THE FLIPPED MATHEMATICS CLASSROOM: A MIXED METHODS STUDY EXAMINING ACHIEVEMENT, ACTIVE LEARNING, AND PERCEPTION

by

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B.S., University of Kansas, 2004

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AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

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Abstract

This study addresses how the flipped method of classroom instruction differs from traditional classroom instruction when comparing student achievement measures in middle and high school mathematics classrooms. The flipped classroom is defined by the Flipped Learning Network (2014) as an instructional method that moves direct instruction outside of the classroom in order to make room in the classroom for a more interactive learning environment where students can actively engage in the content. The flipped classroom strategy theoretically allows teachers the time to develop mathematical ideas and the ability to facilitate that development. For the Common Core State Standards initiative to be effective, teachers need to engage students in new learning experiences that support college and career readiness. By implementing a technology based instructional approach, like the flipped classroom strategy, teachers are able to blend twenty-first century skills with the development of the essential habits of mind of mathematically proficient students (Brunsell & Horejsi, 2013).

This study seeks to understand how the flipped method of classroom instruction can lead to improved student achievement in mathematics courses and improve student perceptions about math in order to encourage course consumption in the future (Zollman, 2011). A modified explanatory sequential mixed methods design was used, and it involved collecting quantitative data and then explaining the quantitative results with in-depth qualitative data. In the quantitative phases of the study, NWEA Mathematics MAP Assessment data were collected from middle school students and course common final assessment scores were collected from middle school and high school students in a large Midwestern suburban school district to determine how student math achievement was impacted for students in a flipped classroom as compared to a traditionally instructed classroom. The frequency of active learning incidents was

also collected during classroom observations. The qualitative phase was conducted as a follow up to the quantitative results to help explain the quantitative results. In this exploratory follow-up, student and teacher perceptions of mathematics achievement as a result of the flipped classroom approach to instruction with middle and high school math students and how those perceptions might be different than those of students and teachers in traditionally taught classrooms along with descriptions of observable active learning incidents in the school district were explored.

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Chapter 1 - Introduction

Throughout the history of the United States, political and societal factors have heavily influenced mathematics education (NCTM, 1970). Whether it was industrialization in the mid-1800s, innovations in science and technology like the telephone, the light bulb, the internet, or the need to compete in a global economy, the need for more individuals with technical skill sets have steadily increased (National Center for Educational Statistics, 2011).

The Common Core movement has risen, in recent times, as a response to the reality that engineering and technology define nations as world powers. It draws on the political and social needs to maintain and grow an economy and compete with the rest of the world and impacts educational research (The Common Core State Standards Initiative, 2014). The focus in the educational community involves suggestions for alternate methods of instruction and a shift away from a drill based approach to learning discrete skills. Common Core suggests a focus on the interconnectedness of math and the balance of procedures and concepts along with developing 21st century learners that are well versed in technology (The Common Core State Standards Initiative, 2014).

Exploring this movement further, political and social factors have teachers of mathematics concerned about accountability (U.S. Department of Education, 2015). How do we focus on standardized approaches to measure student learning, yet shift away from a discrete skills approach? How do we use our traditionally published textbooks to teach in a more thematic and connected manner? How do we improve our vertical discussions about content, and our content knowledge in general, in order to broaden our scope and get a handle on the bigger picture that we need for student success? How do

we teach all students at the level and rigor that Common Core expects and still differentiate and scaffold instruction in a way that meets the needs of all learners? All of these are very pertinent issues that arise from the current movement. Embedded in these are issues related to collaboration, grading practices, and the meaning of homework in our classrooms (Ellis & Berry, 2005).

