unit.	○	○	○	○	○
Unit 04 was a good learning experience.	○	○	○	○	○
I had to work hard in Unit 04.	○	○	○	○	○
I learned a lot in Unit 04.	○	○	○	○	○
I put my best effort into Unit 04.	○	○	○	○	○
The homework assignments were easy to access.	○	○	○	○	○
The homework assignments helped me learn.	○	○	○	○	○
Taking notes for homework made class more interactive.	○	○	○	○	○
The homework assignments and stations increased my interest in the unit.	○	○	○	○	○
Stations helped me to understand topics in the unit.	○	○	○	○	○
I felt motivated to					

explore content and topics in the unit.	○	○	○	○	○
I utilized a variety of resources to explore topics in the unit.	○	○	○	○	○
I worked hard to get a good grade even when I was not interested in some topics.	○	○	○	○	○

Please rate your level of frequency with the following statements about Unit 04. *

	Never	Rarely	Sometimes	Often	Always
I completed different homework options.	○	○	○	○	○
I completed the homework assignments outside of school.	○	○	○	○	○
I completed the homework assignments in school.	○	○	○	○	○
I was excited about the topics in Unit 04.	○	○	○	○	○
I participated in class discussions.	○	○	○	○	○
I worked with classmates on stations.	○	○	○	○	○
Classmate helped me with stations.	○	○	○	○	○
Mr. Winter helped me with stations.	○	○	○	○	○
I asked questions in class.	○	○	○	○	○
I felt challenged to think more about topics.	○	○	○	○	○
I felt challenged by the homework assignment.	○	○	○	○	○
I felt challenged by the stations.	○	○	○	○	○
When working on stations I understood what I had to do to complete the station.	○	○	○	○	○

The notes that I took were helpful when completing the stations in class.	○	○	○	○	○

How confident do you feel about the material AFTER completing the homework but BEFORE coming to class? *

- ○ Very confident
- ○ Confident
- ○ Somewhat confident
- ○ Not confident at all

How confident do you feel about the material AFTER completing the homework and AFTER completing stations? *

- ○ Very confident
- ○ Confident
- ○ Somewhat confident
- ○ Not confident at all

Please describe the amount of effort you put in during your time OUTSIDE CLASS. *

- ○ I tried as hard as I could
- ○ I put in a good effort
- ○ I did not really try
- ○ Little to no effort

• **Please describe the amount of effort you have been putting in during your time IN CLASS.** *

- ○ I tried as hard as I could
- ○ I put in a good effort
- ○ I did not really try
- ○ Little to no effort

In Unit 04, the notetaking was at home and the hands-on activities in class; did you like this? *

- ○ I didn't like it, I would prefer to do activities at home
- ○ I liked it, I prefer to do activities in class

What have you liked best about Unit 04: Hawaiian History?

What part of Unit 04: Hawaiian History would like to see changed the next year?

Submit

Never submit passwords through Google Forms.

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