12-20-2016

Elementary Students' And Teachers' Perceptions Of Flipped Mathematics Lessons

Susan Grace Edwards Mosher
University of New England

ELEMENTARY STUDENTS' AND TEACHERS' PERCEPTIONS OF FLIPPED MATHEMATICS LESSONS

By

Susan Grace Edwards Mosher

BA (Russell Sage College) 1993
MS (Long Island University, Southampton) 1997

A DISSERTATION

Presented to the Affiliated Faculty of

The College of Graduate and Professional Studies

at the University of New England

In Partial Fulfillment of Requirements

For the Degree of Doctor of Education

Portland & Biddeford, Maine

December 2016

Susan Grace Edwards Mosher
December 7, 2016
Educational Leadership

ELEMENTARY STUDENTS' AND TEACHERS' PERCEPTIONS OF FLIPPED MATHEMATICS LESSONS

ABSTRACT

Flipped learning is a pedagogical model that allows more time for students to engage in active learning in the classroom because direct instruction is moved to video and watched outside of class time. Although many studies have shown the effectiveness of this strategy, previous perceptional studies have primarily focused on flipped learning through the lens of high school students and adult learners. This study was designed to explore elementary students' and teachers' perceptions of flipped learning in mathematics. A descriptive qualitative case study was conducted in a suburban elementary school in North Carolina. Three fifth grade teachers and fifteen of their students were interviewed about their experiences after participating in flipped mathematics lessons. The study's conceptual framework was rooted in constructivist theory and concentrated on student engagement, twenty-first-century learners' use of technology, and the acclimatization of the Common Core State Standards for Mathematics. Insights gained from the data described how students viewed their own mathematical learning in a flipped lesson format, as well as teachers' perceptions of the implementation of the flipped format and the effects it had on their students' mathematical learning compared to a traditional format. Data analysis of teacher and student data revealed (1) a preference for the flipped format, (2) the perception that increased active learning benefited student learning, (3) an increase in student ownership of learning, and (4) that the video lectures were valuable to review math content. Students also

described an appreciation for the increased personal learning time with the teacher and more positive parental involvement during homework time. Furthermore, teachers felt the flipped format made them more flexible in their teaching. They noticed an increase in positive learning culture in their classrooms, emphasized the importance of intentional planning while using the flipped format, and noted the need for support and resources for implementing flipped learning at the elementary level. Recommendations for action included: (1) provide resources and support for elementary educators implementing flipped learning, (2) increase student-centered active learning, and (3) inform stakeholders, including parents, of the benefits of and plan to implement flipped learning before implementation begins. This research has implications for the increased use of the flipped model in mathematics at the elementary level.

University of New England

Doctor of Education
Educational Leadership

This dissertation was presented
by

Susan Grace Edwards Mosher

It was presented on
December 7, 2016
and approved by:

Steven Moskowitz, Lead Advisor
University of New England

Tarae Waddell-Terry, Secondary Advisor
University of New England

Danielle Donnini, Committee Member
Windham Raymond School District

ACKNOWLEDGEMENTS

Many people have been a part of my journey that has led to the completion of this dissertation and my graduate education.

I would like to thank the University of New England for offering this rigorous yet flexible doctoral program. Thank you to my dissertation committee, Dr. Steven Moskowitz, Dr. Tarae Waddell-Terry, and Dr. Danielle Donnini, for their advisement, support, and feedback that has proved invaluable.

I would like to especially thank two of my cohort members, Corleigh Donati and Kevin Roberts, who provided me with the grit, courage, and support to keep going during this sometimes lonely and often stressful process.

I would like to thank my school site administrators for their kind words and support over the past three years. Thanks also go to the participating teachers on the fifth grade math team who were so cooperative and graciously allowed me to work with them during such a busy time of year, when they already had so much on their plates. Thank you to the participating students who spoke with me so honestly and shared their insight.

I would like to thank my parents, Jon and Judy Edwards, who have supported me in pursuing this personal goal from the beginning and believed in my potential when I could not. Thank you for always being there for me with your love and support.

Thank you to my teenage sons, Chase and Cheyne, for believing in and encouraging their Mom. Thank you for reiterating back to me all of the homework reminders, study habit lectures, and perseverance speeches that I have given you both over the years, just when I needed them. You are both my rocks and my inspiration.

Most importantly, thank you to my loving husband, Bryan, for his support and encouragement. His patience with me through this journey deserves special recognition and possibly sainthood. There are no words that can fully describe my appreciation of all he has done over the past three years to hold together our family and my sanity. I promise to dedicate more time to you and make up for all the time you sacrificed to allow me to reach this personal goal. This has been an intellectual and emotional journey like no other, and I could not have made it without you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Over the past decade, many innovative instructional pedagogies have surfaced in an effort to effectively reach and engage twenty-first century learners. Educators are changing the traditional lecture based delivery model by infusing technology into their instruction, utilizing blended learning models, and increasing active learning opportunities in their classrooms. One popular form of blended learning, the flipped classroom, is enhancing learning experiences from the elementary level up through adult learning (Baker, 2012; Bergmann and Sams, 2012, 2016).

The purpose of this study is to explore the experiences of elementary teachers and students who have participated in flipped mathematics lessons. Research surrounding the use of flipped lessons at the elementary level is limited, signifying a demand for additional investigation. Current studies related to the use of flipped classroom methodology document the perceptions and experiences of using a flipped model in other educational settings, such as middle school, high school, and college environments. The researcher's primary interest in this study is to understand the perceptions of elementary age student learning via the flipped model. The goal is to learn how upper elementary age students make sense of their mathematical learning when content is presented in a flipped lesson format and how this structure influences their experience and engagement with the content.

The Changing Needs of Twenty-first Century Students

Elementary classrooms of today are made up of students who may have different learning needs than elementary students of the past; therefore pedagogy methods should

be analyzed and transformed in order to more actively engage twenty-first-century students (Prensky, 2010; Kivunja, 2014). Traditional learning theories (Bruner, 1966; Piaget, 1950; Vygotsky, 1978) studied in conjunction with digital learning perspectives (Prensky, 2001b, 2012; Tapscott, 2009; Kivunja, 2014) illustrate the importance of understanding how digital natives learn and of designing pedagogical practices that better align to the learning needs of the digital generation.

There is compelling research to support that twenty-first century students learn differently than students in the past (Barnes, Marateo, & Ferris, 2007; Prensky, 2001a, 2009, 2010). Long before the digital age, prominent education philosopher John Dewey said, "If we teach today's students as we taught yesterday's, we rob them of tomorrow" (Dewey, 1944, p. 167). Although Dewey was speaking about the preparation of students for the twentieth century, this quote is relevant to the preparation of students for the twenty-first century and beyond, as well. Schools will need to continue to transform with the times in order to engage students and prepare them for the jobs of the future (Prensky, 2012). Tapscott (2009) claims that schools should be "places to learn, not to teach" (p. 134), because digital resources available to students today allow them to easily find knowledge based information via the Internet, so that time can be saved for active learning in the classroom. The learning that should take place in the classrooms of today needs to go further to show students how to navigate the digital world for relevant and reliable information, and then to provide guidance in analyzing and evaluating the data retrieved (Kivunja, 2014). Prensky (2012) suggests no longer questioning whether or not to use technology in education, but to shift the focus to how to use the technologies of the day to create more digitally wise students.

Introduction to the Flipped Model

Blended learning is a term that refers to the blending of Internet technology with face-to-face learning (Garrison and Kanuka, 2004). It is a method of educational content delivery that is provided in varying ways via online or digital media with some control of time, place, and pace given to the student. The "flipped classroom model" is a form of blended learning that is becoming increasingly popular in higher education right now (Bergmann and Sams, 2012). In order to increase active learning, this method utilizes technology to flip or invert direct instruction lessons that are customarily done in the classroom with what would be done as homework. Pioneered by high school teachers Jonathan Bergman and Aaron Sams (2012), the flipped classroom is a model of instruction that has been a buzzword in education for the past decade. Flipped learning allows teachers to utilize deeper learning strategies in their classrooms that incorporate content-rich, inquiry-based, active learning pedagogical practices (Bergmann and Sams, 2016). Benefits of utilizing the flipped model include putting learning at the center of the classroom by changing the role of the teacher, allowing for customization and differentiation in the classroom, and making teacher-led demonstrations and classroom projects more engaging (Bergmann and Sams, 2012). With its popularity, the flipped model has been utilized by many educators, and as a result, morphed into varied styles and unique formats. In order to avoid misconceptions concerning flipped learning, the governing board and leaders of the Flipped Learning Network (2014) released a formal definition and a checklist of indicators (see appendix A) for educators to follow while implementing a "flip" to help create clarity and consistency about the model.

Central to the concept of flipped learning is a model in which students are actively engaged in their learning. Constructivist learning theory postulates that students are more engaged in their own learning when they can construct knowledge and meaning from their experiences. The work of Lev Vygotsky (1978) is particularly interesting when looked at in conjunction with a flipped model of learning. Vygotsky's Zone of Proximal Development emphasized the gap between what individuals can learn on their own juxtaposed to what they can learn with support given by a more capable individual. This theory, coupled with more contemporary digital learning perspectives of Marc Prensky (2010) and Don Tapscott (2009), who emphasize a paradigm shift away from traditional "Industrial Age" models of education, support the use of a flipped model in education today.

The urgency to shift from a teacher-centered instructional model to a student-centered instructional model is not only a result of the incipient learning needs of digital natives. Active learning is a term used for instruction that focuses on student activity and engagement (Prince, 2004). Learners learn by doing. Active learning is a framework of constructivism. As a result of the incorporation of active learning methods, students are engaged in higher-order thinking skills such as analysis, synthesis, and evaluation (Bonwell and Eison, 1991). Research has already established the benefits of modifying traditional lecture delivery to enhance learning (Penner, 1984; Ruhl, Hughes, and Schloss, 1987). Employing the flipped learning model is a contemporary modification of the traditional lecture that provides classroom time for teacher-led, student-centered, active learning environments.

The Flipped Model and Active Learning for Elementary Common Core Math

The Common Core State Standards (2010) for Mathematics define what students should be able to do and understand, mathematically, both conceptually and procedurally. They are made up of a clear set of math skills, including conceptual understanding, procedural fluency, and application in real life situations. The key shifts in the curriculum of the Common Core for Mathematics call for greater focus on fewer topics, a coherent body of knowledge that progresses from grade to grade, and an increased level of rigor. They build on previously existing standards, but emphasize the skills needed to prepare students to be college and career ready. These standards have shifted the way elementary mathematics are taught from a focus on computation to a focus on problem solving. Contemporary elementary mathematics classrooms should incorporate and balance the use of digital technology and active learning styles in order to engage students (Roberts, 2005). Flipped classroom models efficiently provide students with access to instructional technology and active learning environments, and have been proven successful in higher education (Bates and Galloway, 2012; Enfield, 2013). In a study of secondary mathematics students using a flipped model of instruction, Clark (2013) found that students responded favorably to the model and noted that their engagement in and communication of the mathematical content had increased. Research by Moore, Gillett, and Steele (2014) suggests that using the flipped model for teaching mathematics can improve students' mathematical knowledge while providing time for high cognitive task engagement required of the Common Core Standards for Mathematical Practice (2010).

Elementary level student-centered classrooms that engage students in active learning can provide students with opportunities to engage in conceptual understanding

of content, especially mathematical practices emphasized by the Common Core State Standards (2010). Providing digital natives in elementary school settings with active learning opportunities such as flipped lessons will help support their learning of conceptual mathematical practices. Likewise, the use of active learning strategies, such as flipped lessons, support and engage the digital natives in the classroom.

Statement of the Problem

With the adoption of the Common Core State Standards (2010), North Carolina elementary students are required to use higher level thinking skills during mathematics instruction. In order to understand conceptual mathematical models and answer multi-step assessment questions, students require more time to practice problem solving in student-centered classrooms. Traditional classroom models of lecture, note-taking, and practice for homework may no longer be meeting the needs of twenty-first century learners. According to Prensky (2012) and Roberts (2005), twenty-first century learners are more likely to build their own knowledge and ideas through the use of technology and active learning environments. New instructional practices, such as flipped lessons, are being utilized across the nation in efforts to meet the learning needs of these learners (Project Tomorrow, 2014).

Currently, there is insufficient research on the use of flipped classrooms at the elementary level. This research is exploratory in nature, and is designed to look at elementary teachers' and students' perceptions of flipped mathematics lessons. This study will examine students' perceived impact of flipped math lessons on their own learning and engagement, as well as the teacher's perceptions of students' learning and engagement. The information gained from this study could help educators make

instructional decisions regarding student engagement while using a flipped model. Furthermore, if students perceive an instructional benefit to the use of flipped lessons, it could impact the future implementation of the use of the flipped model at the elementary level.

Purpose of the Study

The purpose of this research is to describe (a) elementary students' experiences of flipped mathematics lessons, (b) elementary students' perceptions of their own learning through flipped model lessons, (c) the teacher's perceptions of student learning via flipped lessons and its impact on student learning, and (d) the teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format. A descriptive case study at a public elementary school in Cary, North Carolina will analyze fifth grade students and their teacher's perceptions of flipped model lessons with active learning.

Despite the growing popularity of the use of flipped lessons at the elementary level, research surrounding the use of flipped lessons at the elementary level is limited, suggesting the need for further empirical study of the perceptions of elementary-aged student learning via the flipped model. Current studies related to the use of flipped classroom methodology document the perceptions and experiences of using a flipped model in other educational settings, such as middle school, high school, and college environments and will be further discussed in chapter two.

Using a case study methodology, this study will explore elementary students' perceptions of the use of a flipped model in a math class, as well as the teacher's experience and perceptions of student learning. The findings of this study could create

significant changes in pedagogical practices at the elementary level. Insights acquired through this research could prove useful in the development of flipped programs and student-centered mathematics classrooms.

Research Questions

Directing the study are the following four research questions, designed to explore and describe student learning through flipped model lessons in one elementary school in Cary, North Carolina.

- What are elementary students' experiences of flipped math lessons?
- What are elementary students' perceptions of the impact of flipped lessons on their own learning?
- What are elementary teachers' perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement?
- What are elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format?

Conceptual Framework

The flipped classroom model is a form of blended learning that is becoming increasingly popular in higher education right now. In order to increase active learning, this method utilizes technology to flip or invert direct instruction lessons that are customarily done in the classroom with what would be done as homework.

Constructivist learning theory (Bruner, 1966) posits that a student's role in learning is to integrate the content presented by the teacher. This study will emphasize the importance of social constructivist theory (Vygotsky, 1978), which states that

students are more engaged when working together with other learners and the teacher in creating (constructing) new meanings of instructional content.

The interest in flipped learning applied in an elementary classroom was propelled by the researcher's personal experience of transitioning an elementary curriculum to the Common Core State standards. The researcher witnessed teachers struggling with new strategies that focused more on the conceptual *why* of mathematical problem solving, over the previous focus on the step by step *how* style of instruction. Related to this concern for educators was finding the time to explore the standards for mathematical practices, which place an importance on processes and proficiencies in mathematics. Parents of elementary students also found the transition to the Common Core standards to be difficult. While working on homework with their children, parents found the new models and flexibility in problem solving strategies for teaching mathematics to be confusing because they are so different from the way they learned as students. The researcher observed that flipped lessons provide the time needed for conceptual understanding through active learning in the classroom, and the videos sent home help to demystify the new approach for parents. Students benefit by learning the conceptual *why* of mathematical concepts and procedures, develop problem solving skills that can be applied to future situations, and practice applying mathematical ways of thinking to real-world challenges (CCSS, 2010). When applying a flipped model to mathematical instruction at the elementary level, how do students perceive their own learning? A graphic representation of the conceptual framework is illustrated in figure 1.

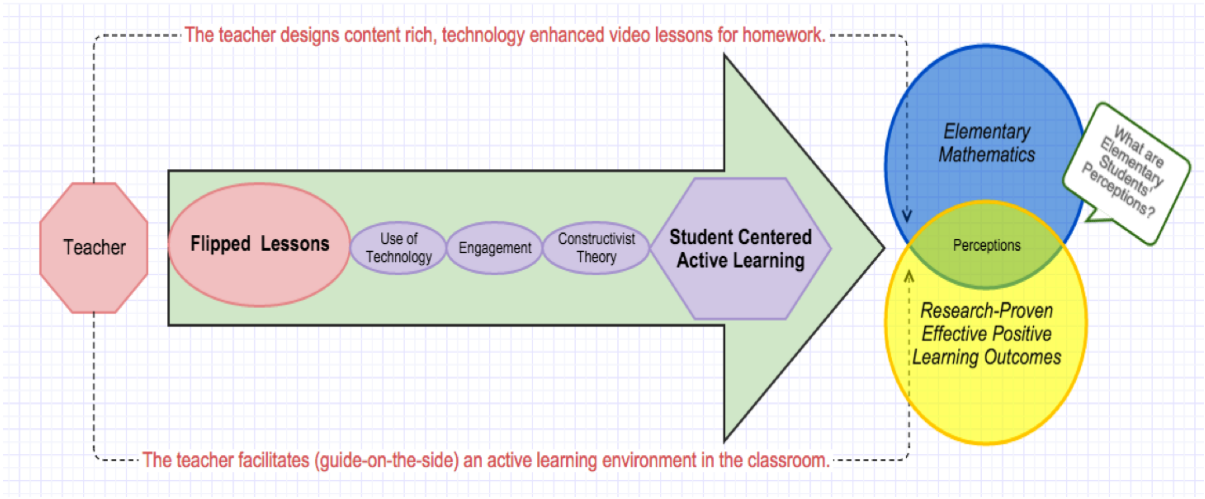

Figure 1. Conceptual Framework

The existing body of research focuses primarily on the study of flipped models on higher education, with minimal studies specifically outlining the application of flipped learning at the elementary level (Bates and Galloway, 2012; Enfield, 2013; Gannod, Burge, and Helmick, 2008; Garrison and Kanuka, 2004; Jaster, 2013; McLaughlin, et al., 2014). To expand the research of flipped learning at the elementary level to date, framed through a constructivist lens, this research seeks to explore and describe elementary teachers' and students' perceptions of learning through flipped lessons. Using a case study methodology, this study will explore elementary teachers' and students' perceptions of the use of a flipped model in a math class through qualitative interviews and observations.