With any movement potentially come more questions than answers, but the one constant that remains is instruction (Leinwand, 2009). In current times, coming off of No Child Left Behind and the current accountability system, the rigor of Common Core seems to overshadow the bigger need, developing mathematical thinking and problem solving in students. According to Leinwand (2009), in order to meet that need and the demands of technology, and society, the focus in math education needs to be on instruction. It is instruction that can foster the collaboration and growth amongst teachers. With effective instruction, students can learn to dig deeper and extend their understanding. They can learn to pursue challenging tasks and process through new situations. With effective math instruction, students can also learn why math makes sense of the world and why it is essential in growing our nation and economy instead of being a source of fear and anxiety (Leinwand).

In order for teachers to focus on instruction and address all the demands placed upon them in a technologically advanced society, many have turned to alternative approaches to instruction. According to Milman (2012), embedding technology and meeting students on their terms has become a popular way to address all of the challenges and because of that the flipped classroom has emerged as a method of instruction that is growing in popularity. A flipped classroom is loosely defined as a method of instruction

where the teacher creates a video of the concept or procedure to be introduced and has students view the video at home before class as their homework. In theory, the in-class time would then be freed up to allow students to engage in tasks that allow for deeper learning around the content in which students can discuss topics with their peers, collaborate around project-based learning activities, or modeling activities while the teacher facilitates the experience (Milman).

Statement of the Problem

Mathematics education in the United States has come under scrutiny in recent years due to low math achievement as measured by national and international assessments. National data released by ACT in 2012 showed that 46% of all high school students that took the ACT exam met the benchmark with a score of 22 or higher on the mathematics portion of the exam. A student scoring a 22 on the math portion of the ACT is said to be ready to enter College Algebra at most four-year institutions in the United States (ACT, 2014). Based on this data, 54% of all high school students tested on the ACT in 2012 were underprepared to take a college math course for credit during their freshman year at a four-year institution (ACT, 2012). Similar to the ACT data, the most recent report released by the United States Department of Education regarding the results of the 2013 National Assessment of Educational Progress (NAEP), 42% of fourth graders nationwide achieved the status of proficient or above, 36% of 8th graders were at proficient or above, and 26% of high school seniors were at proficient or above (National Center for Educational Statistics, 2014). When tracking these students up to the college level, research has shown that 60% of students enrolled in two-year college programs in the United States are placed into math courses below the level of College Algebra.

Because of this, 75% of these same students end up failing or dropping their math courses and then leave college without earning a degree (Boaler, 2013).

When thinking about student mathematics achievement from an international perspective, the United States rank showed a slight improvement on international assessments as compared to other nations in recent years. In the most recent 2011 report from the Trends in International Mathematics and Science Study (TIMSS) produced by the Institute for Educational Sciences and the National Center for Educational Statistics, the data showed that the United States as a whole ranked eleventh out of fifty tested countries on fourth grade benchmarks and ninth out of forty-two tested countries on eighth grade benchmarks (National Center for Educational Statistics, 2011).

With the national and international data highlighting the need for reform in K-12 mathematics education, other research has been conducted to address what seems to indicate success for students in terms of achieving a four-year college degree at any major institution. Zollman (2011) presented research he conducted on entering freshman at a regional conference of the National Council of Teachers of Mathematics (NCTM) in 2011. In his research, Zollman identified three indicators of success that could determine if a student would go on to complete a four-year college degree. The first indicator of success, according to Zollman, was high school math course consumption. Students that completed Algebra as their highest math course in high school had an 8% chance of going on to a four-year institution and earning a degree. This statistic changed dramatically for students whose highest course was Algebra 2. Those students completing Algebra 2 had a 40% chance of going on to college and earning a degree. Once a student took a fourth level math course in high school, their chance of completing

a college degree ranged from 62-80% depending on the course they completed (Zollman).

The second indicator of success that Zollman (2011) highlighted from his research indicated that the higher the math course taken, the more likely students are to go on to complete a college degree regardless of their ethnic background. In fact, Zollman noted that this indicator had a higher success rate for Hispanic and African-American students. The third indicator of success impacted the quantity of math taken by students in high school. Students who took more math courses were also more likely to go on to complete a four-year college degree. Once again, Zollman noted that all three indicators of success were not impacted by socioeconomic status, race, or ethnicity (Zollman).

Based on this national, international, and college achievement data, it seems clear that students in the United States need more math and higher quality math instruction than what they may be currently receiving. Students should have an opportunity to feel connected to mathematics. Teachers need a way to develop student understanding and interest in mathematical concepts and ideas in order to encourage students to continue to take more math courses in high school, and upper level math courses, to increase their chances of college success and improve the standing of the United States as a nation. According to the Common Core State Standards initiative, helping students to develop mathematical habits of mind through the Standards for Mathematical Practice, "develop student practitioners of the discipline of mathematics" (The Common Core State Standards Initiative, 2014). In order to achieve this, mathematics instruction needs

reform. Many teachers, in recent years, have looked into using the flipped classroom approach to instruction as a way to address these demands.

What is appealing about the flipped classroom approach to instruction for secondary and post-secondary teachers of mathematics is the instructional time gained inside the scheduled class time (Brunsell & Horejsi, 2013). By using this instructional strategy, teachers are able to use class time to develop understanding in students. They are able to present students with more meaningful tasks that develop problem-solving skills. Students are then able to collaborate, justify, and defend their processes while the teacher facilitates and guides them. Students are able to walk away from the experience more engaged in their own learning and with the ability to analyze new situations by thinking critically about mathematical concepts and ideas (Brunsell & Horejsi, 2013). This is incredibly timely given the transition to more rigorous standards and the focus on modeling and argumentation provided by the Common Core State Standards (The Common Core State Standards Initiative, 2014). Modeling with mathematics and mathematical discourse are critical factors in developing conceptual understanding in students. Instructional strategies, like the flipped classroom model, seem to support these features. This approach seems to allow time in class for more meaningful differentiation opportunities and for the development of mathematical discussions that can lead to deeper understandings of mathematical content, promote connections across topics, and increase student achievement in the area of mathematics (Strayer, 2007; Tucker, 2012).

Purpose of the Study

This study addresses how the flipped method of classroom instruction differs from traditional classroom instruction when comparing student achievement measures in

middle and high school mathematics classrooms. A modified explanatory sequential mixed methods design (Creswell & Plano Clark, 2011) was used, and it involved collecting quantitative data and then explaining the quantitative results with in-depth qualitative data. In the quantitative phases of the study, NWEA Mathematics MAP Assessment data and common mathematics semester final assessment grades were collected from middle school and high school students in a large Midwestern suburban public school district to determine how the flipped classroom approach to instruction differed in terms of student achievement measures as compared to a traditionally instructed classroom. As a second component of the quantitative phases, data were collected with respect to the frequency of active learning incidents observed in classrooms in order to further assess differences associated with the flipped classroom as compared to the traditional classroom.

The qualitative phase was conducted as a follow up to the quantitative phase to help explain the quantitative results. In this exploratory follow-up, student and teacher perceptions of mathematics achievement as a result of the flipped classroom approach to instruction with middle school and high school math students and how those perceptions might be different than those of students and teachers in traditionally taught classrooms in the school district were explored. Similarly, as a follow-up to the second quantitative focus regarding the frequency of observable active learning incidents, qualitative descriptions of the observed incidents were also explored.

Research Questions

The study will focus on the following research questions:

1. Overarching Question:

How do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers?

a. Quantitative Focus
    i. How does the flipped classroom approach, in the secondary mathematics classroom, impact measures of student learning as identified by course semester final exams and NWEA Mathematics MAP data?
    ii. How does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom?

b. Qualitative Focus
    i. Do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?
    ii. Do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?

iii. In what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom?