Assumptions, Limitations, Scope of Study

Assumptions of this study include the universal delivery and reception of a flipped classroom model by the individual teachers involved. Despite efforts to provide professional development on flipped classroom methods to create consistency, there is

always the possibility that the individual delivery of the method may vary from teacher to teacher.

This study is limited to one suburban elementary building in North Carolina that may not be representative of other urban or rural areas. The school's socioeconomic profile, as well as the diverse ethnic population of this location may create unique qualifications for other study comparisons. While this research is not intended to be generalized to all flipped classrooms, the value and insights collected from this study will contribute to the body of research on the topic.

Due to the case study methodology including students aged nine to twelve years of age, another possible limitation includes the qualitative responses of the participants involved. Qualitative results will be limited to those students with parental permission to participate, and interview answers will be limited to the honesty and willingness of each participant to share.

The researcher also acknowledges the potential for bias when researching one's own organization and has been mindful to the need to be attentive, intelligent, reasonable, and responsible (Coghlan and Brannick, 2014) throughout this research project. In order to circumvent bias, the researcher has exercised interaction with Merriam's (2009, p. 212) list of questions, "Challenging the trustworthiness of qualitative research." Specific limitations and how these issues will be addressed will be explained in the methodology chapter.

Significance of the Study

This research will provide insightful contributions to the body of educators utilizing the flipped model at the elementary level. The findings of this study could

provide important pedagogical direction for teachers planning to implement this method in an elementary mathematics setting. Furthermore, the findings of this study could provide twenty-first century learners with instruction that better meets their needs.

Definition of Terms

The following definitions are specified for clarity, as they relate to this study.

Blended Learning. The blending of Internet technology with face-to-face learning (Garrison and Kanuka, 2004.)

Flipped learning: According to the governing board of the Flipped Learning Network (2014), flipped learning is defined as "a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter." The four pillars of FLIP and the FLN's definition of flipped learning are the foundational beliefs held by the researcher for this study.

Active Learning: Learning that takes place through experiences that engage the learner in inquiry is sometimes collaborative and puts the responsibility of learning on the learner (Prince, 2004). The learners learn by doing.

Digital Wisdom: Marc Prensky defines digital wisdom as "a twofold concept, referring both to wisdom arising from the use of technology to access cognitive power beyond our innate capacity and to wisdom in the prudent use of technology to enhance our capabilities" (Prensky, 2012, p. 202). This includes the skills and experiences using digital technology that educators must provide for students.

Student-Centered Learning: In student-centered learning, the teacher is a facilitator of learning, rather than the sole presenter of content. Students are engaged in active learning.

Student Perceptions: Student perceptions are a combination of students' descriptions, observations, and interpretations of their environment.

Student Engagement: Although it is a universally desired trait for students to have in an educational setting, defining student engagement as an indicator of instructional success is difficult due to the complexity of the topic. For the purpose of this study, student engagement will refer to a "student's willingness, desire, and compulsion to participate in, and be successful in, the learning process promoting higher level thinking for enduring understanding" (Bomia, Beluzo, Demeester, Elander, Johnson, and Sheldon, 1997, p. 294). The definition of engagement could extend to the level of student motivation for learning as well.

Conclusion

The purpose of this qualitative, descriptive case study is to explore and describe elementary students' perceptions of their own learning through flipped mathematics lessons, as well as to describe elementary teachers' perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement, and to describe elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format. The flipped classroom model is still a relatively new model of blended learning, but its popularity is sweeping the nation and the globe (Mok, 2014). Flipped lessons allow more instructional time for active learning by providing more direct, content-rich, lecture-style lessons in video

format as homework (FLN, 2014; Bergmann and Sams, 2016). Active learning is based on constructivist learning theory that focuses on the learner as the learner actively engages in activities that promote higher level thinking skills (Prince, 2004). The demand for increased active learning opportunities with the Common Core State Standards for Mathematics makes flipped lessons a good fit as an instructional style. While previous research has proven the effectiveness of the flipped model in higher education, this study seeks to describe and provide understanding about the perceptions of elementary math teachers and elementary math students in regard to student learning after experiencing flipped lessons.

Understanding student perceptions of learning via the flipped model will provide insight to the growing depository of knowledge regarding the use of this method, especially at the elementary level. The following chapter will walk the reader through the relevant research concerning this study, including digital wisdom, student-centered learning, and the flipped classroom model, to provide a background for understanding the topic and outline the deficient areas of research.

CHAPTER 2

REVIEW OF THE LITERATURE

The Common Core State Standards (CCSS) demand that elementary age students be exposed to the conceptual foundations of math practices through collaborative problem solving and active learning (NGACBP, 2010). Elementary teachers can find themselves frustrated with the time it takes to define and demonstrate the various methods of problem solving, while they are left with very little classroom time to focus on active learning and exploration of the concepts with collaborative groups. Likewise, parents complain of "different" methods of solving math problems than what they are accustomed to from their own schooling. They are unable to help their children at home with homework due to not understanding the conceptual models, because they are so different from the algorithmic solutions they learned. While students will eventually learn the algorithmic solutions, CCSS requires that conceptual understanding be foundational for more purposeful active learning to take place.

In a traditional classroom, classroom time is used for lecture and information delivery, while homework time is used for application or practice of the new content presented in class. The flipped classroom is a type of blended learning that engages digital youth through active learning practices during classroom time. In a flipped classroom model, technology is utilized to leverage learning time in the classroom. Conceptual methods are presented in video format for homework, leaving more time for active learning in the classroom (Bergmann and Sams, 2012).

This literature review will define the major conceptual ideas surrounding this study of elementary math teachers' and students' perceptions of a flipped classroom. The

following topics will be discussed: digital wisdom, student-centered/active learning, the associated rigor of the Common Core math standards, and flipped learning (definition, tools, and research). Digital wisdom will be defined and outlined as a framework for the use of blended learning in the elementary classroom in the twenty-first century. Theoretically, student-centered learning, part of constructivist learning theory, will be delineated as a core principal of flipped learning. A history of flipped learning, including its definition and associated digital tools, and a review of the related literature will also be examined. The literature will lead to a case for an exploratory study that will enhance the body of literature for educators and for further research.

Digital Wisdom

The onset of digital technology in the past 25 years produced a new category of students, encompassing children from kindergarten to college. Prensky (2001b) coined the term *digital natives* to describe this group, as they represented the first generations to grow up not knowing a world without digital technology such as computers, the Internet, and video games. Those who came before the digital generations, but were traversing through a world surrounded by technology, were termed *digital immigrants* (Prensky, 2001b).

Digital natives have different thinking patterns, learning processes, experiences, and perspectives than digital immigrants (Phillips and Trainor, 2014). Digital natives thrive in busy, collaborative environments where multitasking and instant gratification are the norm (Prensky, 2001a; Phillips and Trainor, 2014). Meanwhile, digital immigrants could be easy to spot as the ones who print their emails and still rely on step-by-step manuals for products that are set up for intuitive understanding. The differences

manifest more clearly with a classroom full of digital natives whose teacher is a digital immigrant. They often do not speak the same language, which inhibits engagement (Prensky, 2001a).

Prensky (2009, 2012) contrasts his previous distinction of digital native and digital immigrant with a concept more relevant to the past decade: digital wisdom. Digital wisdom signifies the wisdom gained from the use of digital technology for gaining instant and abundant data. The digitally wise are able to navigate the technology effectively. "How and how much [people] make use of these resources, how [people] filter through them to find what they need, and how technology aids them will certainly play an important role in determining the wisdom of their decisions and judgments" (Prensky, 2009, para. 2). Whether a person is a digital immigrant or a digital native, their digital wisdom comes from their ability to combine their natural intelligence with digital enhancements in order to access data, analyze, plan, prioritize, gain insight to others, and seek alternate perspectives (Prensky, 2009).

Just as we have taught and modeled for students how to use a dictionary or how to address a postcard, we need to teach them how to not only safely, but also prudently, navigate the digital world using digital enhancements. Despite Prensky's (2001a) assertion that digital natives instinctively maneuver through technology with ease, digital wisdom and citizenship comes with modeling and practice (Alberta Ministry of Education, 2013).

Juxtaposed to the advocates of digital enhancements are those who worry that by using calculators, people will lose the ability to perform mental math. Unfortunately, this mentality and other barriers often impede implementation of digital technology in schools

(Balanskat, Blamire, and Kefala, 2006; Ertmer, 1999). Peck, Cuban, and Kirkpatrick (2002) describe similar difficulties with technology integration but specifically categorize them as "inside of school" barriers and "outside of school" barriers. The most commonly cited reasons for lack of technology integration in schools are teachers' lack of self-efficacy, commitment, and general unwillingness to change (Keengwe, Onchwari, and Wachira, 2008; Ertmer, 1999; and Becker, 2007.)

While the literature is filled with evidence of barriers to the implementation of instructional technology, technology does still need to be integrated into education in order to model and grow digital wisdom. Overall, the successful integration of technology relies on the application of informed pedagogy, or knowing how students learn (Barnes, Marateo, and Ferris, 2007; Kivunja, 2014). Instruction should not be technology-centered, but student-centered.

Constructivist Theory

Constructivist theory is based on the principle that learning is an active process (King, 1993; Mayer, 2004). Students build their knowledge through inquiry by interacting with the world around them and making sense of what is experienced (Strayer, 2012). More in-depth information on constructivism is discussed in the following section, student-centered learning.

Student-Centered Learning

The emergence of instructional technology in elementary school education is not the only change in educational practice over the past few decades. There has been a major pedagogical shift toward student-centered learning. Student-centered learning is grounded in constructivist theory (King, 1993). One popular description of the student-

centered learning shift was the title of a 1993 article by Alison King: "Going from sage on the stage to guide on the side." The "sage on the stage" is the traditional teacher-centered approach to instruction, where the teacher stands and delivers content, and the student's role is to absorb the knowledge. Student-centered learning puts the teacher (guide) on the side, as a coach who facilitates the students' learning. Rather than being the center of knowledge, the teacher is actively involved in the students' learning. In a teacher-centered classroom the student is a passive participant, but in a student-centered classroom the student is active, using higher level thinking skills (Turner, 2011). Moalosi (2013) discusses a comparison of a social constructivist (student-centered) instructional approach versus a direct instruction (teacher-centered) approach and concludes that social constructivism is more effective in the learner's cognitive development than direct instruction.

Driven by student interest, real-world application, and hands-on learning, student-centered learning allows for students to be active in their own learning. Students develop knowledge and skills through experience and practice (Turner, 2011). The teacher facilitates these learning processes by developing activities for students to complete that activate the student's prior knowledge and allow the student to build on that knowledge through problem solving and inquiry (Marzano and Toth, 2014). Research on student-centered learning reveals that by increasing the amount of authentic learning opportunities in the classroom, students will feel more confident in their learning and are more engaged (Protheroe, Shellard, and Turner, 2004; Turner, 2011; Enfield, 2013).

The basics of student-centered learning are not new. Historic philosopher John Dewey (1859–1952) described the benefits of learning environments that include real-

world problem solving. Problem solving is an active learning process, which is a significant characteristic of student-centered learning. Psychologist Lev Vygotsky (1896–1934) believed that social interaction and communication were fundamental in the cognitive process (Vygotsky, 1978). Student-centered learning promotes collaboration and cooperation among students in the classroom (Turner, 2011), which emulates Vygotsky's theory. Jean Piaget (1896–1980) developed a theory based on the assimilation of new knowledge constructed from the organization of prior knowledge (Wadsworth, 2004). Likewise, student-centered learning environments provide a framework for students to solve complex problems and think critically about new content (Hannafin and Land, 1997).

In contrast to student-centered learning, there are many studies that support direct and guided instruction. Mayer (2004) investigates three studies dating back to the 1960s, and in each case guided instruction was proven more effective than pure discovery methods (student-centered, active learning models). Krischner, Sweller, and Clark (2006) define direct instruction as, "providing information that fully explains the concepts and procedures that students are required to learn as well as learning strategy support that is compatible with human cognitive architecture" (p 75). This type of instruction is what King (1993) referred to as the sage on the stage, because the teacher is directing and delivering all of the knowledge to passive recipients, the students.

Empirical evidence from two controlled experiments (Moreno, 2004) supported direct instruction. Moreno (2004) established that direct instruction by explanation led to deeper learning than using corrective feedback following discovery learning. The argument for direct instruction is understandable when learning foundational reading and

math skills in elementary school. In higher education, direct instruction is in the form of lecture, where large passive learning groups of students are provided with content from the instructor.

Therefore, since research supports both sides of the argument, one is compelled to question which type of instruction is best. A combination of both approaches would be ideal (Hawks, 2014). For example, the instructor could start out with direct instruction to explain foundational concepts, and then move into a student-centered approach, where students take a more active role in their learning.

With the implementation of the Common Core State Standards (2010), math teachers are urged to move away from covering the content "a mile-wide and an inch deep." Instead, teachers are challenged to focus on deeper learning, teaching the content standards while emphasizing eight core mathematical practices (see table 1). With a combination of direct instruction and time for deeper active learning, students would be

Table 1.
Common Core Math Practice Standards

The Common Core Math Practice Standards
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make sense of structure.
8. Look for and express regularity in repeated reasoning.

Note. The Common Core Math Practice Standards support rigor and depth in teaching the mathematics content standards. (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010)

able to acquire both the rigorous content from lecture and participate in activities that focus on the mathematical practice standards.

Hawks (2014) suggested a flipped classroom as a method of instruction that would provide time for both explanatory direct instruction as well as student-centered active learning. The flipped (synonymous with inverted) classroom is a type of blended learning where passive learning is done outside the classroom, and time inside the classroom is saved for active learning (Hawks, 2014).

Flipped Learning

One way to describe a flipped classroom model is "moving from an instructor-centered learning environment to a student-centered learning environment" (Honeycutt and Garrett, 2013, p. 7). Another description of a flipped (inverted) class is from Lage, Platt, and Treglia (2000): "Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and visa-versa"
(p. 32).

The term "flipped classroom" gained popularity in 2007, when two Colorado high school chemistry teachers developed the concept as a solution to the problem of athletes who often missed class content due to athletic events (Bergmann and Sams, 2012). Realizing that the athletes were able to successfully access and learn the lectured-based content via online video during afterschool hours, Bergmann and Sams (2012) got the idea to use the model for all students to free up class time to do more student-centered activities. When the teachers used voice-over slide presentations and screen-capture tools to record their lectures, and provided reading assignments for preview ahead of time;

class time was then available for reviewing misconceptions of the material and providing real-life examples of the content for deeper study. This flipped, or inverted, model of teaching gained global popularity, mostly in higher education, and spread to various other content subjects (Garrison and Kanuka, 2004; Lowell, Bishop, and Verleger, 2013). Bergmann and Sams (2013) have designated their flipped model as the "Flipped Mastery Model."

Despite the proliferation and popularity of flipped learning, little empirical research exists on the subject (Baker, 2012; Bergmann and Sams, 2012; Fulton, 2012; Herreid and Schiller, 2013; Staker and Horn, 2012; Tucker, 2012). The research that does exist is focused on high school and college education (Bates and Galloway, 2012; Enfield, 2013; Gannod, Burge, and Helmick, 2008; Garrison and Kanuka, 2004; Jaster, 2013; McLaughlin, et al., 2014; Butt, 2014). There is also a heavy presence of information about flipped learning found through non-empirical sources, such as online blogs, magazine articles, and private and business websites.

Defining Flipped Learning

Part of the problem with finding dependable research is due to the confusion of terms associated with flipped learning, as well as a lack of explicit definitions for the instructional practices that take place both inside the classroom and out. The practice of supporting student learning through the use of digital technology is referred to in the literature as blended, inverted, flipped, hybrid, and various other terminologies (Staker and Horn, 2012; Margulieux, McCracken, Bujak, and Majerich, 2014; and Chen, Wang, Kinshuk, and Chen, 2014). Multiple terms that are used inconsistently are problematic for research purposes. First of all, the search terms could lead to fallible results, and second,

unless the exact design and procedure of the study are spelled out, the replication of an experiment is impossible. This frustration has been addressed in recent literature attempting to define the terms and create a universal language of the models (Staker and Horn, 2012; Margulieux, McCracken, Bujak, and Majerich, 2014; Hamdan, McKnight, McKnight, and Arfstrom, 2013; and Chen, Wang, Kinshuk, and Chen, 2014).

According to Staker and Horn (2012), the flipped learning model falls under an umbrella of blended learning. In their white paper, "Classifying K-12 Blended Learning," Staker and Horn (2012) define six models of blended learning and create a taxonomy of language to differentiate the emerging models. A schema to classify the spectrum of instruction that ranges from fully traditional "brick-and-mortar" instruction to "full-time online" learning is illustrated in figure 2 (Staker and Horn, 2012). Four different operational models of blended learning are designated as the rotation model, flex model, self-blend model, and the enriched-virtual model. The rotation model primarily takes place at a brick-and-mortar school, and students rotate through different centers. According to Staker and Horn (2012), the flipped classroom is under the classification of a rotational model, where the students rotate on a fixed schedule between online delivery of introductory content at home and face-to-face instruction at school.

Other researchers have also attempted to differentiate the blended learning models. Margulieux, McCracken, Bujak, and Majerich (2014) identified two dimensions to use for categorization. How the content is delivered is one dimension, and the other dimension is the type of instruction. Within the taxonomy, the content delivery ranges from "delivery via instructor" to "delivery via technology." Likewise, the type of instruction ranges from "information transmission" (teacher-centered) to "praxis"

(student-centered). Margulieux et al. (2014) then presents "The Learning Experiences Taxonomy," which places within the taxonomy examples of combined learning experiences according to the delivery method and type of instruction. Margulieux et al. (2014) states that a flipped classroom is synonymous with an inverted classroom and that

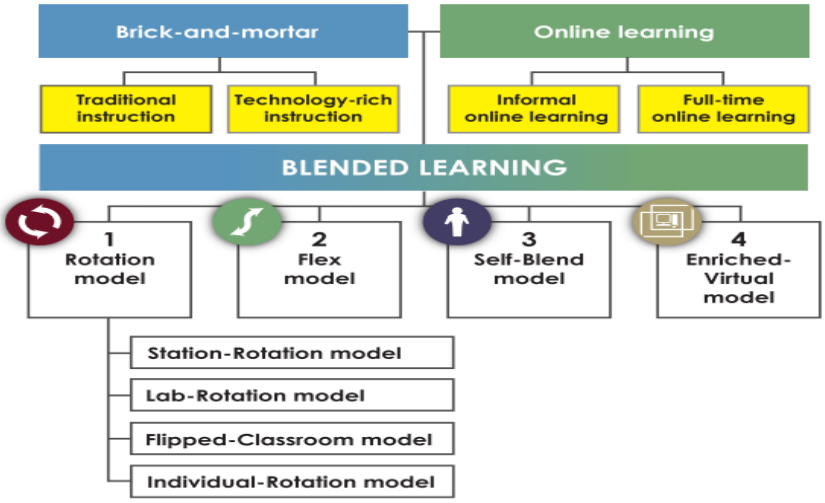

Figure 2. Staker and Horn's 2012 Blended Learning Model: The flipped classroom model, as it fits into blended learning and other instructional models (Staker and Horn, 2012).

both are types of blended learning.

Hamdan, McKnight, McKnight, and Arfstrom (2013) reviewed the basics of the flipped classroom and defined unifying themes. The themes were described in an acronym from the word FLIP: Flexible environment, Learning culture, Intentional content, and Professional educator. The "F," flexible environment, means students have flexibility in when and where they learn. Learning culture, "L," refers to the shift in instructional model from teacher-centered to student-centered. Intentional content, "I," represents the purposeful use of time that is gained in the classroom with the flip. The instructor, with careful planning, incorporates active learning strategies, such as problem-based learning and peer collaboration, into the in-class time. Finally, the "P," for

professional educators, stipulates that even though video-lectures are used, the flipped classroom is not a replacement for having real teachers in place. Hamdan, McKnight, McKnight, and Arfstrom (2013) accentuate that the planning and pedagogical knowledge necessary to maximize the active learning in the flipped classroom require an even more skilled professional educator than that of a traditional classroom.

Deficiencies of the "FLIP" acronym (Hamdan, McKnight, McKnight, and Arfstrom, 2013) were delineated in an article by Chen, Wang, Kinshuk, and Chen (2014) titled, "Is the FLIP enough? Or should we use the FLIPPED model instead?" The purpose of the research done by Chen et al. (2014) was to create a "more robust" model for flipped learning in higher education. The researchers cited Staker and Horn's (2012) classification model of blended learning and proposed an extension of the acronym to include an additional three letters to FLIP, making it FLIPPED, to better align with the needs of higher education. The additional letters stand for: Progressive networking activities, Engaging and effective learning experiences, and Diversified and seamless learning platforms.

The altered instructional "FLIPPED" model was tested by Chen et al. (2014) through a mixed methods study involving 32 college students from Taiwan who experienced a semester-long flipped course. The results, based on survey and interview analysis, indicated that the model was successful with college-age students. A challenge noted in this study was that students who failed to watch the content videos prior to class substantially fell behind. Recommendations included some sort of incentive or motivation factor to encourage students to participate in the out-of-class work. In another study, similar recommendations concerning incentives were made (Frydenburg, 2012).

To motivate students to participate in the out-of-class work, Frydenberg (2012) recommended counting quizzes toward the final grade.

Similar to the work mentioned in Hamdan, McKnight, McKnight, and Arfstrom (2013), further clarity and definitions come from an online resource called The Flipped Learning Network (FLN) (2014). In 2014, in an attempt to clear up common misconceptions about flipped learning, the governing board of FLN (including Jon Bergmann, one of the "founding teachers" for flipped learning) created a formal definition of the term, defining "the Four Pillars of F-L-I-P™," and a checklist of eleven indicators that educators must incorporate into their practice for it to be considered "flipped learning." Further references to flipped learning in this study refer specifically to the definitions defined by FLN, outlined in appendix A.

Tools for Flipped Learning

Teachers who flip their classrooms have a significant amount of planning and preparation to do for both the home and the classroom aspects of the model. In planning the lessons, Bergmann and Sams (2014) recommended focusing on Bloom's Revised Taxonomy (Bloom, 1956; Anderson and Krathwohl, 2001), and keeping the lower-order tasks, to be watched at home, in the videos and the higher order tasks in class, where the teacher will be there to coach and guide the students through them.

Video recordings should be appropriate lengths to hold the students' attention. Bergmann and Sams (2013, 2016) recommended one to one-and-one-half minutes per grade level, so a fifth grader's video would be five to eight minutes long. There is an ever-growing selection of products and tools that can be used to record lecture video and other digital content for out-of-class assignments. Screen-casting tools include

Screencast-o-matic, Jing, Educreations, Snagit, Camtasia, and various others. To make the videos interactive, teachers can integrate a Google form or use a specialized program, like Educanon, to pause and ask questions during the video.

While teachers should focus on the active learning lessons they will use during class, using or creating a quality homework video is important as well (Bergmann and Sams, 2012). Video lectures do not always need to be created by the teacher. There are collections of educational videos available online in which teachers can access, for example, Khan Academy and TED-Ed.

Flipped Learning Research: Higher Education

Prior research devoted to blended learning or flipped classroom models mainly exists with higher education populations (Milman, 2012). Garrison and Kanuka's (2004) paper concluded that blended learning has great possibilities to improve the effectiveness and efficiency of higher education.

Through the use of pre- and post-course surveys, McLaughlin et al. (2014) reported that students at the University of North Carolina Eshelman School of Pharmacy had a preference for the flipped model in future course work. Butt (2014) described results of positive feedback of college students' perceptions about a flipped actuarial course in Australia. Similarly, a flipped model of instruction studied at the California State University in Northridge resulted in survey reports from students stating that the course was effective in helping them learn the content, increased self-efficacy in their ability to learn independently, and provided an engaging learning experience (Enfield, 2013.) Both instructors and students reported a preference for the inverted class structure in a study of microeconomics students (Lage, Platt, and Treglia, 2000). Alternatively, a

flipped college introductory statistics class that was studied under the flipped model did not have positive results due to students feeling the class structure was too fragmented (Strayer, 2012). Strayer's (2012) research suggested that flipped models should not be used in introductory college classes where students might not yet have a vested interest in the course work.

Results from a study by Day and Foley (2006) indicated that an inverted-style course had positive effects on achievement. The study was conducted in a college-level computer interaction course taught with both a study and a control group. The students who participated in the inverted class scored significantly higher on course assessments than those in the control group.

Flipped Learning Research: K-12

"Speak Up," facilitated by Project Tomorrow (2014), is an annual national online survey given to K-12 students, parents, teachers, administrators, and community members. For the past two years, there have been questions about flipped learning on the survey. On the 2013 survey, nearly three-quarters of more than 180,000 middle and high school students responded that flipped learning would be a good way for them to learn. When comparing the two years of data, the results illustrated that student use of video to support learning in grades six through twelve has increased (Project Tomorrow, 2014). The graph in figure 3 illustrates the growth. This suggests a rise in flipped learning practices in the middle school grade range.

Peer-reviewed research on flipped classrooms with elementary age students is insufficient to date. Formal research on the topic was scarce, but incleded a dissertation on blended learning and student engagement in K-5 schools (Prouty, 2014). Prouty used a

mixed methods case study to find out if tablet usage in K-5 classrooms increased student engagement. Although in this study the usage of tablets was categorized as blended learning, it is not definitive of a flipped classroom. Data was collected from participating teachers, and student observations were made. Results of the study showed a positive response from participating teachers.

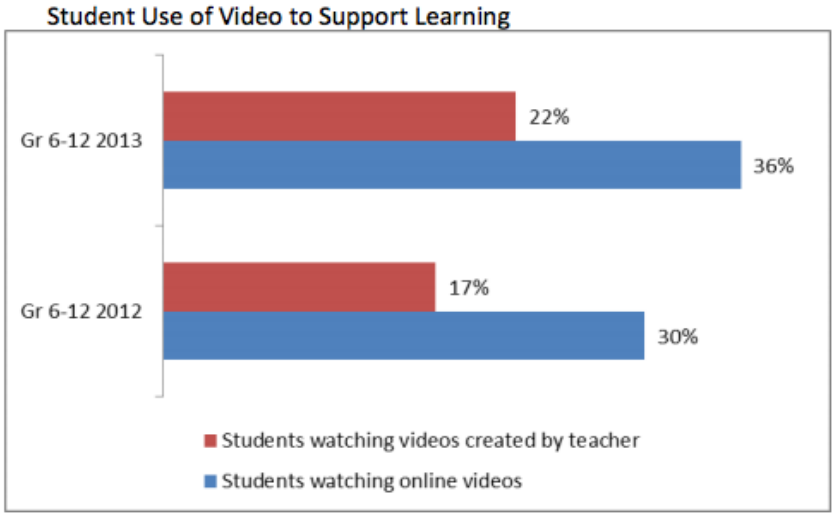

Figure 3. Student use of video to support learning (Project Tomorrow, 2014)

Informal data was found on a school district (Stillwater, 2012) webpage reporting on a pilot fifth grade elementary math flipped classroom program in Stillwater, Minnesota. The pilot, called "Flipped Math Classroom," was started in 2011 with six fifth-grade teachers from five different elementary schools. During the yearlong pilot stage, participating students, teachers, and parents took survey assessments in order for the school to gather data to use to guide decisions on whether or not to continue using the flipped model. Student standardized test data was also factored in to the decision. Prior to the pilot, the six teachers participated in a four-day training program where they learned how to create videos and other online assignments, as well as how to design meaningful

active learning environments in the classroom. When the pilot was over, survey analysis showed an overall positive response from students. Standardized test results, when compared with six control classrooms in September and January, showed no statistical difference, although the flipped classrooms covered more curricula in the same amount of time than the control groups. The teachers who participated decided to continue flipping their classes, and the program expanded to include twenty-five fourth, fifth, and sixth grade classrooms. Parents reported that they felt their children did better in the flipped environment, enjoyed math more than in the past, and requested that their children continue in a flipped classroom.

The insufficient explicit research on flipped classrooms at the elementary level, despite implicit evidence of its use, indicates a gap in the research.

Conclusion

The flipped classroom is an innovative solution to the twenty-first century teachers' challenge of reaching and teaching our digital youth through active learning practices during limited classroom time. This literature review has examined the needs of today's digital natives in our classrooms, the importance of providing student-centered classrooms with active learning opportunities, and has defined flipped learning with a summary of the literature surrounding this blended learning format from the past decade and a half. The research has clearly indicated the positive perceptions and effects on learning that a flipped learning environment can have on higher education. While there is evidence of the use of the flipped model in elementary schools nationwide, there is neither quantitative nor rigorous qualitative data to support such use (Goodwin and Miller, 2013).

This proposed study will be significant to the field of educational research because whereas flipped classrooms at various levels have been studied in the past, there is little research focusing on elementary perceptions of learning (Davies, Dean, and Ball, 2013; Enfield, 2013; Hamden et. al., 2013; Lage et al., 2000). A descriptive case study will enhance the body of literature for educators and for further research.

CHAPTER 3

METHODOLOGY

The purpose of this qualitative, descriptive case study was to describe elementary students' experiences of flipped lessons, to describe perceptions of their own mathematical learning in a flipped lesson, to describe elementary teachers' perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement, and to describe elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format. Students in three fifth grade mathematics classes exposed to lessons in flipped format were observed and participated in interviews in order to answer the research questions. The teachers were interviewed to gain insight regarding student learning via a flipped lesson. The study took place at a public school in Cary, North Carolina. The methodology chosen for this study allowed rich descriptive data to be collected through interviews with students and the teachers, as well as observations conducted by the researcher. The data was analyzed for themes related to the research questions and the literature review.

It is important to understand the student and teacher perceptions of student-centered and technology-rich pedagogical methods, such as flipped learning, in today's classrooms. The insights gained from this research study could help to fill the gaps in the current literature regarding student and teacher perceptions of flipped learning in mathematics at the elementary level.

Setting

The study focused on fifth grade students from three classrooms where flipped lessons in mathematics are utilized. The research took place in a suburban public elementary school in Cary, North Carolina. At the time of the study, approximately one thousand kindergarten through fifth grade students were enrolled in the school. The school campus serves students from upper-middle class neighborhoods (City-Data, 2016). The free and reduced lunch program at the site for the 2014–2015 school year was 5 percent (WCPSS, 2015). The average class size of an upper elementary (fifth grade) classroom used in this study was roughly twenty-eight students. The school's mission statement from the school improvement plan reads, "School A will provide a relevant and engaging education and will graduate students who are collaborative, creative, effective communicators and critical thinkers." The school has been awarded as a National Blue Ribbon School three times (2000, 2006, and 2016).

The teachers of the classrooms used in this study participated in site-based professional development focused on implementing flipped learning. The teachers involved also participated in additional flipped classroom trainings through Professional Learning Networks (PLNs) and at conferences, such as North Carolina Technology in Education (NCTIES). Although the researcher is a member of the site organization as an instructional resource teacher, she is not in a supervisory position to the teachers, and she is not directly responsible for any classroom of students in the school. Doing action research in the researcher's own organization has benefited the study because it allowed for access to classrooms, participants, observational data, and other valuable artifacts pertaining to this case study. A case study format allows for in-depth analysis of this

bounded system, rich descriptions from participants, and inductive investigation of potential themes (Merriam, 2009; Stake, 1995). This case study sought to describe the perceptions of elementary flipped lessons on student learning. A descriptive case study describes procedures and experiences related to specific events within a context (Stake, 1995).

Participants

Participation in this study was on a voluntary basis. The researcher utilized purposeful sampling in order to intentionally select participants who have been exposed to flipped lessons. Teacher participation was based on subjects taught by the teacher (must include mathematics), teacher qualifications for delivering flipped lessons, as well as the teacher's agreement to partake in the research study. Student participation was pooled from the cooperating teachers' classrooms. The ages of the students involved in this study ranged between nine and twelve years. Proper parental permission protocol was followed for student participants. Measures were taken to match student understanding of the study to maturational age of students. Student assent was also obtained.

Criterion sampling was the primary type of sampling used for this study. Creswell (2013) defines criterion sampling as cases that meet some criterion. The criteria for inclusion were teachers who had trained and students who had participated in flipped lessons. Secondary to criterion sampling, convenience sampling was utilized, as students who had appropriate permissions and were in the classrooms of teachers performing flipped lessons were used. After appropriate permissions and flipped lesson participation criteria were met, the goal of further filters for student interviewees was to create a

heterogeneous sample (Creswell, 2012). Further purposeful stratified sampling then occurred as efforts were made while sampling to allow for variation of gender, academic performance, ethnicity, and socio-economic status within the bounded entity of the defined case (Merriam, 2009). The researcher collected artifacts of instruction (lesson plans, flipped video samples, and learning products), observed active learning in the classroom, kept a research journal of notes, and interviewed the selected teachers and students.

Data

Data was collected in this study using a qualitative case study methodology. The five process steps for data collection were used, as outlined by Creswell (2012), which should be followed in qualitative studies. Although not necessarily in this linear order, the steps include and will be further described in this chapter: identifying the research participants, gaining access and obtaining permissions, considering what type of information is needed to answer the research questions, designing interview protocols that are needed to collect and record the data, and directing the data collection processes in an ethical manner (Creswell, 2012, p. 205).

The student and teacher interview questions (appendices B and C) were open-ended and designed to maximize understanding of student perceptions and learning. Vigorous case study methodology seeks to discover a comprehensive understanding of a small number of cases set in real world contexts (Stake, 1995). A multiple instrumental case study model was followed in order to study several cases (students), which provided insight into the theme of flipped lesson learning (Creswell, 2012). Data was collected

through the teacher interviews, the student interviews, classroom observations, and researcher notes.

Student interviews were conducted at the conclusion of the students' participation in a flipped mathematics lesson. Interview audio was digitally recorded, sent away for professional transcription, and then analyzed for themes using NVivo Qualitative software. The actual number of students interviewed was dependent on permissions granted, but the researcher planned for eight to twelve students to be represented. Details of the permissions process for the student participants will be discussed in the participant rights section. The wording of and the vocabulary used in the questions were age appropriate for student understanding. Data collected through the students' and teachers' interview sessions were digitally recorded by the researcher and transcribed using a professional iPad application. Follow up interview sessions were conducted as needed for clarification after preliminary data was analyzed.

Participating teacher interviews were also conducted to seek teacher perceptions of the flipped lesson phenomenon and as a debriefing exercise after the lesson was complete. For validity, interview data, including the researchers own interpretations and conclusions, underwent member checks with the teacher participants (Creswell, 2012).

Analysis

NVivo software was used to code, search for themes, and further analyze the data collected. Transcribed interview data was loaded into the NVivo software where the non-numerical data was then carefully analyzed for word based themes, attitudes, experiences, and descriptive or explanatory opinions. Descriptive coding took place in the first cycle of coding, looking for words or phrases in the data. Saldaña (2015) suggests using

descriptive coding to summarize data in words or short phrases, most often in the form of a noun. Further cycles of coding added themes or categories. The electronic coding software aided in the process of identifying similarities and relationships, highlighting differences, extracting themes, and creating generalizations. To increase data validity, researchers have an ethical obligation to minimize the misrepresentation and misunderstanding (Stake, 1995, p 109); therefore it is good practice to use the multi-method research approach of triangulation. Both inductive and deductive thinking were implemented while analyzing themes and crosschecking data.

The conceptual framework served as a guide for the analysis of themes. Data and themes derived from interviews was triangulated with classroom observations, artifacts, and member checks.

Participant Rights

Protocols set by the Institutional Review Board from University of New England for safe research with human subjects were stringently followed throughout this study. Additionally, approval was obtained for this action research study from the Wake County Public School System's research and accountability department. Procedures to protect and inform participants with minimum risk were implemented. The teachers, students, and the students' parents signed informed consent forms and understood that participation in this study was voluntary. Appropriate informed consent forms and student assent forms explained, in clear and age appropriate terms, the purpose of the study and details of partaking in the research study. Copies of the student assent, teacher consent, and parent consent forms can be found in appendices D, E, and F.

To maintain anonymity for participant privacy, identifying information was coded. The researcher ensured that all interview recordings and formal/informal discussions related to the study remained confidential. Data was stored on a secure device and was encrypted. Any artifacts collected were also coded, with all identifying records/data removed. Following the study, all audio recordings and transcriptions were deleted. Paper files and any other documentation with identifiable information were shredded.

This study provided no risk to the participants. There were no personal, psychological, or physiological risks or deception to the teacher or to the students who participated in this study. The teachers were informed that their participation, or lack of participation, did not have a positive or negative effect on their employment, evaluation, or position within the organization. Students were informed that their answers to the interview questions had no effect, positive or negative, on their grades or performance in the associated class. Participating students were compensated with small thank you token gifts for their time and cooperation.