Suggestions from and Limits of Current Research

Previous research on the flipped classroom approach to instruction has focused on content areas outside of mathematics. These studies highlight increased student achievement, positive student perceptions, and an increase in project-based learning approaches during class time (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Herreid & Schiller, 2013). Some studies also focused on the drawbacks of the instructional approach by discussing student resistance to the format, lack of understanding on the students' part around the content presented in the videos, and overall poor quality of instruction presented in the videos that were used or created (Herreid & Schiller, 2013; Strayer, 2012).

All of the studies considered, however, have researched high school or post-secondary classrooms. The content area of mathematics was also underrepresented in the research (Pugalee, 2001; Wilson, 2013; Strayer, 2012). Implementation of the flipped classroom in a middle school or high school math classroom is not available in most of the research and discussion of the model. The studies available also primarily focused on quantitative achievement outcomes and quantifiable perceptions using a Likert Scale (Pierce & Fox, 2012). Little research has been conducted on how students perceive mathematics and their ability in their math classrooms as a result of engagement in the flipped classroom approach to instruction. Research is also limited in regards to teacher perceptions about the effectiveness of the flipped classroom approach to instruction and

its impact on student learning, and on detailed descriptions of how the model is implemented in the classroom. Even less research has focused specifically on describing those perceptions and implementation in a qualitative manner (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013).

Limitations/Delimitations

Due to the nature of this study being conducted in classrooms where teachers were choosing to experiment with the flipped classroom approach to instruction in mathematics, results are not generalizable or transferrable beyond the specific population from which the sample was drawn. Also due to the variances between teachers using the flipped classroom approach to instruction, results may not be generalized or transferred to all flipped classrooms as compared to traditionally structured mathematics classrooms.

In order to account for variances in student ability upon entering the flipped mathematics classroom, norm-referenced fall assessment data was compiled as a pre-assessment of student ability and compared for growth with spring assessment data, where available, using the same instrument. Due to the potentially large pool of participants and discrepancies between teachers and implementation practices, research was limited to comparing two middle school classrooms and four high school classrooms where half used the flipped method of classroom instruction and half used a more traditional approach to classroom instruction in the same course at each level.

Definition of Terms

1. Academic Achievement – student mastery of intended mathematics objectives as recorded by course letter grades and percentages (School District Data, 2015).
2. Active Learning - opportunities where students engaged in mathematical discourse with their peers, modeling activities, and project-based learning activities.
3. Common Core State Standards in Mathematics – grade level mathematics standards developed by the National Governor's Association of the United States and the Council of Chief State School Officers in order to address the deficiencies and inconsistencies between states' mathematics programs (The Common Core State Standards Initiative, 2014).
4. Constructivism – theory of learning defined by Bruner (1960) as the process in which students construct their own understandings based upon existing knowledge and their own experiences.
5. Differentiated Instruction – instructional design in which teachers adjust content to meet the needs of various cognitive levels of students (Tomlinson, 2005).
6. Flipped Classroom – method of instruction where traditional lectures over mathematical procedures and concepts are videotaped and viewed by students outside of class prior to the class period in which they will be using and/or applying the information (The Flipped Learning Network, 2014).
7. Formative Assessment – method of assessment that involves checking for student understanding or progress and can be used to evaluate instruction.

This type of assessment can be formal in the form of written journal entries, exit slips, homework, or quizzes. This type of assessment can also be informal in the form of student responses to in class questions, teacher observations, peer-to-peer interactions, or discussions (NCTM, 2014).

8. Guided Practice – examples of mathematical tasks that involve mathematical concepts and/or procedures that students complete under direct supervision of the teacher in order to develop mastery of the course objective being presented (Hunter, 1982).
9. Instructional Strategy – techniques utilized by teachers to promote mastery of objectives, understanding of content, and independent learning in students.
10. NWEA MAP – norm-referenced assessment administered two to three times per year and is aligned to the Common Core State Standards in Mathematics known as the Measures of Academic Progress (NWEA, 2015).
11. Project-Based Learning – method of learning in which students are engaged in real-world, complex tasks that involve multiple solution pathways and multiple objectives, and require reasoning, discussion, and justification in order to acquire deeper understanding (Edutopia, 2015).
12. Mathematical Argumentation and Discourse – Defined by The Common Core State Standards Initiative as, "Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and

use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments" (The Common Core State Standards Initiative, 2014).