Potential Limitations of the Study

One limitation of this study is that it does not represent a fully flipped classroom model. The classrooms used in this study flipped some mathematics lessons for the purposes of this study. When scrutinizing the results of this study, the pedagogy used should be fully understood; this study aimed to seek the perceptions of the teachers and the students' own learning when exposed to flipped mathematical lessons.

The small sample size of students and three teachers involved in this case study could be a potential limitation. While a particular phenomenon was examined (flipped lessons), generalization to other school settings is not assumed.

The issue of bias needs to be addressed, as the researcher is professionally established within the school setting and with the teacher participants for this study. Juxtaposed to the idea of bias, the long-standing relationship between the participants and the researcher allowed for deeper and more honest reflections and observations of the flipped lesson phenomenon as it relates to student engagement and achievement; there was more open communication without threat of judgment. To minimize risk of bias, the researcher maintained ethical and honest data collection, analysis, and reporting practices.

Conclusion

The rigor of the Common Core State Standards for math (2010), coupled with the need to appropriately engage the digital natives in today's elementary classrooms with active learning opportunities, makes flipped learning a good fit as an instructional pedagogy. The research questions that were examined in this study focused on elementary students' experiences of flipped mathematics lessons, elementary students' perceptions of their own learning through flipped model lessons, and teachers' perceptions of student learning via flipped lessons and its impact on student learning versus traditional lessons. This study could help future instructional decisions about the use of flipped lessons at the elementary level by understanding both the students' and the teachers' perceptions of learning through a flipped lesson format.

CHAPTER 4

RESULTS

The purpose of this qualitative study was to explore the experiences of elementary teachers and students who have participated in flipped mathematics lessons. The research questions that guided this study are as follows:

- What are elementary students' experiences of flipped math lessons?
- What are elementary students' perceptions of the impact of flipped lessons on their own learning?
- What are elementary teachers' perceptions and experiences of the implementation of flipped lessons as they relate to student learning and engagement?
- What are elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format?

Qualitative data for this descriptive case study was gathered by interviewing both student and teacher participants of flipped math lessons. In addition, the researcher kept a journal to document thoughts, insights, observations, and experiences throughout the study. This chapter includes a description of the participant sample, explains the data analysis procedures of the study, and presents the results of the data analysis and a summarization of the results. The results provided a rich data set that allowed the researcher to gain insight to the issues surrounding the research questions.

Description of the Sample

The research site is a public elementary school in suburban Cary, North Carolina. The median household income of the school's zip code was 112,288 dollars annually and the average home value was 463,757 dollars (City-data, 2016). The K-5 site school serves

approximately 1000 students and provides a quality K-5 education in a challenging, nurturing, multi-cultural environment. The percentage of students eligible for free or reduced lunch was 5%. The racial composition of the school (depicted in table 2) was 45.5% White, 43.3% Asian, 3.1% Black, 4.8% Hispanic, 3.1% Multiracial, and 0.2% Other (WCPSS, 2015). The school has established a strong reputation in the county as a school where high academic standards prevail. The staff is progressive in their use of pedagogical strategies and dense with intrinsically motivated teacher-leaders.

Table 2
Racial Composition of Site

White	45.5%
Asian	43.3%
Black	3.1%
Hispanic	4.8%
Multicultural	3.1%
Other	0.2%

The teacher participants. The fifth-grade team of teachers consists of four math and science teachers and four reading, writing, and social studies teachers. These teams switch classes midday, resulting in each teacher teaching their subjects twice, to two different groups of students. The fifth grade math team was selected to participate in this study due to their knowledge of flipped learning and the application of the pedagogy in their classrooms. Each of the participating teachers had been implementing flipped lessons for a minimum of two months prior to this study. While all four of the math teachers agreed to partake in the study, only three were used due to scheduling constraints. Each of the participating teachers had a history of using the flipped learning format during math lessons. The frequency of each teacher's lesson flipping is noted in table 3, along with basic demographic information. Although each teacher had experience

flipping lessons in the past, the study was conducted during the first quarter of the school year, so the flipped math lessons were a brand new experience to some of their students.

Table 3
Teacher Participants

Participant	Years of Teaching	Highest Degree Level	Experience Flipping Lessons
Teacher A	11–15 years	Master's Degree	10 months
Teacher B*	16–20 years	Bachelor's Degree	2 months
Teacher C	0–5 years	Bachelor's Degree	13 months

*National Board Certified Teacher

Teacher interviews were conducted over a period of two weeks at times that were mutually convenient to both teacher and researcher. Confidentiality was maintained by holding each interview in a private office within the school site, and anonymity was maintained through the use of pseudonyms.

The student participants. The student sample consisted of fifteen students, ages ten to eleven. Five students from each of the three participating teacher classrooms were selected. Students were selected based on criterion sampling. Criterion sampling is demarcated as the selection of cases that meet some predetermined criterion of importance (Creswell, 2013). The criterion used for student inclusion was that students must be assigned to one of the three participating teachers and had participated in flipped lessons. In addition to criterion sampling, convenience sampling was also used, as students who had appropriate parental permissions were selected. After appropriate permissions and the flipped lesson participation criterion was met, the goal of further filters for student interviewees was to create a heterogeneous sample. Further purposeful stratified sampling then occurred as efforts were made to allow for variation of gender,

academic performance, and ethnicity that mirrored the overall school population. Table 4 outlines the basic demographic information of the fifteen student participants.

Table 4
Student Participants

Participant	Gender	Ethnicity
A1	Female	White
A2	Female	Asian
A3	Female	White
A4	Male	White
A5	Male	White
B1	Female	Asian
B2	Female	Multi-racial
B3	Male	Asian
B4	Male	Asian
B5	Male	White
C1	Female	Asian
C2	Female	White
C3	Female	White
C4	Male	Asian
C5	Male	White

Analysis Method

Both teacher and student interviews as well as logs documented in the researcher's journal made up the qualitative data for this study. Interviews were digitally recorded on a secure device. The recordings were transcribed by an outside source and then uploaded into NVivo for Mac, Version 11 software. NVivo is a data analysis software program that is designed to work with rich qualitative data sets. Coding was completed separately for the teacher and student interview files. The researcher used an open method of coding, where codes were named as they occurred in the data. Words and phrases were assigned systematically as the researcher went through the textual data. The researcher's journal and observational notes were referenced in both projects for a comprehensive analysis. Within the NVivo software, the researcher performed several

rounds of descriptive coding of both data sets. The data analysis program (NVivo) enabled the researcher to gather related material together in one container, called a node, so that emerging patterns and ideas could be more easily identified and labeled. Within each set, nodes were designated and then further combined by emerging themes. Thematic analysis occurred through a process of capturing keywords, identifying similarities and relationships, examining researcher reflection, and creating generalizations (Saldaña, 2015). The emerging themes were further analyzed and reevaluated until the point of saturation was reached. Data saturation occurs when new information is no longer being extracted from the data (Merriam, 2009).

The conceptual framework served as a general guide and reflection point for the analysis of themes. Themes emerged throughout both the teacher interview data and the student interview data. Triangulation of the data was used to crosscheck the data for validity. In the process of triangulation, the researcher compared multiple responses from each interview question for similarities in order to strengthen the rationality of the emergent themes. The themes were cross-referenced by member checks and further confirmed through the researcher's observational notes.

There were four significant themes that emerged from the student data, each having related subthemes. The teacher data produced four major themes, with multiple subthemes as well. These themes will be discussed at length in the next section.

Presentation of Results

While there were many similarities between the teacher and the student data, each will be presented alone. The similar categories in both datasets indicate that the teachers' and the students' perceptions of flipped learning were often twofold: their perceptions of

the flipped lesson experience coincided with their perceptions of the student learning that occurred within the lesson. There were similar overarching themes for both data sets; they are outlined in figure 4.

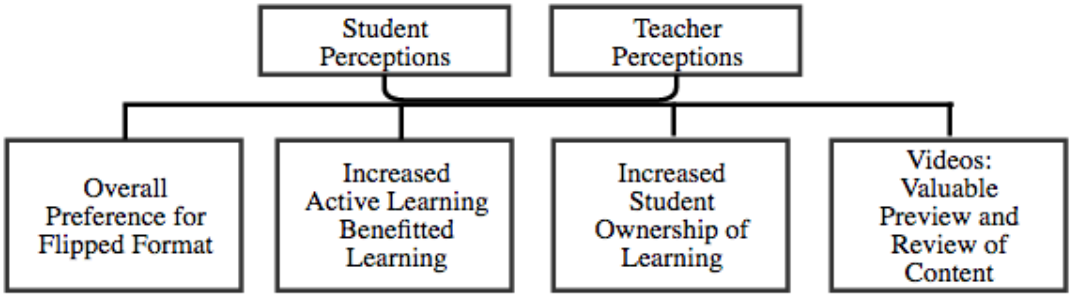

Figure 4. Similar themes that emerged from both the Students' and the Teachers' interview data.

Student Experience and Perception Data

After analyzing and organizing the collective student interviews and the researcher's notes, several themes emerged about the students' perceptions of the flipped mathematics lesson. The four major themes can be summarized as follows: preference for flipped lessons, more time with the teacher; increased student ownership of learning, and increased positive parental involvement. Each theme also had subthemes from the student data about the flipped format. The major themes and the associated subthemes are represented below in table 5.

Table 5
Themes Presented within the Coding Process for Student Data

Major Themes	Subthemes
Preference for Flipped Lessons	Active Learning Over Passive Learning
	Increased Sense of Engagement
	Preference for Peer Collaboration
	Increased Sense of Motivation
	Use of Technology
More Time with the Teacher	Students Seek Teacher Attention
	Teacher Time Less Intimidating
Increased Student Ownership of Learning	Sense of Control
	More Accountable for Learning
	Video Homework Prepared Learning
Increased Positive Parental Involvement	Understanding of the Common Core Standards

Student Theme 1: Preference for Flipped Lessons

The student interview data repeatedly showed that the students had a positive perception of and preference for flipped lessons. This was evidenced by the following: Students reported that they felt they learned more with active learning in the classroom, they preferred it over the passive learning experiences of traditional lecture style lessons, and they perceived the flipped format to support collaboration, motivation, and engagement.

Active learning over passive learning. Active learning from the participants' perspective is defined as participating in learning that is not passive—learning by doing. Concerning the active learning experience, student A1 said, "I like that it's not just doing a paper. You also get to work together and create things. We created a video, and while we made it, it helped me get a better understanding of the division." The same student further described her perception of the lesson, "Well, it was really hands-on. We got to do stuff in class and we had a chance to explain what we learned. We basically got to teach

it." The student was referring to an activity where the students worked in small groups to design a lesson teaching the division strategy they had learned. They then used iPads to video the finished lesson. Each of the five students in that class referenced that activity as either "fun," "meaningful," "helped me understanding the math," or "better than a regular lesson." Active learning involves the students in moving around and doing things, rather than sitting passively. Student C2 supports this idea when saying, "… it helps you understand math better. It's more fun than other lessons. You get to participate in the lesson instead of just sitting there being talked to." The student participants in this study had an overall positive perception of and preference for the active learning interconnected to flipped lessons.

Increased sense of engagement. Another positive subtheme indicating a preference for flipped lessons is the student perception of flipped lessons to be more fun and more engaging than traditional lessons. Engagement in the classroom for student participants includes the degree of interest, passion, and attention the students felt toward the lesson. Student C1 explained that the problem that was worked on in the group was entertaining and made them laugh, "I really liked the problem about the sheep, it was real and funny because we didn't want to leave any sheep behind. Everyone paid attention in our group!" The use of technology is another reason students claimed that flipped lessons were engaging. They cited preferring watching video for homework on technology and having more opportunities to work with technology in class as reasons they liked flipped lessons. Student A2 said:

> I love the homework and the classwork in a flipped lesson! You get to go on the computer. In a regular lesson, you don't get as much computer time. And I like

> working in class with my friends on technology instead of sitting bored and listening to the teacher all day. I like my teacher a lot, she is not boring, but it is more fun to try to explain to her what I am learning and doing when there is some sort of technology in front of me! (S A2)

Student participants found flipped lessons to be more engaging than traditional lessons due to their perceived levels of interest and attention to the lessons.

Preference for peer collaboration. The student interview data also indicated that students enjoy collaborative activities. Student participants define collaboration as working together to create something or reach a common goal. There were 60 incidences within the raw data of students referring to their preference for working in pairs or small groups over working independently or in whole class settings. Reasons ranged from being shy in front of the whole class to knowing they worked harder in peer groups under positive peer pressure. Student C2 claimed, "I think everybody liked working in groups better, and everybody in my group understood the math problems we did better than if we were struggling alone. No one was really messing up. That is good for something hard like division!" The students spoke of the benefit of being able to communicate with each other while working through the activity. Communication and collaboration are twenty-first century skills, and the students provided a clear partiality for this type of activity over lecture style. Many students commented that working together to solve each problem benefited their learning. Student B5 explained the process of working with a partner to solve the problems: "We both thought about the problem, and if one of us forgot a step, the other one remembered and then we walked through it together to first get an understanding of the problem and then we solved it together." The students

construct meaning together in a collaborative fashion, just as Vygotsky (1978) theorized that students are more engaged when working together with other learners and the teacher in creating (constructing) new meanings of instructional content. Student A3 spoke of the convenience for finding help, if needed:

> If I was stuck on something, my group would help me, and then I can understand more, or I could just go slower with them and it would be easier. If we all did not know, the teacher was right there to ask. There is no excuse not to understand how to do that division! (S A3)

This data indicates the students' satisfaction with and preference for collaborative activities that took place during the flipped lessons.

Increased sense of motivation. The data showed that the students felt more motivated to learn in a flipped format lesson. Student participants describe motivation as their interest and willingness to do something. Student A5 described a feeling of motivation to do homework so the lesson would not be missed, "In a regular lesson, if you don't do your homework you just get a homework slip, but in a flipped lesson, you have to do your homework or you won't have fun during the lesson. You would miss it." The researcher's notes described one of the participating teacher's methods for encouraging homework completion: Students who did not watch the video for homework (by choice), were required to watch the video on the classroom computer during the activity, and then do passive independent work to practice the featured mathematical concept. The teacher's notion was that by watching the rest of the class participate in the active learning, the offending student would catch on very soon that it is worth his while to watch the video in order to be able to participate in the more engaging activity. While

student A5 had indeed watched the video assignment for homework, the prospect of missing the activity kept the student accountable for doing the homework. The protocol set up by the teacher provided motivation for the students.

Use of technology. Students prefer watching an instructional video for homework to traditional written homework. Ten of the fifteen students stated that the reason they preferred having a video for homework over traditional homework was because they were able to use technology. Many of the students perceived watching the video, even when accompanied by guided notes or accountability questions, to be "less" homework than traditional practice homework sheets.

Student Theme 2: More Time with the Teacher

Each of the participating students indicated in the interview that he or she perceived a positive difference in the teacher's role in the classroom. The shift they refer to is the teachers' transition from "sage on the stage" to "guide on the side," as described by King (1993). In a flipped lesson format, lecture time is moved out of the classroom and into the realm of homework, resulting in an increased amount of time for active learning. The active learning observed by the researcher during the classroom time did provide ample time for the teacher to reach more students in small groups or individually.

Students seek teacher attention. By having the lecture moved out of the classroom time in a flipped lesson, the teacher was available to spend more time with students. Many students recognized this, as evidenced by student A5's perception of the teacher's role in a flipped lesson: "The teacher was just walking around visiting all of our groups. I like that because otherwise I don't get to talk to her so much. I think she just

walks around and looks for the groups that are having trouble." Similar comments were made by other students, including student A4, who stated:

> Flipped lessons give you more time to get attention from the teacher. I think it saves the teacher some time, too… because we are doing the boring learning part at home, then when we come to school, we have more time to do the really difficult thinking, but that is good because she (the teacher) is there to help us. (S A4)

This suggests that students seek attention from the teacher, and they perceive the flipped format as a chance to obtain that attention in a learning environment.

Teacher time less intimidating. Sometimes more attention from the teacher is desired by the student, but the need is masked by timid personalities or fear of speaking in front of the class. Student B2 and Student C2 indicated that they felt less intimidated talking to the teacher in a small group session than in a whole group. Student C2 confessed that long division had been taught in the previous year (in fourth grade), but the student did not understand it. The student did not want to tell the teacher about being confused due to embarrassment. The student said that the video provided the privacy and time needed to learn the concept, and then the student was able to ask classmates for help the next day to clarify what was learned. Due to the way flipped lessons are designed, with video homework and a more student-centered class time, these students were able to feel more confident in their knowledge acquisition and the ability to seek help when needed. Student C1 explained the preference for the flipped format:

> I think I learned more in the flipped lesson because in a normal lesson, I don't like asking the teacher for stuff. I'm just really shy about that so with the flip lesson,

> everything I needed to know was in the video, or I was able to discuss with my small group. That way, if I did have to ask the teacher, it wouldn't be as scary as asking in front of the whole class. (S C1)

Student Theme 3: Increased Student Ownership of Learning

Sense of control. Data analysis revealed seventeen references to students taking a more responsible role in their own learning. Increased student ownership of learning emerged from various data nodes indicating that students noticed a difference in that they were more in control of their own learning than with a teacher lecture. Student ownership of learning can be defined as the investment a student has in learning. Student B2 explains how a flipped lesson is different from a traditional lesson:

> It is different than a regular lesson because you get to learn by yourself and with your group, and there are no teachers. Well, the teacher was there, but only if you needed her. After she told us the activity to do, then you feel like you are in control of it, not her. She is not telling you how to learn, she is letting you learn. (S B2)

Multiple students reported feeling empowered by the ability to manipulate the video to stop, reverse, and replay. Student A3 stated, "It was helpful because I could play it again or stop it to practice. I liked that control." The students recognized the ability to control their learning through the video at a pace that was right for them, and that this was not usually the case in a traditional lesson, as noted by student C4, "You learn from the video at home, so you could replay it as many times as you want. It would help you because in class, you can't replay the teacher. You can't do that." Student C4 goes on to add, "I think

it helps me learn more, since I can replay the video, rewind, and pause when I need time to think."

More accountability for learning. Many students described that they felt more accountable for their learning in the flipped lesson. One student indicated the extra effort he exhibited in the active learning lesson because he did not want to let his friends down by not doing his part. Students not only feel more accountable to their peers, but they feel a sense of yearning to learn. Another student recounted that during the group work in the flipped lesson, he noticed the mistakes he had been making previously while attempting long division, and he wanted to learn how to fix his errors. He said he would have just "let it go" if he had gotten a traditional homework problem wrong in the past, because he didn't care as much. His responsibility to the activity and the nonthreatening work environment in class triggered his desire to take control of his mistakes and learn from them. Student B4 admitted to making an effort to stop guessing:

> It improved my learning by not guessing the answers, like if you guess the answers you might get them wrong, but most likely you'll get wrong and if I get a habit of doing that then it will be really bad because I'm going to get my test wrong and stuff. If it is a not a flipped activity, then people do not notice when I am guessing, and I usually get away with it. With a flipped lesson, I work out the problems with classmates and my teacher, so everyone together figures out the right answer eventually, no matter what. I couldn't just write down any old answer to get it done because my classmates I am working with would be like, "Hey!" (S B4)

Video homework prepared learning. Finally, students reported more interest in the empowerment of their own learning through their comments around the homework video being a "head start" to learning. Student B3 stated feeling ready to learn at school because the video had provided a preview of the topic. The student felt more confident and eager to practice the learned skill. The preparatory confidence the video gave the students in their mathematical learning is further evidenced in the following quotes:

- The video is like a preview of what we will learn in class. It's a helper to get you ready. (S B5)
- The video gave me a head start of knowing what we would do at class and then it helped me practice a little bit and so when we went to class, I kind of knew what it was. I think the video gave me a head start so I wasn't lost. (S B1)
- It helped me, because I knew, since the video from the day before, I already knew how to do it and it was way easier to read it. The problems were things in life that might come up where you would need to use division, so it made sense. The video made the math part simpler. And on the video, it talked about all of the steps you do in long division. I think that it really helped me in school the next day. Otherwise, I would have been staring at the problem clueless. (S C3)
- The video told me exactly how to solve long division problems. At first, it was a bit tricky, but then when I watched the video and then watched some points over again, it made more sense. Then when I went to school, it was easier to do. (S C5)

This theme described how the data showed that students felt ownership of their own learning while participating in a flipped lesson.

Student Theme 4: Increased Positive Parental Involvement

Understanding of the Common Core standards. The Common Core standards have shifted the way elementary mathematics are taught from a focus on computation to a focus on problem solving. Many of the conceptual models of mathematics used to teach elementary students are very different from what current students' parents remember learning themselves as students. While in the past at the research site, this has been a point of friction in parental communication and the understanding of homework assignments, the data analysis indicated a theme that states otherwise. Eight of the fifteen students commented that their homework relationship with their parents was better with the flipped video than it was with traditional homework. Student B4 laughingly said, "My mom said that this new way (flipped lessons) makes homework time more peaceful, you know, like not frustrating, because I am not asking her questions she maybe does not know!" Student B1 explained that their mom didn't understand "the new ways of math" and wasn't much help with homework. The student happily reported that their mother "didn't have to Google the answers anymore, instead she watched the video and learned with me."

The student data showed an overall positive perception of and preference for flipped lessons, an appreciation of having more time with the teacher, an increased sense of student ownership of learning, and an increase in positive parental involvement. The researcher sums up the student perception of flipped lessons with the following endearing quote from student B1:

> In the flip lessons, I actually don't really have anything I don't really like. Maybe the name. Why does it have to be called that? Can't they just call it the new way

of having a lesson? Then we can call the old way, with regular homework, we can just call it, "the old way." (S B1)

Teacher Perception and Implementation Data

The four emergent themes from the teacher interview data mirrored the FLN's "Four Pillars of the FLIP," defining the basic principles of a FLIP (see appendix A, FLN, 2014). The data gathered from the teacher interviews fell into descriptive themes that correlated to the acronym FLIP and helped to describe the teachers' perceived positive learning outcomes of their students. The researcher adapted the FLN's use of the FLIP acronym, and organized the teacher data to represent the major findings of this portion of the study. These headings—instructional **F**lexibility, **L**earning culture, **I**ntentional planning, and reflective **P**ractitioner—will be further discussed in this section as they relate to the themes that emerged from the teacher interview data. Table 6 illustrates the main themes, along with the subthemes from the teacher data that will be discussed in this section.

Table 6
Themes Presented within the Coding Process for Teacher Data

Major Themes	Subthemes
Instructional Flexibility	Increased Active Learning Time
	Increased Student Engagement
	Increased Student Voice and Choice
	Naturally Transformed Learning Spaces
	Teacher Letting Go of Control
Learning Culture	Teacher as the Guide on the Side
	Student Ownership of Learning
	Relevancy of Practice
	Student Preference for Collaborative Work
	Increased Positive Student Attitudes
Intentional Planning	Shift in Mindset
	Video Acquisition
	Activity Preparation
	Differentiation
Reflective Practitioner	Growth from Feedback
	Increased Student Learning
	Need for Support

Teacher Theme 1: Instructional Flexibility

According to FLN (2014), teachers must establish a flexible learning environment in order to engage in Flipped Learning. Indicators of a flexible learning environment include: allowing for a variety of learning modes, physically rearranging learning spaces to accommodate learning activities, permitting students to interact and reflect on their learning, being flexible with expectations of timelines and assessments of student learning, and facilitating appropriate and engaging active learning experiences. Table 7 presents five subcategories related to the flexible environment parent theme.

Table 7

Instructional Flexibility Subcategories

Increased Active Learning Time
Increased Student Engagement
Increased Student Voice and Choice
Naturally Transformed Learning Spaces
Teacher Letting Go of Control

Increased active learning time. One of the most common subthemes related to flexible environments discussed during the teachers' interviews was noting an increase in active learning time. The data indicated forty-five mentions of the positive aspects of increased active learning time in a flipped lesson format. All three participants described the increase to be beneficial to student learning throughout their interviews. Active learning is defined in this research as learning that takes place through experiences that engage the learner in inquiry, is sometimes collaborative, and puts the responsibility of learning on the learner (Prince, 2004).

In one of the lessons observed by the researcher, the students worked collaboratively in small groups to produce a video in which they designed and presented a lesson that would teach the teacher how to work through a long division problem using the strategy they learned on the video at home the night before. Teacher A stated:

> The activity in class is even more important. I think the students learn more by working collaboratively with their peers, creating some sort of product—in this case the lesson to teach me the division, and it forces them to think more critically and use higher level thinking skills. These active learning opportunities would not be as easy to make time for in a traditional lesson. (T A)

The teacher recognizes the extended time for purposeful learning activities that the flipped lesson allowed. Further supporting the importance of the active learning time, Teacher C commented that while she has not experienced an unsuccessful flipped lesson, she could imagine that any interference with the gained active learning time in the classroom could potentially be defined as a failure. Another teacher said that in the flipped model, there seems to be more learning time and more time to fit in all of the content, "it just feels less rushed."

Increased student engagement. The researcher's journal, along with feedback from the teachers during the interview process, indicated an increase in student engagement during the flipped lesson. As discussed in chapter 1 in defining the term *engagement,* it is a universally desired trait for students to have in an educational setting. However, defining student engagement as an indicator of instructional success is difficult due to the complexity of the topic. For the purpose of this study, student engagement refers to a "student's willingness, desire and compulsion to participate in, and be successful in, the learning process promoting higher level thinking for enduring understanding" (Bomia, Beluzo, Demeester, Elander, Johnson, and Sheldon, 1997, p. 294). The definition of engagement could extend to the level of student motivation for learning, as well.

Teachers reported that students were more engaged in the flipped classroom lesson because of the nature of the flipped lessons. Teacher C emphasized, "they are more engaged—they are not just listening to me. The hands-on nature of the activities are more active and keeps their attention." She elaborates with,

> They are able to collaborate. They are able to work together. They're not just sitting in their seat. They are up moving around. They are using manipulatives and technology. It's just not a lecture kind of format anymore because their video is doing that part of it. My students are much more engaged, and happy, working in a flipped format lesson. (T C)

While the students are also engaged in traditional lessons, the teachers reported an increase in engagement during the student-centered activities that occur for more time in flipped lessons.

Watching a short video lecture for homework also received status for engaging students. Teacher B described a new phenomenon in her classroom: higher homework completion rates while using a flipped format, as well as an increase in her students' motivation to learn. She contributes the increased excitement for homework to be part of the students' twenty-first century learning behaviors,

> It's a different, but more natural way of teaching and learning for these students. They love videos. They love going home and playing with the computers and using their devices. Flipping fits right in with their desire to use technology, but in a better way: for them to learn. Of course it is more engaging than traditional homework. (laughs) My students are *asking for* video homework now! (T B)

The researcher's notes buttressed these claims with notes from the student interviews indicating the students' preference for homework in video format over traditional practice papers.

Increased student voice and choice. An increase in student voice and choice seems like an expected outcome when there is increased engagement and student-

centered learning; however, a few particular aspects of student voice and choice were exhibited in the analysis of the teacher interview data. The flipped lesson format allows input from students and choices about their learning topics, partners, and products. Within the purposefully designed student-centered activities, teachers allowed for more input from the students about the mathematics topics focused on in class, the partners they chose to work with, and what type of product they would create to demonstrate their learning.

Teacher A explained in her interview that the students are almost always able to choose not only the partners they will work with, but also the product in which they will present the content they have learned. While some teachers struggle to release their control and provide input and choice for their students, two of the three teachers explained that it was easier to do so in a flipped format. One teacher expressed her journey of providing more choice for her students by first allowing them to choose their own partners. She started by asking them to pick a partner that they learn well with or someone that they can teach something to. "I was happily surprised, because they didn't just goof-off with their friends, they chose wisely, maybe better than I would have done for them! This (flipped lesson) allows me to more easily provide my students with choices."

Naturally transformed learning spaces. Technology-rich and student-centered learning spaces provide for flexibility to the active learning classroom. By having the willingness and ability to rearrange the physical furniture and seating to allow for the gathering of various sized group work or project design, teachers can provide more authentic learning experiences for the twenty-first century learners in their classrooms.

Data analysis revealed the participating teachers' connection between active learning in a flipped lesson and flexible learning spaces. One teacher expressed gratitude for her forethought in transitioning her classroom to include more flexible seating in conjunction with her increased use of flipped lessons, as they go hand-in-hand. The researcher observed that in each lesson, the students either used flexible seating or created their own to facilitate collaborative work with their peers. The digital natives of today are accustomed to learning in spaces, times, and styles of their own choosing, therefore, the learning spaces often need to match the learning styles. The researcher noted that in one of the lessons where the classroom was set up in a more traditional style with desks in rows, the students had to twist to face each other in a comfortable manner or sit or stand in an awkward position in order to participate in the group discussion, possibly hindering the opportunities for participation and growth within each group.

Teacher letting go of control. According to the FLN (2014), flipped learning teachers need to be flexible not only in their physical learning spaces, but with their expectations and mindsets about teaching and learning. The data showed a common theme of teachers adjusting to the shift of control that they are accustomed to in a traditional format. This does not mean that flipped lessons are chaotic or without classroom management. It is simply a shift toward more flexible strategies and expectations, usually resulting from the increase in student voice and choice as well as increased student ownership of learning. For example, Teacher A refers to the modification in her methods of keeping the students accountable for watching the videos and learning the material, "I think it's been an adjustment for me, like, the control aspect of knowing whether they've watched the video or not. It has been about me changing my

mind set. It's not a disadvantage, but it's a change for me." Teacher B expressed the difficulty she had adjusting to not sending home homework practice sheets, as well as shifting her role away from the center of the classroom.

Teacher Theme 2: Learning Culture

The second major theme derived from the teacher transcripts and researcher's notes focused around learning culture. In a teacher-centered traditional model, the teacher is the primary source of knowledge. In a flipped model, there is a shift to learner-centered instruction, where students are actively involved in knowledge construction. Students explore topics in greater depth as they participate in their own learning in meaningful ways (FLN, 2014). There are five subcategories to the learning culture node, which are outlined in table 8 and discussed in this section.

Table 8

Learning Culture Subcategories

Teacher as the Guide on the Side
Student Ownership of Learning
Relevancy of Practice
Student Preference for Collaborative Work
Increased Positive Student Attitudes

Teacher as the guide on the side. In order to create a culture of learning, constructivist theory supports the idea that teachers should become "a guide on the side," as opposed to "the sage on the stage" (King, 1993). Student-centered learning puts the teacher (guide) on the side, as a coach who facilitates the student's learning. Data in the study revealed that the teachers not only recognize their position as either the sage or the

guide, but also see the benefit of becoming the latter. Teacher A sees her role as the teacher in a flipped lesson as:

> I am more of the guide through the areas that they have questions about, versus the center of the lesson. I am there to answer the questions that they have after they have watched the lesson or why they are practicing it, to help clarify things, to help push their thinking further. I guess more of, well, kind of their assistant. (T A)

She further explained how she walks through the classroom, listening in to the group conversations, listening to the questions they ask each other, "and that tends to lead me to whether they know what they are doing or not because a lot of them will ask each other questions that they might not ask me."

In a teacher-centered classroom, the student is a passive participant, but in a student-centered classroom, the student is active, using higher level thinking skills (Turner, 2011). Teacher C expresses how she believes her students think more critically, share with less self-consciousness or inhibition, and work harder to solve the problems when she is acting as the guide on the side, rather than the lecturer in a whole group activity:

> I think that I just like being able to see them work together and not have me being the center of their learning, you know, if there are two of them sitting there together and one of them doesn't understand the problem, but the other one does, they naturally teach each other. It's really cool to see that: those ah-ha moments, where they are like, 'Ooh, Ms. 'C' tried to explain this to me but I didn't understand it and I was too embarrassed to ask her again, but when you explained

it, I got it.' It's really cool to see that. That doesn't happen when I am in front of the class lecture-style. (T C)

All three teachers spoke about the necessary and cognizant shift out of the teacher-centered spotlight in a flipped lesson in order to make the lesson successful.

Student ownership of learning. According to the teacher interview transcript data, teachers noticed an increase in students' ownership of their own learning while using the flipped lesson format. When describing what they found to be successful in their flipped lesson experience, all teacher participants cited the increased responsibility in learning that they noticed in their students. Examples included students coming to class prepared to learn with homework completed, seeking help from peers or the teacher when needed, and student manipulation of the homework video to help review and prepare for class. Teacher A explains the benefit of the experience like this: "If (the students) have the ability to be the one that's in charge of their own learning, where and when they learn it and they feel ownership over it, then they are more engaged and they learn more."

Relevancy of practice. Teachers felt that flipped lessons were appropriate opportunities to provide real-life problem-based practice to their students. Opportunities to practice math skills and concepts are more meaningful when the problems are presented with examples that are relevant to the students' lives. Teacher B taught her students how to view the video in order to learn from it, as opposed to watching a video for entertainment, by relating it to a more relevant concept for her students—reading a book or a math word problem.

While describing the importance of using relevant problem-based questions, participating teachers emphasized the importance of making the activity mirror the

mathematical application of the concept to what the students might do or see in everyday life. For example, Teacher C acknowledged that some math concepts are more difficult to apply to real life situations in a meaningful way to fifth graders, like long division. However, then "you just need to be creative… and prepared."

Student preference for collaborative work. Data analysis showed that collaboration with positive references was cited within the teacher interview data twenty-five times. Teacher participants felt that the students not only preferred working in collaborative groups, but that doing so increased the students' learning of the concept. Teacher A expresses:

> I think that sometimes they learn more from each other and when they are given that time, and the flip format gives them that time, when they're allowed to communicate and collaborate with each other, they answer each other's questions in a way that's kind of, you know, well, I don't always speak the same language as them, so they get more out of the discussion with each other. They speak the same language and I think that they have a comfort level with each other, too. And they are more willing to take risks with each other. So I think their learning is much greater when they can work together. And they feel better about it. I feel better about it! (T A)

Collaboration is a twenty-first century skill that students need to master in order to succeed in today's society, and flipping lessons provides an appropriate setting in which to practice.

Increased positive student attitudes. From the teacher sample, each one expressed an increase in positive student attitudes toward homework and classwork. One

teacher spoke specifically about a student who had a notably better attitude in class and suddenly began completing homework when she started flipping the lessons. She described an overall higher motivation to learn in her class, in addition to the attitude change, stating that those factors are probably related. Teacher A extended the positive attitude shift to include the students' parents as well:

> The students attitudes about the work—at home and in class—are definitely better. I think they really like having the video as homework. I mean I even have more parents watching the videos. They're doing the homework at night, too. I have not had any complaints from parents about not understanding the math we do in class this year—and that is a change. (T A)

Teacher C stated that her students seemed much more excited about their homework when she assigns a video to watch, and her homework completion percentage rates are at an all time high.

Teacher Theme 3: Intentional Planning

The *I* in Flipped Learning Network's acronym definition of FLIP stands for intentional content. As a major theme revealed through the data analysis of this study, intentional content refers to the educator being intentional in her mindset, her planning of both the video and the activity, and in her planning for differentiation. The data analysis showed that teachers perceive a strong need to use intentional planning to maximize the learning in a flipped lesson. Table 9 summarizes the four subcategories to the intentional planning theme.

Table 9

Intentional Planning Subcategories

Shift in Mindset
Video Acquisition
Activity Preparation
Differentiation

Shift in mindset. As described in the section reporting the shift from teacher-centered to student-centered teaching, the data indicated that teachers are aware of and in favor of this pedagogical shift, but it must be intentional. Teacher B felt that intentional communication to the students about the shift is crucial to success. She stated, "I guess the successful part comes from knowing the structure of a flipped lesson and communicating those expectations to the students. Otherwise they'd be expecting me to hand over the information from the front of the room like before." Teachers A and C said they had to repeatedly remind themselves of the shift when they first started flipping lessons. During one of the lesson observations, the researcher noted that the teacher looked as if she had to deliberately refrain from jumping in to give the students the answer instead of waiting for the process of student ownership of learning to take over.