13. Modeling Activities – activities in which students demonstrate their understanding through mathematical representations, whether they be algebraic, pictorial displays, discourse, simulations, or other facets (The Common Core State Standards Initiative, 2014).
14. Secondary Mathematics – the level of mathematics defined by a student's grade level. Secondary mathematics students in this study are students enrolled in 7^{th} grade through 12^{th} grade.
15. Summative Assessment – method of assessment that describes student mastery of intended learning objectives. This method is formal and final in

nature and demonstrates what students know and have retained as measured by course objectives (NCTM, 2014).

16. Traditional Classroom Approach – a pedagogical approach that is represented by a method of instruction where the teacher reviews new mathematics content in class, students engage in guided practice, independent practice, and then practice additional problems at home for homework (Hunter, 1982).

Summary

Based on the research already conducted, there are many implications for using the flipped classroom strategy in the middle and high school mathematics classroom. Some of the research suggests that when implemented effectively, student achievement and perception about mathematics improve (Hanover Research Council, 2013). The research also suggests that using the strategy frees up instructional time traditionally spent on passive instructional techniques and makes room for more authentic, modeling, and project-based learning experiences (Strayer, 2007; Tucker, 2012). In order to support the Standards for Mathematical Practice, specifically math practice number four, model with mathematics, and math practice number three, construct viable arguments and critique the reasoning of others, teachers need time with students to develop those habits of mind.

The flipped classroom strategy theoretically allows teachers the time to develop mathematical ideas and the ability to facilitate that development. For the Common Core State Standards initiative to be effective, teachers need to engage students in new learning experiences that support college and career readiness. By implementing a technology based instructional approach, like the flipped classroom strategy, teachers are able to

blend twenty-first century skills with the development of the essential habits of mind of mathematically proficient students (Brunsell & Horejsi, 2013). This study seeks to understand how student achievement in the flipped mathematics classroom compares to student achievement in traditionally instructed classrooms, and how student and teacher perceptions about teaching and learning in math might differ between the two groups.

Chapter 2 - Review of Literature

Philosophical and Theoretical Foundations

This study utilized both a post-positivist and social constructivist world view. The focus was to determine how a specific instructional strategy compared to a more traditional instructional approach with respect to student achievement measures in a secondary mathematics classroom while also providing detailed information about teacher and student perceptions on the course instructional techniques. Based on these worldviews, it was the assumption of the researcher that maximizing instructional time in the classroom could impact student learning as measured by course semester final exam grades and by norm-referenced assessments, where available. However it was also the assumption of the researcher that intentionally designed lessons that meet course objectives, allow for equal access, and differentiate for learners were also essential components to impacting that same achievement as measured by the aforementioned measures. In order to identify potential best practices in terms of mathematics instruction, it was essential to collect both quantitative achievement data and qualitative perception data from the participants involved.

This study focused on the theoretical foundation of constructivism as it applies to student learning. Thoughts about how learners construct knowledge can be seen in the ideas of John Dewey when he suggested that students are products of their own personal experiences; however the term constructivism as a theory of learning was developed by Bruner (1960) and Piaget (1950). Using constructivist ideas, learners actively interact with new content in order to make sense of material by experiencing and merging that information with prior learning experiences (Hoover, 1996). Through this learning

theory, students involved in a flipped classroom experience should be able to engage in more hands-on, visual or interactive classroom activities. These experiences would allow them to construct new meaning for themselves based on prior learning experiences including knowledge gained from the videos they watched and from other previous opportunities to connect with mathematics.