Video Acquisition. Similar to the basis of intentional learning within Flipped Learning Network's (2014) Four Pillars of FLIP, participating teachers in the study stated that they needed to be intentional in determining what they needed to teach and what materials were appropriate for students to explore on their own. Examples of this subtheme emerged through teachers' comments about video preparation. Two of the teachers expressed a common concern over locating—either by curating from outside resources or creating their own—videos that were age appropriate, contained the

standards intended, and were within the recommended length. Whether the teachers intended to create their own video or find one online, there was an undertone of frustration in keeping the video to the recommended age level length of seven to eight minutes. On top of that, the time required to locate these resources created a strain on the teachers. The following are some of the expressions of the teachers concerning video preparation:

- To find instructional videos that address the standard and make sure that they're teaching exactly what we're doing in class and what they're going to be able to collaborate on and what I'm going to be able to pull small groups for. Just make sure that it touches on all parts of what they're going to do in class. Then if I can't find a video, I've got to go to the drawing board and do something myself and figure that out.
- I think it is sometimes hard or time consuming to find the videos that go right with the standard or exactly with what we're teaching or what they're working on the next day. I need to be very intentional and plan in advance.
- It's been a little frustrating on some ends, because not a lot of good quality videos are out there. I'm hoping down the road, if flipped lessons at the elementary level becomes more popular, that more people will create them. There are loads of videos for higher grade levels, but not as many for elementary.

Juxtaposed to these statements, Teacher A claimed, “I think that we are lucky because we have a lot of resources and tools available to make our own videos. So the video part I think has not been that difficult.” She goes on to state that because of all of the resources available, that should never be a reason not to try the flipped format.

Despite being time consuming and sometimes frustrating, when asked, all three teachers said they felt that the time it takes to prepare for a flipped lesson is similar to the preparation time for a traditional lesson. Teacher C says, "because you are not having to waste additional time re-teaching concepts."

In addition to preparing the video, the teachers indicated the importance of preparing the students for the video. Teacher A said, "It might be unsuccessful if I have not set them up well enough to get what I want them to get out of the video. At this age, they need to be front loaded a little bit about the topic." Upon probing, she explained that this could mean both instructions for the students on how to watch a video for academic purposes versus entertainment, but also the need to front-load the students at this age with either a brief verbal introduction to the topic or a guided note-taking tool.

Activity preparation. Analogous to intentional video preparation, teachers felt that it was necessary to be intentional concerning the classroom lesson activity as well. Each teacher associated her success with her intentional planning for the active learning lesson. One teacher confessed that with traditional lessons, teachers could potentially "wing it," requiring little to no preparation ahead of time; however, flipped lessons require planning in order to be successful. Teachers notice the time they invest in planning flipped lessons pays off in student learning. Regarding purposeful planning for a flipped lesson, Teacher A says, "Because of planning, I am already thinking about the questions they might have, and about what things they might have difficulty with. So I think I am better prepared to help them than I would be in a traditional lesson." Teacher C posits that it is a matter of shifting to a different mentality of preparing. "I don't think it's a matter of more work. It's a different kind of preparation. . . . I think it's

about the same. I feel like the preparation for the flipped lesson is more purposeful and meaningful, though." While stated in multiple ways throughout each interview, each teacher agrees that intentional planning for a flipped lesson is worth the investment in student learning.

Differentiation. Continuing with the pattern of the importance of planning in the success of a flipped lesson, the teacher interview data indicated there were many opportunities for differentiation while using a flipped format, but planning was essential. Differentiation themes emerged from the data concerning the various ways that content can be differentiated within a flipped lesson.

Flipped lessons can be differentiated through video choice, note-taking tools, and student manipulation of the video. Teacher A exemplifies this theme:

> They're able to learn at their own speed, their own pace. They can stop the video and re-watch it. They can speed it up and fast-forward it. They can go back and re-watch it again. I think the flipped format naturally differentiates for every student. If the pace of the video does not offer differentiation, I don't have to give all my students the same video. They can watch a video on their level, at their comfort. So by doing that not everybody is having to listen to me say the same thing. They're getting a video lesson that's appropriate for them. (T A)

Teachers also scaffold the type of note-taking tool provided to students, if such a tool is required for the content. Note-taking papers could have grids of information, partially filled in graphic organizers, or sentence starters. Each of these tools helps students to learn and record the content with assistance.

Other comments revolved around differentiating through the class time activity or group placement. Teacher B talked about placing students purposefully in groups to allow for peer instruction. She stated, "Even the kids who are comfortable with the content grow in their abilities through the practice, and by teaching someone else they are using higher order thinking skills." Teacher C sometimes groups students by ability after the first active learning day to be able to see who needs additional help. "It was nice to be able to sit with them and have that time, to really have that small group attention that I can't in a regular lecture type lesson." The activity itself can also be differentiated; teachers indicated they can give varying levels of activities, or scaffold the activity for certain students, if needed. Teacher A says, "Flipping definitely gives me more time to work with students and to see their individual needs. Both the students and I, as the teacher planning the lessons, are involved in more critical thinking."

Teacher Theme 4: Reflective Practitioner

Professional educators are a necessity for flipped learning in order to facilitate learning in a student-centered environment. Reflective educators are cognizant, analytical, and evaluative of what goes on in their classroom, which leads to adjustments and improvements in their teaching methods or trials. The data organized under this thematic heading is summarized in table 10 and encompasses the teacher's role in being reflective in her practice by assessing the success of new pedagogy, growing in her methods through peer feedback and student achievement results, adjusting her instruction, and recognizing where support is needed.

Table 10
Reflective Practitioner Subcategories

Growth from Feedback
Increased Student Learning
Need for Support

Increased student learning. Interview data repeatedly showed that the participating teachers perceived an increase in student learning with the use of flipped lessons over traditional style lessons. This data emerged in response to multiple interview questions, including:

- Tell me about a time when you think using a flipped lesson was successful.
- What are the advantages and disadvantages of a flipped math lesson?
- What do you like about the flipped lessons?
- What do you think the students learned from the lesson?
- How did the video the students watched for homework help them prepare for the activity during math class today? How was having a video to watch for homework helpful for their learning?
- How did the activity during class support the students learning?
- When you use a flipped math lesson, do you think the students learn more, less, or about the same as a regular lesson? Why?
- How was the students' participation with their peers during the class math activity helpful to their learning?

Responses included the benefits of the video for homework, the active learning opportunities, the increased amounts of teacher availability, and the increased time in class for peer collaboration.

The benefit of the increased amount of teacher facilitated practice time that flipped lessons provide was coded fifty-one times in the data. One reference was made to the ability to incorporate the common core math practice standards in conjunction with the content standards within a flipped format, and how that has increased mathematical confidence and learning in her classroom. Teacher C explained her perception that students learn more during a flipped lesson as follows:

> I think they definitely learn more with a flipped lesson because of the collaborating piece—being able to work together has proven very effective. What we do in class in a flipped lesson versus in a traditional lesson is so much more relevant—so the kids are more engaged, therefore learning more. Also because of the videos, they have them as reference for the rest of the year. Then, of course, they are getting that one-on-one attention from me, you know, when they are stuck or confused, so there are fewer gaps in their understanding. (T C)

Teacher B stated that not only did the students learn the mathematical concept better in the flipped format but they also got to learn about themselves and about how they learn, which would carry over to successes in other subjects as well.

Growth from feedback. Participating teachers recognized the importance of acting on feedback from all stakeholders. Formative assessments guide teachers' instructional decisions, and that is no different with flipped lessons. Two teachers indicated the use of "entry" or "exit" tickets after students watch the homework video to

check for understanding. Having the flexibility and insight to reteach a concept or clear up a misconception about a mathematic process is important to ensure student understanding. Teachers indicated that the flipped format provided natural formative assessment checkpoints with opportunities to revisit content either by having students rewatch the video or by taking advantage of small group remediation in class. They mentioned feeling rushed and unable to use the time to resolve misunderstandings with previous content when there was so much more content to cover in a traditional format.

Other important stakeholders to provide feedback about the flipped lessons are the students' parents. One teacher exclaimed, "It was so nice to hear that I was being supported and that they were in favor of the technique. It is great to get a positive email from a parent!" The positive reinforcement helped the teacher know her efforts to begin flipping some math lessons were on the right track. Teacher A said she worked with a parent to arrange a way for the student to access the technology needed to watch the video. While the family did not have a computer with Internet access at home, they collaboratively made a plan to work around the situation. If the parent was unable to get the student to the library or a coffee shop to use the Internet the night before, the student would inform the teacher first thing in the morning and the teacher would make a classroom computer accessible to the student right away to watch the video before class started. Not only was communication important to this success, but also the teacher's willingness to hear the issue and be flexible toward a solution. In both cases, the teacher was able to grow in her delivery of future flipped lessons through constructive feedback.

Need for support. The newest teacher to the concept of the flip indicated twice in her interview that she desired feedback and support from teachers who had previous

experience flipping lessons. She wanted to be able to share her thoughts, questions, and concerns over the process with other educators who were also flipping elementary level math. With a concern for the fidelity of her ability to flip a lesson for young students, she wished there was more of a network of elementary teachers flipping the lesson. Much of the support and resources she found online were focused on higher-grade levels. Additionally, as reported in the intentional content section, two of the three teachers found locating appropriate video content and classroom activity ideas for the elementary level to be challenging.

Summary

In this chapter, the researcher presented the findings of this descriptive qualitative study. The findings are based on the analysis of both the fifteen participating students' and the three participating teachers' interview transcripts, and are supported by the researcher's journal of observational notes. The findings were presented in two parts: the analysis of the student interview data and the analysis of the teacher interview data. Both parts correspond with major themes that emerged from each dataset.

Data in the first section focused on the participating students' experiences and perceptions of their own learning within a flipped mathematics lesson. In the area of data analysis, four major themes emerged as students discussed (1) their overall positive perception of and preference for flipped lessons; (2) their appreciation of the increased personalized learning time with the teacher; (3) their awareness of an increased ownership of their own learning; and (4) their experiences of increased positive parental involvement.

The second section of data focused on the participating teachers' experiences in implementation and perceptions of student learning within a flipped mathematics lesson. The researcher organized the emergent data for this section using the acronym of FLIP. Each letter represents a major theme that developed from the exploration of the teacher transcript data: (F) instructional Flexibility; (L) Learning culture; (I) Intentional planning; and, (P) reflective Practitioner. Furthermore, each of these major themes consisted of relative subthemes.

This descriptive case study examined the perceptions and experiences of one school through the collection and analysis of rich qualitative data organized by theme. This research was exploratory in nature, and was designed to look at elementary teachers' and students' perceptions of flipped mathematics lessons. This study examined students' perceived impact of flipped math lessons on their own learning and engagement, as well as the teachers' perceptions of students' learning and engagement. Interview data was recorded, transcribed, and then coded using open and descriptive coding. Major themes emerged from the student data, including student preference for flipped lessons, increased student ownership of learning, and increased positive parental involvement. The analysis of the teacher data revealed four major themes, including instructional flexibility, learning culture, intentional planning, and reflective practitioner. Associated subthemes were identified in the teacher data as well. Chapter 5 discusses the themes that emerged from this study as they relate to the research questions and the literature and makes recommendations for future research and practices based on the findings.

CHAPTER 5

CONCLUSIONS

The purpose of this study was to investigate elementary students' and teachers' perceptions of student learning through flipped lessons in elementary math. Although flipped learning has become a popular method of instructional delivery for students of all ages, there is little known about the perceptions of learning at the elementary level. This study was set in an elementary school and sought to provide insight on the experiences and perceptions of student learning from the point of view of elementary school teachers and students who had participated in flipped mathematics lessons.

This chapter discusses the interpretations, implications, and recommendations of the findings of this study. Interpretations of the findings will present conclusions regarding the research questions and address limitations of the study. The implications of the study will be considered in conjunction with the conceptual framework presented in the literature review. In addition to a discussion of how the results may be of use to relevant stakeholders, recommendations based on this study's conclusions will be considered.

Interpretation of Findings

The following four research questions directed this research and were designed to explore and describe student learning through flipped model lessons in one elementary school in North Carolina.

- What are elementary students' experiences of flipped math lessons?
- What are elementary students' perceptions of the impact of flipped lessons on their own learning?

- What are elementary teachers' perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement?
- What are elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format?

Themes and patterns emerged from interview data and observational notes and were reported in chapter 4. The themes are addressed below in response to the research questions as well as with regard to the themes proposed in the literature review.

Research Question 1: What are elementary students' experiences of flipped math lessons? After reviewing the transcripts and the data, several conclusions can be made signifying that students in this study had overall positive experiences with flipped mathematics lessons. The students' positive experiences of the flipped lessons were linked to the following associated traits of the flipped lesson format: an increased use of technology and the increased time for student-centered active learning.

Digital natives/digital wisdom. The students in this study are digital natives, as defined by Prensky (2001b), as they have grown up not knowing a world without digital technology. These students have been raised surrounded by the instant and abundant data available to the digitally wise. Prensky (2009) emphasizes the need for people to learn digital wisdom and have the ability to combine their knowledge and education with digital enhancements in order to efficiently access additional data, gain further insights, and seek alternate perspectives on content provided. The students in this study showed a preference for the increased use of technology in the flipped lesson format. For digitally wise students, the use of technology is a routine practice that they are accustomed to applying to their own recreational and educational endeavors. This is corroborated in the

study by the multiple positive responses in the interview data stating that the students enjoyed watching the videos via technology at home and utilizing technology to enhance their learning in the classroom. The students' experience of learning within a flipped lesson format is framed by their comfort with and desire of utilizing technology.

Student-centered learning. Interview responses and data analysis also revealed that students perceived flipped lessons to be more engaging than traditional math lessons. The reasons the students gave for describing the flipped format as more engaging than a traditional math lesson format were related to elements of constructivist theory, specifically student-centered active learning. Constructivist theory states that learning is an active process (King, 1993). In a flipped lesson, there is usually more time to apply to this pedagogy than in a traditional lesson where content rich lectures encompass much of the class time. The student-centered active learning that was featured in the study classrooms' lessons appealed to the students. The data surrounding the students' experiences also showed that students prefer to work in collaborative student groups, which is a prominent feature of active learning. Social interaction and communication are fundamental in the cognitive process, according to psychologist Vygotsky (1978). Following Vygotsky's theory, Turner (2011) states that student-centered learning promotes collaboration and cooperation among students in the classroom.

Common Core math and parental involvement. As described in chapter 4, the students reported that they experienced increased positive parental involvement in their studies during the flipped lesson format. The Common Core State Standards (2010) require teachers to focus on deeper conceptual learning in mathematics at the elementary age. Content standards are taught along with specific practice standards that allow for

deeper conceptual learning within each topic. One of the reasons that the researcher was inspired to study flipped learning at the elementary level was because the researcher had observed concerned parents as they tried to understand the new standards and the focus on conceptual learning. The conceptual models of mathematics used to teach elementary students within the common core are very different from the procedural based instruction that students' parents remember learning themselves as students. The flipped lesson format provided both the students and the parents with step-by-step instructional homework videos that explain "the new math." These videos not only provided the students with the preparation they needed to participate in the active learning in class the next day but also increased the parents' understanding of the conceptual models. The researcher noted that the teachers who had intentionally informed and prepared the stakeholders in their classroom (parents, administrators, etc.) about the flipped learning process had more of the students in their class who commented on the positive parental involvement. The students took note of the increased parental involvement in their homework, stating things like "more peaceful homework times" and "my parents liked to watch the videos, too." The flipped format homework videos bridged a communication gap between the school and the home and resulted in an increase of positive parental involvement with homework, as perceived by the students in this study.

Research Question 2: What are elementary students' perceptions of the impact of flipped lessons on their own learning? Much of what the students perceived as positive related to the first research question was also interconnected with their understanding of their own mathematical learning. Specifically, the following themes described in chapter 4 emphasized the students' perceptions of the impact of flipped

lessons on their own learning: more time with the teacher and an increase in student ownership of learning.

More time with the teacher. Students disclosed an appreciation for the increased personalized learning time with the teacher that they perceived during the flipped lesson. The literature positions the recent pedagogical shift towards student-centered learning (Prince, 2004; Turner, 2011). Student-centered learning provides more time for the teacher to individualize instruction and guide students in their learning. King (1993) described a "sage on the stage" as a traditional teacher-centered approach to instruction, as opposed to a student-centered approach that puts the teacher (guide) on the side, as a coach who facilitates the student's learning. Teachers in a flipped format are not the center of knowledge, but rather they are actively involved in the students' learning. The data suggests that the students noticed this shift of instructional method and liked it. Students indicated in the data that they felt more motivated in their learning by having the teacher as a guide on the side. They felt more confident, contrasted to having the teacher as the center of the classroom, where they felt more intimidated in expressing or sharing their own learning.

Increased student ownership of learning. As reported in chapter 4, students acknowledged taking a more responsible role in their own learning during the flipped lesson format. Prince (2004) defines active learning as learning that takes place through experiences that engage the learner in inquiry, is sometimes collaborative, and puts the responsibility of learning on the learner. In this study, students noticed they were more in control of their own learning than the teacher, and felt a sense of responsibility for their own learning. Students reported feeling more in control of the pace and amount of

content they learned with the video by being able to stop it, rewind it, and review it on their own. While research supports both student-centered instruction and guided instruction as being effective, flipped lessons use both pedagogies. As a result, the students felt more in control of the guided instruction they received via video for homework, and more responsible for learning the content and being ready to apply their knowledge in the classroom during the student-centered activities.

Research Question 3: What are elementary teachers' perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement? The results of the teacher data relate in tandem with both research questions three and four, as both questions convey the teachers' perceptions of student learning and engagement in a flipped lesson, and the data presented results in each case in comparison to a traditional lesson. However, since research question three is focused on the teachers' perceptions of the implementation of flipped lessons, this section will concentrate on the data that emerged related specifically to implementation. The themes associated with teachers' perceptions of the implementation of flipped lessons are: shift in pedagogical mindset, curating video resources, activity preparation, and ease of differentiation.

Shift in pedagogical mindset. The teachers in this study described their intentional shift in instructional mindset while implementing flipped lessons. They reported that successful implementation required clear communication with the students and the parents about the way flipped lessons differ from traditional ones, so they would know what to expect. This purposeful communication is not something a teacher would need to explicitly do within a traditional lesson, as students would already have been accustomed

to the format and work expectations. By intentionally explaining to both the students and their parents the way the video lectures for homework freed up classroom time, they felt the implementation of the actual lessons was more successful.

Teachers also described the change in their mindset regarding their classroom teaching style within a flipped lesson. The shift toward more active learning within the classroom time forced the existence of a more student-centered classroom. The teachers expressed their experiences of shifting to be a guide on the side, rather than a sage on the stage (King, 1993).

Curating video resources. A theme concerning the difficulty in acquiring appropriate elementary leveled flipped lesson resources emerged from the data. Two of the teachers expressed difficulty in locating videos to use for homework. These teachers experienced difficulty curating videos from online sources that fit elementary standards and recommended time lengths for the age (Bergmann and Sams, 2016). They also felt ill-equipped or time burdened with the thought of creating videos themselves. The literature mentioned the difference between digital immigrants and digital natives (Prensky, 2001b), suggesting that digital immigrant teachers might not be as comfortable with technology as their digital native students. This data reveals either a struggle in digital navigation or a lack of available resources for elementary levels. The acquisition of videos, at the elementary level, to use for homework for flipped lessons was perceived as a struggle in this study.

Activity preparation. Aligned with the need to be intentional in pedagogical mindset when implementing a flipped lesson, the teachers also perceived the need to be intentional in the preparation of successful classroom activities to support student

learning within a flipped classroom. The data showed that teachers reported being more purposeful in their planning and use of time for student learning in a flipped lesson. While active learning and student-centered learning were not new to all of the teachers in the study, the time allotted for such activities in the classroom was longer as a result of the implementation of flipped lessons. This additional time, saved by moving the lecture outside of the classroom, called for more intentional planning from the teachers. The teachers experienced and reported on the additional purposeful planning time required to implement a successful flipped lesson.

Ease of differentiation. One product of the above mentioned additional purposeful planning for a flipped lesson is more opportunity for the differentiation of content for students. There are several ways a flipped lesson can be differentiated (Bergmann and Sams, 2016) including video choice, note-taking tools, student manipulation of the video, and within the classroom with student grouping, activity content, and more strategic teacher attention. The data showed that the teachers in this study recognized the additional opportunities to differentiate for their students and took advantage of the benefit.

Research Question 4: What are elementary teachers' perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format? The major themes illustrating the perceptions and experiences of flipped lessons in comparison to traditional lessons are focused on preference for active learning, increased student engagement, increased student voice and choice, increased student ownership of learning, and the acknowledgement of students' preference for collaborative work.

Active learning. As evidenced by the teacher perception data, increased active learning time benefits student learning. Although the teachers had many positive opinions concerning various dimensions of the flipped lesson format, the theme that repeatedly came up concerning student learning was the benefit of increased time for active learning. Previous research supports the benefits of allowing students to learn by doing through student-centered authentic learning opportunities (Protheroe, Shellard, and Turner, 2004; Turner, 2011; Enfield, 2013). The teachers' preference mirrors the students' responses showing a preference for flipped lessons as a result of the increased amount of active learning time. The teachers highlighted the benefits of using active learning in their classrooms. They noticed that the students preferred learning in that format and attributed the time saved by the flipped lesson format as the reason for the increased active learning time.

Student engagement. An expected advantage of the use of active learning practices is increased student engagement. Increased student engagement through the active learning opportunities promoted deeper thinking, high level thinking, and more confident learners within the flipped lesson format. Active learning uses more hands-on activities where students learn by doing, and the teachers reported noticing the students' being more attentive and focused on the lesson, thus engaged. Another dimension of engagement related to the flipped format is the increased homework completion rates reported by the teachers within a flipped format. The students found the video lessons as homework to be more engaging than traditional homework. While this data is not measuring engagement in a quantitative manner, the teacher data, student data, and the researcher's notebook all revealed similar results of increased student engagement.

Student voice and choice. The flipped lesson format allowed for student choice of learning topic, partner, and product. The data revealed that the teachers found it was easier to release control of these instructional aspects and provide more student voice and choice. In the lessons observed, the students were able to view and manage the video lecture in a manner that best fit their own learning styles. They were able to choose learning partners to work with in the classroom and they also had choice surrounding the type of problem they solved in class as well as how they presented the product of their learning. The teachers' experiences and perceptions of the increased student agency within a flipped lesson indicated they felt it benefited the students' learning.

Student ownership of learning. Teachers in this study reported noticing an increase in student ownership of learning. This is also aligned with the student data, as the students reported feeling more responsible for their own learning within a flipped lesson format. The learning culture associated with flipped learning focuses on student-centered learning. The teacher perception data revealed that the teachers noticed students were coming to class more prepared to learn with homework completed, seeking help from peers or the teacher when needed more often in the flipped format than in a traditional lesson format. Flipped lessons also provide some independence for students to watch the video lecture at home, and this translated as student ownership of learning in the teachers' perception. The students' data supported this, as they reported that the ability to manipulate the homework video to help review and prepare for class gave them more of a sense of responsibility than traditional homework.

Collaborative work. Collaboration is a byproduct of student-centered active learning. Collaboration, active learning, and critical problem solving are elements that

are emphasized by the standards within the Common Core State Standards (CCSS). The standards petition for elementary age students to be exposed to the conceptual foundations of rigorous math practices involving collaborative thinking (NGACBP, 2010). Prensky (2001a) and Phillips and Trainor (2014) identified in the literature that digital natives thrive in busy, collaborative environments. The data in this study support this, as both the student and the teacher data designated a preference for flipped lessons based on the increased amount of collaborative work time associated with the method. Although there are other instructional pedagogies that involve collaborative learning cultures, the increased time provided for this method within the flipped format stood out as noteworthy in this study.

The teachers in this study noted that the time saved by moving some of the direct instruction out of class time and into homework time was beneficial to the mathematical learning of their students. They reported having increased time for more active learning experiences and collaborative activities, which allowed for more authentic practice problems of choice, which resulted in students being more engaged and showing an increase in the ownership of their own learning.

Additional Findings

Additional findings emerged from the teacher data that did not directly relate to the research questions, but are notable. As evidenced by the data, teachers reported the intentional planning needed in order to create a successful flipped learning environment. They indicated the importance of planning appropriate video content for homework and meaningful class time activities. While the benefits of student learning may outweigh the time spent planning, two of the three teachers reported the additional time as a significant

factor in using the flipped format. The teachers felt the overall planning time for a flipped lesson was about the same as a traditional lesson, but it was all up-front planning for the video and the activity, as opposed to in a traditional lesson where reteaching is often necessary and additional planning time is required for that. This factor was noted in the literature as well. Hamdan, McKnight, McKnight, and Arfstrom (2013) wrote that the planning and instructional knowledge necessary to maximize the active learning in the flipped classroom require a more skilled educator than that of a traditional classroom. Also, the teachers described a purposeful shift in mindset concerning the instructional change from sage on the stage to guide on the side (King, 1993) was necessary in order to navigate through a flipped lesson.

Furthermore, two of the participating teachers described difficulty in finding elementary level resources related to flipped learning. For example, there are limited videos existing for teaching elementary content available for curation, compared to the vast resources available to upper levels. The data also indicated that teachers seek support and advice avenues from experienced elementary teachers who have flipped their classrooms, and this sort of support is not as easily accessible as it is for teachers of upper grades and adult learners.

Limitations

While this single case study cannot provide a definitive foundation for the implementation of flipped learning at the elementary level, it does have implications for prospective audiences, such as administrators, teachers, and curriculum designers. Other individual educators, schools, or instructional communities could use the results of this study to guide decisions regarding the use of flipped learning in other elementary grades.

Additionally, this study cannot claim to include all new findings of the use of flipped learning in elementary grades, but it does provide perceptional data of the participants at the site to date.

Implications

One of the main purposes for this study was to address the lack of substantial previous research focused on elementary age students' and their teachers' perceptions of mathematical learning within a flipped lesson format. This study observed and recorded those perceptions with descriptive qualitative data that additionally compared teachers' perceptions of the flipped format to that of a traditional lesson format. Because little empirical data existed to date that had a focus on the application of the flipped format to elementary mathematics, this study aimed to fill a gap in the literature.

Findings of this study could help to better the field of education by bringing awareness to the benefits and positive perceptions of employing the flipped lesson format in elementary grades. As evidenced by the data, fifth grade mathematics students' experiences of learning with the flipped format are positive for many reasons, including their preference for the method over a teacher-centered traditional model, their increased ownership of learning, and their experience of increased positive parental involvement. These student perspectives could help guide the decisions of educators who are considering the method in their own classrooms to see the positive reception of the students in this study. There are also implications for educators who are seeking the experiences of the teachers who have used the flipped format in elementary mathematics.

Furthermore, this study gives perspective on the transformative learning processes of educators undergoing a change in pedagogy, such as the shift to flipped learning in this

case. The results of this study indicated that students and teachers perceived positive benefits of the flipped lesson format and that students preferred the flipped format to traditional lessons. While students perceived that the flipped format improved their own learning, they did not necessarily need to appropriate change in order to experience the benefits of the pedagogy. On the other hand, the teachers were required to change their former thought process and approach to teaching in order to use the flipped lesson design. Transformative learning theory states that adult learners are reflective in terms of content, process, and premise while evolving through a change (Mezirow, 1991). The theory is based on constructivist theory, as learners make meaning of a learning experience. The meaning, or perceptions, of the teachers learning within the context of the flipped learning instructional practice was positive as evidenced by the data.

Recommendations for Action

Based on careful analysis of the data, the following recommendations for action have been established:

- Resources should be developed within school districts or learning networks focusing on flipped learning at the elementary level. Resources could include a bank of content-aligned videos that are appropriate lengths for elementary age student attention spans and student-centered active learning ideas that are relevant to elementary grade level standards and young student aptitudes.
- All stakeholders (administrators, colleagues, parents, and students) should be fully prepared and informed about what flipped lessons entail and how they will be implemented before they are implemented.

- Teachers should maximize the time they save when using the flipped format and incorporate active learning experiences whenever possible.

These recommendations come as a result of the literature, as well as the data gathered and analyzed throughout this study. The researcher acknowledges that this study focused on a small sample size within a specific location and population. While these recommendations come from the analysis of the data gathered under these conditions, the researcher feels these recommendations for action in the practice and implementation of flipped lessons at the elementary level could be applicable to other elementary educators and settings.

Recommendations for Further Study

This study focused on a specific site, with a specific grade level, and specific student and teacher population to explore perceptions surrounding flipped learning in elementary math. The findings of this study offer multiple entry point opportunities for other possible research related to the use of flipped learning. Based on the results of this study, the researcher recommends additional studies to be conducted in the following areas:

- Furthering the descriptive narrative of the perceptual data gathered in this study with different student and staff populations would strengthen the validity and reliability of this study.
- This study could be replicated with additional elementary grade levels. Researchers may be able to learn if similar perceptions of mathematical learning occur with younger elementary students.

- This study could be modified to investigate flipping other subject areas at the elementary level.
- This study could be repeated, but extended to increase the sample size. A larger student and teacher population could offer deeper understanding of the perceptions analyzed in this study.
- Another study could be developed to focus more intently on teacher perceptions of the processes and planning involved in flipping elementary lessons.
- A similar study could be conducted in a setting where the teacher fully flips the classroom, as opposed to the flipped lesson design of this study.
- The role of the parent in flipped learning at the elementary level emerged as a theme within this study. Further qualitative research investigating the perceptions of the parents of students who experience the flipped lesson format could add to the literature.
- Further studies could focus on the professional development necessary to prepare elementary teachers for flipping lessons.
- Support models for educators practicing the flipped model could be explored quantitatively in relation to the effectiveness of the flipped lessons.

Conclusion

Based on this descriptive case study, the researcher found that elementary students and teachers have an overall positive perception of flipped lessons implemented

in mathematics. Common themes in the data revealed four main outcomes: both the teachers and the students had a preference for flipped lessons over traditional lessons, increased active learning benefited student learning, students displayed an increase in ownership of their learning, and flipped video lessons provided a valuable preview and review of content to the students. The student data further evidenced the students' preference for flipped lessons, including the students noticing the benefit of having additional time with their teacher on a more individual level than that of a traditional lesson, and the students' perception of increased parental involvement with their homework. The teacher data indicated implications for instructional flexibility, intentional planning, the importance of student-centered active learning, and maintaining a reflective practice when implementing a new pedagogy like flipped learning.

The results of this study may provide insight to other school districts, curriculum planners, or individual educators who are interested in implementing the flipped model at the elementary level. One purpose for this research was to help fill the gaps in the current literature regarding student and teacher perceptions of flipped learning in mathematics at the elementary level. The researcher's primary goal for this research was to learn how upper elementary age students make sense of their mathematical learning when content is presented in a flipped lesson format and how this structure influences their experiences and engagement in the content. It is important to find out how teachers and students perceive student learning within particular pedagogical methods. As educators across the planet persevere in effectively educating the digital natives of their classrooms, new and innovative instructional approaches, such as flipped learning, need to be explored from all angles and with all age levels. The perceptual data gathered in this study will guide

future stakeholders' decisions concerning the implementation of flipped learning at the elementary level.

REFERENCES

Alberta Ministry of Education. (2013). Digital citizenship: Technology briefing, No. 2. Alberta Education.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives. New York: Longman.

Baker, C. (2012). Flipped classrooms: Turning learning upside down: Trend of "flipping classrooms" helps teachers to personalize education. *Deseret News*, 11. Retrieved from http://www.deseretnews.com/article/765616415/Flipped-classrooms-Turning-learning-upside-down.html?pg=all

Balanskat, A., Blamire, R., & Kefala, S. (2006). The ICT impact report: A review of studies of ICT impact on schools in Europe: *European Schoolnet*. Retrieved from http://insight.eun.org/shared/data/pdf/impact_study.pdf

Barnes, K., Marateo, R., & Ferris, S. (2007). Teaching and learning with the net generation. *Innovate*, 3(4).

Bates, S. & Galloway, R. (2012). The inverted classroom in a large enrollment introductory physics course: A case study. *The Higher Education Academy*.

Becker, C. M. (2007). *An examination of the relationship between teachers' technological experiences, skills, and integrative practices*. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3263046)

Bergmann, J. & Sams, A. (2012). *Flip your classroom. Reach every student in every*

class every day. Washington, DC: International Society for Technology in Education.

Bergmann, J. & Sams, A. (2013). Flipping for mastery. *Educational Leadership,71(4),* 24–29. Bergmann, J. & Sams, A. (2014). Flipped learning: maximizing face time. *ProQuest Education Journals,* 68(2), 28–31.

Bergmann, J. & Sams, A. (2014). Flipped Learning. Gateway to student engagement. Washington, DC: International Society for Technology in Education.

Bergmann, J. & Sams, A. (2016). *Flipped Learning for elementary instruction.* Washington, DC: International Society for Technology in Education.

Bloom, B.S. (1956). *Taxonomy of educational objectives, handbook 1: The cognitive domain.* New York, NY: David McKay Co., Inc.

Bomia, L., Beluzo, L., Demeester, D., Elander, K., Johnson, M., & Sheldon, B. (1997). *The impact of teaching strategies on intrinsic motivation.* Champaign, IL: ERIC Clearinghouse on Elementary and Early Childhood Education. p. 294.

Bonwell, C. & Eison, J, (1991). *Active learning: Creating excitement in the classroom.* Washington, DC: School of Education and Human Development, GWU.

Bruner, J. (1966). *Toward a theory of instruction*. Cambridge, MA: Harvard University Press.

Butt, A. (2014). Student views on the use of a flipped classroom approach: Evidence from Australia. *Business Education & Accreditation*, 6(1), 33–43.

Chen, Y., Wang, Y., Kinshuk, & Chen, N. (2014). Is FLIP enough? Or should we use the FLIPPED model instead? *Computers & Education*, 79, 16–27.

City-Data. (2016). Cary, North Carolina Neighborhood Map—Income Boundaries.

Retrieved on February 6, 2016 from http://www.city-data.com/nbmaps/neigh-Cary-North-Carolina.html.

Clark, K. (2013). Examining the effects of the flipped model of instruction on student engagement and performance in the secondary mathematics classroom: An action research study. Retrieved from ProQuest.

Coghlan, D. & Brannick, T. (2014). *Doing action research in your own organization, 4th Edition.* Washington DC: Sage.

Creswell, J. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research, 4th ed.* Boston: Pearson.

Creswell, J. (2013). *Qualitative Inquiry and Research Design: Choosing Among Five, 3rd ed.* Los Angeles, CA: Sage.

Day, J., & Foley, J. (2006). Evaluating a web lecture intervention in a human–computer interaction course. *IEEE Transactions on Education*, 49(4), 420–431.

Davies, R., Dean, D., and Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development*, 61, 563–583.

Dewey, J. (1944). *Democracy and Education*, New York: Macmillan Company. p. 167.

Enfield, J. (2013). Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN. *TechTrends*, 57(6), 14–27.

Ertmer, P. A. (1999). Addressing first- and second-order barriers to change: Strategies for technology integration. *Educational Technology, Research and Development*, 47(4), 47–61.

Flipped Learning Network (2014). The four pillars of F-L-I-P. Retrieved from

http://www.flippedlearning.org/definition.

Frydenberg, M. (2012). *Flipping Excel.* Proceedings of the Information Systems Educators Conference, 29(1914), 1–11.

Fulton, K. (2012). Inside the flipped classroom. *The Journal*. Retrieved from http://thejournal.com/articles/2012/04/11/the-flipped-classroom.aspx

Gannod, G.C., Burge, J.E., & Helmick, M.T. (2008). *Using the inverted classroom to teach software engineering.* Proceedings of the 30th International Conference on Software Engineering, Leipzig, Germany, May 10–18.

Garrison, D. R., & Kanuka, H. (2004). Blended Learning: Uncovering Its Transformative Potential in Higher Education. *The Internet and Higher Education*, 7, 95–105.

Goodwin, B & Miller, K. (2013). Evidence on flipped classrooms is still coming in. *Educational Leadership*, 70(6), 78–80.

Hamdan, N. McKnight, P., McKnight, K., & Arfstrom, K. M. (2013). *The flipped learning model:* A white paper based on the literature review titled "A review of flipped learning." Retrieved from http://fln.schoolwires.net/cms/lib07/VA01923112/Centricity/Domain/41/WhitePaper_Flippedlearning.pdf

Hannafin M.J. & Land S.M. (1997). The foundations and assumptions of technology enhanced student-centered learning environments. *Instructional Science*, 25(3), 167–202.

Hawks, S. (2014). The flipped classroom: Now or never? *Education News*, 82(4).

Herreid, C. & Schiller, N. (2013). Case Studies and the Flipped Classroom. *Journal of College Science Teaching*, 62–65.

Honeycutt, B. & Garrett, J. (2013). *The flipped approach to a learner-centered class*: A magna publications white paper.

Jaster, R.W. (2013). *Inverting the classroom in college algebra: An examination of student perceptions and engagement and their effects on grade outcomes*. PhD Thesis, Texas State University-San Marcos, May 2013.