Constructivism

Research centered on how students learn mathematics is abundant. Several theorists have offered explanations and recommendations for classroom instruction and teacher qualifications in order to maximize understanding and student achievement in the classroom. With the most recent reform movement surrounding the Common Core State Standards in Mathematics, discussions of constructivist approaches to teaching and learning mathematics have come to the forefront.

Constructivism is a theory of learning that is typically credited to Piaget, Bruner, and Vygotsky. Piaget (1950) theorized that intelligence is constructed by the learner when trying to make sense of the world around them. This theory emphasizes the active construction of knowledge as a means of maximizing learning experiences (Southwest Educational Development Laboratory, 1994). Constructivism takes on several different forms throughout education. Types of constructivism include cognitive constructivism, radical constructivism, and social constructivism (Doolittle, 2015). Cognitive constructivism is one of the basest forms of constructivism and is the form developed by Piaget. This form focuses primarily on how learning develops in children and is defined as what goes on inside the learner's head (University of Berkley, 2015). Radical constructivism is a form of constructivism typically associated with Ernst von Glasersfeld

(2013) and focuses on the premise that knowledge is not only constructed by an individual's experience, but also by that person's perception of reality. Social constructivism is often attributed to Vygotsky's work and is the form that combines the tenants of radical and cognitive constructivism while also focusing on the idea that knowledge can also be shared and acquired through social experiences (Doolittle, 2015). This form of constructivism is the form most often seen throughout the Standards for Mathematical Practice.

Social constructivism has several important components. Central to this theory is the idea that students make choices about whether or not new information should be accepted (Epstein, 2002). If a student chooses to accept the new information, he or she will then attempt to fit the new information into his or her preconceived notions about the world (Epstein, 2002). Constructivists often argue that students learn best when they are in control of their learning and when they are aware of their control (Epstein, 2002). A consideration, however, is that with this theory students sometimes form misconceptions about particular concepts (Southwest Educational Development Laboratory, 1994). If a student is presented with new information that contradicts his or her existing ideas about the world, he or she may try to accommodate both views instead of changing his or her existing ideas (Southwest Educational Development Laboratory, 1994)

As cited in Epstein (2002), there are nine principles of learning in which most social constructivists subscribe. The principles are that learning should be active, students have to learn how to learn, kinesthetic learning experiences and problem solving enhance learning, language affects learning, social activity produces meaningful learning experiences, students need contextual information and conceptual information to learn,

learning takes time, and motivation to learn is essential. These principles give way to guidelines for teaching and learning (Epstein, 2002). According to the Southwest Educational Development Laboratory (1994), teachers in a constructivist classroom should emphasize the importance of knowledge, beliefs, and skills a student brings to learning. Instruction in a constructivist classroom should rely on a student's readiness, organizing the curriculum in a spiraling fashion, and going beyond the curriculum mandated by the school or district (Huitt, 2003).

Social constructivism has several expectations of the learning environment in order for the classroom to truly be considered constructivist. For students in a constructivist mathematics classroom, an observer could expect to see them focusing on problem solving skills, applying math concepts to real world situations, expanding on knowledge, and collaborating with their teacher and their peers (Stiff, n.d.). In a constructivist classroom, students are responsible for learning and they are engaged in social discourse (Southwest Educational Development Laboratory, 1994). Students are actively involved in inquiry-based learning that requires them to make predictions and apply higher order thinking skills (Huitt, 2003).

For the teacher in a constructivist classroom, an observer could expect to see a lesson that begins with an assessment of students' prior knowledge so that the concept can begin with students' experiences (Huitt, 2003). Teachers in a mathematics classroom that is based in constructivism would be using raw data, primary sources, and interactive materials that provide hands-on experiences linked to real world situations (Southwest Educational Development Laboratory, 1994). Teachers would be posing problems and asking open-ended questions (Stiff, n.d.). Lessons would focus on encouraging the

students to analyze, predict, justify, and defend their ideas (Southwest Educational Development Laboratory, 1994). Students' ideas and opinions would be encouraged, supported, and respected (Epstein, 2002).