Keengwe, J., Onchwari, G., & Wachira, P. (2008). Computer technology integration and student learning: Barriers and promise. *Journal of Science Education and Technology*, 17(6), 560-565. doi: 10.1007/s10956-008-9123-5

King, A. (1993). From sage on the stage to guide on the side. *College Teaching*, 41, 30–35.

Kirschner, P. A., Sweller, J., & Clark, R. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential and inquiry-based teaching. *Educational Psychologist*, 41, 75–86.

Kivunja, C. (2014). Theoretical perspectives of how digital natives learn. *International Journal of Higher Education,* 3(1).

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, 31(1), 30–43.

Lowell, J., Bishop, J., & Verleger, M. (2013). *The flipped classroom: A survey of research*. Paper accepted to the 120th American Society of Engineering Education Annual Conference & Exposition, Atlanta, GA, June 23–26.

Margulieux, L. E., Bujak, K. R., McCracken, W. M., and Majerich, D. M. (2014).

Hybrid, blended, flipped, and inverted: Defining terms in a two dimensional taxonomy. Paper accepted to the 12th Annual Hawaii International Conference on Education, Honolulu, HI, January 5–9.

Marzano, R. & Toth, M. (2014). *Teaching for rigor: A call for a critical instructional shift.* (White paper). Learning Sciences Marzano Center, West Palm Beach, FL.

Mayer, R. (2004). Should there be a three-strikes rule against pure discovery learning? A case for guided methods of instruction. *American Psychologist*, 59(1) 14–19. doi: 10.1037/0003-066X.59.1.14

McLaughlin, J. E., Roth, M. T., Glatt, D. M., Gharkholonarehe, N., Davidson, C. A., Griffin, L. M., Esserman, D. A., & Mumper, R. J. (2014). The flipped classroom: A course redesign to foster learning and engagement in a health professions school. *Academic Medicine*, 89, 236–243.

Merriam, S. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mezirow, J. (1991). *Transformative Dimensions of Adult Learning*. San Francisco, CA: Jossey-Bass.

Milman, N. B. (2012). The Flipped Classroom Strategy: What Is It and How Can It Best Be Used? *Distance Learning*. 9(3), 85–87.

Moalosi, W.T. (2013). Effects of direct instruction and social constructivism on learners' cognitive development: a comparative study. *Academic Research International*, 4(6).

Mok, H.N. (2014). *Teaching tip: The flipped classroom. Journal of Information Systems Education.* 25(1), 7–12.

Moore, A., Gillett, M., Steele, M. (2014). Fostering student engagement with the flip. *The Mathematics Teacher*. 107(6), 420–425.

Moreno, R. (2004). Decreasing cognitive load for novice students: Effects of explanatory versus corrective feedback in discovery-based multimedia. *Instructional Science,* 32, 99–113.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards for Mathematics.* Retrieved from http://www.corestandards.org/Math

Peck, C., Cuban, L., & Kirkpatrick, H. (2002). High-tech's high hopes meet student realities. *Education Digest,* 67(8), 47.

Penner, J. (1984). *Why many college teachers cannot lecture*. Springfield, Ill.: Charles C. Thomas.

Phillips, C. & Trainor, J. (2014). Millennial students and the flipped classroom. *Journal of Business and Educational Leadership,* 5(1).

Piaget, J. (1950). *The psychology of intelligence*. New York: Routledge.

Prensky, M. (2001a). Digital natives digital immigrants part 2: Do they really think differently? On The Horizon, 9(6), 3–16. http://dx.doi.org/10.1108/10748120110424843

Prensky, M. (2001b). Digital natives, digital immigrants part 1. On The Horizon, 9(5), 1–6. http://dx.doi.org/10.1108/10748120110424816

Prensky, M. (2009). H. sapiens digital: From digital immigrants and digital natives to digital wisdom. *Journal of Online Education,* 5(3).

Prensky, M. (2010). *Teaching Digital Natives: Partnering for real learning.* Thousand

Oaks, CA: Corwin.

Prensky, M. (2012). *From Digital Natives to Digital Wisdom: Hopeful Essays for 21st Century Learning.* Thousand Oaks, CA: Corwin.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education,* 93(3), 223–231. doi:10.1002/j.2168-9830.2004.tb00809.x

Project Tomorrow. (2014). Speak up survey: Flipped learning network. Retrieved from http://www.tomorrow.org/speakup/pdfs/SU13SurveyResultsFlippedLearning.pdf

Protheroe, N., Shellard, E., & Turner, J. (2004). *Helping struggling learners in the elementary and middle grades.* Arlington, VA: Educational Research Service.

Prouty, C. (2014). *Student engagement: Best practices in teaching in a K-5 blended learning environment* (Doctoral dissertation, Northwest Nazarene University).

Roberts, G. (2005). *Technology and learning expectations of the Net Generation. In* Oblinger, D. and Oblinger, J. (Eds.), Educating the Net Generation 3.1–3.7). Retrieved from http://www.educause.edu/research-and-publications/books/educating-net-generation/technology-and-learning-expectations-net-generation

Ruhl, K., Hughes, C., Schloss, P. (1987). *Using the pause procedure to enhance lecture recall.* Teacher Education and Special Education 10: 14–18.

Saldaña, J. (2015). *The Coding Manual for Qualitative Researchers, 3rd Edition*. Los Angeles, CA: Sage.

Stake, R., (1995). *The Art of Case Study Research.* Thousand Oaks, CA: Sage.

Staker, H., & Horn, M. (2012). *Classifying K-12 blended learning*. Retrieved from the Innosight Institute website http://files.eric.ed.gov/fulltext/ED535180.pdf

Stillwater Area Public Schools. (2012). *The Flipped Classroom*. Retrieved from http://www.stillwater.k12.mn.us/departments/technology/technology-around-district/flipped-classroom

Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15, 171–93. doi:10.1007/s10984-012- 9108-4

Tapscott, D. (2009). *Grown up digital: How the net generation is changing your world.* New York: McGraw-Hill.

Tucker, B. (2012). The flipped classroom. *Education Next,* 12(10), 82–83.

Turner, S. (2011). Student-centered instruction: Integrating the learning sciences to support elementary and middle school learners. *Preventing School Failure*, 55(3), 123–131.

United States Department of Education. (2016). *The National Blue Ribbon Schools Award Winners.* Retrieved from http://nationalblueribbonschools.ed.gov/awardwinners/index.php

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wadsworth, B. J. (2004). *Piaget's theory of cognitive and affective development: Foundations of constructivism*. Longman Publishing.

Wake County Public School System, Data and Accountability Student Locator. (2015). Child Nutrition Services FRPL Count by School. Retrieved on February 6, 2016 from

http://www.wcpss.net/cms/lib/NC01911451/Centricity/Domain/100/FRPL_EL_Performance_2015.pdf

APPENDIX A

The Four Pillars of F-L-I-P™

According to FLN (2014), in order to engage in Flipped Learning, teachers must incorporate the following four pillars into their practice:

F- Flexible Environment

Flipped Learning allows for a variety of learning modes; educators often physically rearrange their learning spaces to accommodate a lesson or unit, to support either group work or independent study. They create flexible spaces in which students choose when and where they learn. Furthermore, educators who flip their classes are flexible in their expectations of student timelines for learning and in their assessments of student learning.

F.1	I establish spaces and time frames that permit students to interact and reflect on their learning as needed.
F.2	I continually observe and monitor students to make adjustments as appropriate.
F.3	I provide students with different ways to learn content and demonstrate mastery.

L- Learning Culture

In the traditional teacher-centered model, the teacher is the primary source of information. By contrast, the Flipped Learning model deliberately shifts instruction to a learner-centered approach, where in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities. As a result, students are actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful.

L.1	I give students opportunities to engage in meaningful activities without the teacher being central.
L.2	I scaffold these activities and make them accessible to all students through differentiation and feedback.

I- Intentional Content

Flipped Learning Educators continually think about how they can use the Flipped Learning model to help students develop conceptual understanding, as well as procedural fluency. They determine what they need to teach and what materials students should explore on their own. Educators use Intentional Content to maximize classroom time in order to adopt methods of student-centered, active learning strategies, depending on grade level and subject matter.

I.1	I prioritize concepts used in direct instruction for learners to access on their own.
I.2	I create and/or curate relevant content (typically videos) for my students.
I.3	I differentiate to make content accessible and relevant to all students.

P- Professional Educator

The role of a Professional Educator is even more important, and often more demanding, in a Flipped Classroom than in a traditional one. During class time, they continually observe their students, providing them with feedback relevant in the moment, and assessing their work. Professional Educators are reflective in their practice, connect with each other to improve their instruction, accept constructive criticism, and tolerate controlled chaos in their classrooms. While Professional Educators take on less visibly

prominent roles in a flipped classroom, they remain the essential ingredient that enables Flipped Learning to occur.

P.1	I make myself available to all students for individual, small group, and class feedback in real time as needed.
P.2	I conduct ongoing formative assessments during class time through observation and by recording data to inform future instruction.
P.3	I collaborate and reflect with other educators and take responsibility for transforming my practice.

Flipped Learning Network (FLN), (2014) The Four Pillars of F-L-I-P$^{TM:}$ FLN Four Pillars information used with permission. http://flippedlearning.org/cms/lib07/VA01923112/Centricity/Domain/46/FLIP_handout_FNL_Web.pdf

APPENDIX B

Student Interview Guide

Thank you for agreeing to help me with my research. I appreciate your help!
I'd like to ask you a few questions about the flipped math lesson you just completed. There are no right or wrong answers. I would like to learn more about what you thought about the lesson.

(RQ#1 What are the elementary math students' experiences of flipped lessons?)
General/Experiences

1. Tell me about your math homework assignment.
2. Tell me about the activity you did during math class.
3. How would you describe a flipped lesson to a friend who didn't know what it was?
4. What do you like about the flipped lessons?
5. What don't you like about the flipped lessons?
6. Would you recommend a flipped lesson to your friends? Why or why not?

(RQ#2 What are elementary students' perceptions of the impact of flipped lessons on their own learning?)
Perceptions of learning

7. What do you think you learned from the lesson?
8. How did the video you watched for homework help you prepare for the activity during math class today? How was having a video to watch for homework helpful for your learning?
9. How did the activity during math class help you understand the content?
10. When your teacher uses a flipped math lesson, do you think you learn more, less, or about the same as a regular lesson? Why?
11. How has the flipped lesson format improved your learning of mathematics?
12. How was your participation with your peers in the math activities during class time helpful to your learning?
13. How is a flipped lesson engaging?
14. Any other comments about flipped math lessons?

NOTE: All follow-up interviews will follow this method of questioning. Probing questions will be used throughout the interview(s) to gain a more comprehensive description of participants' experiences.

APPENDIX C

Teacher Interview Guide

Thank you again for agreeing to help me with my research. I could not do this without your cooperation. I'd like to ask you a few questions about the flipped math lesson you just completed with your class. There are no right or wrong answers. I would like to learn more about what you thought about the lesson.

(RQ#3 & 4 What are an elementary teacher's perceptions and experiences of the implementation of flipped lessons as it relates to student learning and engagement? What are an elementary math teacher's perceptions of student learning and engagement in a flipped lesson format versus a traditional math lesson format?)

General/Experiences

1. How would you describe your role as a teacher implementing a flipped lesson?
2. How would you describe your experience preparing for a flipped lesson? How does that experience compare to preparation for a traditional lesson?
3. Tell me about a time when you think using a flipped lesson was successful.
4. Tell me about at time when you think using a flipped lesson was unsuccessful.
5. What are the advantages and disadvantages of a flipped math lesson?
6. What do you like about the flipped lessons?
7. What do you not like about the flipped lessons?

Perceptions of Student Learning and Engagement

8. What do you think the students learned from the lesson?
9. How did the video the students watched for homework help them prepare for the activity during math class today? How was having a video to watch for homework helpful for their learning?
10. How did the activity during class support the students learning?
11. When you use a flipped math lesson, do you think the students learn more, less, or about the same as a regular lesson? Why?
12. How was the students' participation with their peers during the class math activity helpful to their learning?
13. Do you feel like your students are able to focus or pay attention more or less during a flipped homework assignment or a regular homework assignment?
14. Do you think your students are more engaged during the lesson after the flipped video homework?
15. Have you noticed a change in your students' attitudes about homework when utilizing a flipped lesson format?
16. Any other comments about flipped math lessons?

NOTE: All follow-up interviews will follow this method of questioning. Probing questions will be used throughout the interview(s) to gain a more comprehensive description of participants' experiences.

APPENDIX D

Parent Consent Form

PARENT/GUARDIAN CONSENT FOR A MINOR TO PARTICIPATE IN A RESEARCH PROJECT

University of New England, Doctor of Education in Educational Leadership

Title of Project: Teacher and Student Perceptions of Flipped Lessons in Elementary Math

Researcher: Susan Mosher

What is the purpose of the study? The purpose of this doctoral research study is to investigate the teachers' and students' perceptions of student learning through flipped lessons in elementary math.

What procedures are involved? For this research, I will be observing a math lesson in a flipped format in your child's classroom, and then I will interview some students to learn about their experiences and perceptions of their own learning. I will digitally record the interview sessions to aid in my data collection. A flipped lesson is an instructional approach in which direct instruction is provided in a short video to be watched from home as homework, and classroom time is transformed into a dynamic, interactive learning environment where the teacher guides students as they apply concepts and engage in the subject matter.

What are the possible benefits? While there is no direct benefit to your child for participating in this research (other than a token gift of a $1 gift certificate to the school store from the researcher), there are indirect benefits to future instructional planning and research in the field of elementary education. Insights acquired through this research could prove useful in the development of flipped programs and student-centered mathematics classrooms.

What are the possible discomforts or risks to your child? There are no foreseeable risks or discomforts from participation in this study.

Contact Information:
If you have questions regarding your child's participation in this research, you may contact Susan Mosher, Instructional Resource Teacher, and study researcher in person, at 919-387-4493 or by email smosher1@une.edu.

How will the privacy and confidentiality of your child's information be protected? The data in this study will be confidential. I will be the only individual with access to interview recordings and transcripts. Your child will not be identified by name in the research report or any future publications. Your child will be provided with an alias that

will be used throughout the data-gathering and research report. Only the researcher will know the students' real names.

Participation
Participation in this research project is completely voluntary. You have the right to withdraw your child for any reason at any time without penalty to you or your child. Your child can decline to participate, decide to stop at any time, or refuse to answer any questions without penalty.

Agreement
I have been informed about the study's purpose, procedures, possible benefits and risks, and protections. I have been given an opportunity to ask questions and I understand that I can contact the researcher to ask other questions at any time. By signing this form, I am not waiving any of my legal rights. I have read and understand this form and I sign it freely and voluntarily. I understand that I will be given a copy of this form to keep.

I agree to allow my child _____ to participate in this study.

_____
Printed name of Parent/ Guardian

_____ _____
Signature of Parent/ Guardian Date

I do NOT agree to allow my child _____ to participate in this study.

_____
Printed name of Parent/ Guardian

_____ _____
Signature of Parent/ Guardian Date

_____ _____
Signature of Researcher Date

APPENDIX E

Student Assent Form

University of New England

Teacher and Student Perceptions of Flipped Lessons in Elementary Math

Hi, my name is Mrs. Mosher. I am here to talk to you about a lesson you will be participating in for math. For this lesson, your teacher will be using a special type of lesson called a "flipped lesson." After the lesson, I will ask you some questions, so I can find out what you thought of that lesson.

I will be coming to your math class to visit and watch the lesson, then I will meet with you afterwards to ask you what you thought about that lesson. If you want to be a part, I will ask you some questions and record our meeting so that I can remember what you said and write it down later. If you don't want to share your thoughts, you do not have to, you can still be in all the lesson activities, I just won't ask you the questions after or keep track of your answers.

When we are finished with our meeting, I will write a report about what I learned, but I will not use your name or anyone else's name.

Your parents have given us permission to ask you if you would like to be a part of this activity but you do not have to take part if you do not want to and no one will be mad at you if you decide not to.
It is completely up to you and you can change your mind and stop being in the activity at any time.

Do you have any questions?

Do you feel that you would like to be in the activity?

If no: Thank you for talking to me.

If yes: Print your name or put an X or your initial on the line below.

I have decided to be in the activity even though I know that I don't have to do it. Mrs. Mosher has answered all my questions.

Child's signature or mark _____

Signature of person obtaining consent _____ Date _____

Print name of person obtaining consent _____

APPENDIX F

Cooperating Teacher Participant Consent Form

University of New England
Teacher and Student Perceptions of Flipped Lessons in Elementary Math

Dear _____

You are invited to participate in this research study. You are eligible to participate in this study because you are a member of the *School* community of educators, and you teach the grade level and subject matter related to the focus of this study.

The following information is provided in order to help you to make an informed decision whether or not to participate. If you have any questions at any time, please do not hesitate to ask.

The purpose of this doctoral research study is to investigate the teachers' and students' perceptions of student learning through flipped lessons in elementary math. A flipped lesson is an instructional approach in which direct instruction is provided in a short video to be watched from home as homework, and classroom time is transformed into a dynamic, interactive learning environment where the teacher guides students as they apply concepts and engage in the subject matter. Your participation in this study requires you, if you have not done so already, to participate in professional development on the creation and implementation of The Flipped Learning Model[tm].

For this research, the researcher will be observing one math lesson in a flipped format in your classroom and afterwards will interview you to learn about your experiences implementing the flipped lesson and to ask you about your perceptions of your students' learning.

Interviews will be audio recorded for the researcher's use only. There are no known risks associated with this research. The information obtained in this study will have no bearing on supervision, evaluation or other professional responsibilities. Any information obtained during this study which could identify you will be kept strictly confidential. The information obtained in this study may be published in educational journals or presented at educational conferences, but the data will contain no identifying information.

In addition, the researcher will conduct student interviews in order to discover what students experience and perceive of their own learning when a flipped lesson is utilized.

Your rights as a research subject have been explained to you. You are free to decide not to enroll in this study or to withdraw your participation at any time without adversely affecting your relationship with the investigator, *School* or The University of New England.

If you have any additional questions concerning your rights or the details of this study,

you may contact Susan Mosher, Instructional Resource Teacher, and study researcher in person, at 919-387-4493 or by email smosher1@une.edu.

Documentation of Informed Consent
You are voluntarily making a decision whether or not to participate in this research study. Your signature certifies that you have agreed to participate having read and understood the information presented. You will be given a copy of this consent form to keep.

_____ _____
Signature of Participant Date

In my judgment the participant is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to participate in this research study.

_____ _____
Signature of Investigator Date