In order for students to have the opportunities to construct meaning, teachers should also have knowledge of what types of activities they can design in order to deepen student understanding. Skemp (2006) defines deep understanding of mathematical content as relational understanding, which represents the idea that a student "knows what to do and why" (p. 89). A teacher that focuses on relational understanding and allowing students to construct meaning recognizes that,

> It is necessary to provide a structure and a set of plans that support the development of informed exploration and reflective inquiry without taking the initiative or control away from the student. The teacher must design the tasks and projects that stimulate students to ask questions, pose problems, and set goals. Students will not become active learners by accident, but by design, through the use of plans that we structure to guide exploration and inquiry. (Richards, 1991, p. 38).

When implemented effectively, the constructivist mathematics teacher benefits from situations where mathematics content becomes easier for students to remember due to the constructed meaning and the connections made between concepts, and the development of an environment that promotes discourse and satisfaction on the part of the learner (Skemp, 2006).

Because of this, it is also important for the teacher in a constructivist mathematics classroom to be cognizant of how he or she constructs meaning and how he or she acts

upon his or her own interpretations of meaning as it relates to mathematics content. Since constructivists believe that meanings are social products, how teachers, themselves, learned mathematics and constructed meaning of the content plays a significant role in how they deliver mathematics instruction in the classroom (März & Kelchtermans, 2013). Greenes (1995) states,

> The teacher is a model of a mathematical investigator, practicing the mathematical behavior, the investigative processes expected from students. He or she is a resource, assisting students with the location of relevant tools, information, and other materials (Greenes, 1995, p. 61).

Ausubel used these ideas to create his own learning theory also centered on constructivist principles. Ausubel hypothesized that the meaning learners constructed was based upon what knowledge he or she already possessed (Ivie, 1998). Using that rationale, it seems natural for teachers to build upon prior knowledge by using advanced organizer techniques to assist students in constructing new meanings. Similarly, it also seems logical that teachers would need to design instruction in such a way that they are able to help students build background knowledge, while at the same time providing opportunities for students to engage in meaningful mathematical tasks where the teacher can then facilitate a productive discussion (Ivie, 1998).

A social constructivist would highlight that the discussion experience itself can allow students to reflect and critique the concepts being analyzed and allow them the opportunity to construct their own meaning. Ausubel would argue that this kind of process begins with advanced organizers (Ivie, 1998). Simon (2004) would also suggest that the process fits with his ideas related to meaningful task selection (Simon & Tzur).

Simon's idea of selecting appropriate tasks also relates to the importance of effective questioning techniques and the development of meaningful mathematical discourse. This can be seen in a scenario presented by Schifter (1996) in the article, *A Constructivist Perspective on Teaching and Learning Mathematics.* The scenario examines a measurement task designed by a teacher that led to her students constructing knowledge related to why standardized measurements are necessary to the real world.

Using these two theories, teachers are able to ground mathematical concepts in natural and meaningful applications, and construct a learning experience in which students can use their own experience and knowledge to solidify the concepts. Based on this belief that knowledge can be constructed by the learner and that advanced organizers, meaningful task selection, and mathematical discourse are vehicles to facilitate that experience, many teachers have been experimenting with alternate methods of instruction for their classrooms.

Differentiated Instruction

As another response to the need for more meaningful mathematics instruction, increased student achievement, and with the onset of the Common Core State Standards, teachers have been working to identify ways to meet the needs of all students and improve in their chosen profession. One component of meeting the needs of today's learners and making math accessible to more students, in order to increase achievement, is through varying instructional strategies, aforementioned, and differentiation. Differentiated instruction seems to be a challenging topic for many secondary math teachers due to space and time limitations and the pressure that many feel to "cover"

course objectives in order to prepare students for a high stakes assessment (Tomlinson, 2005).

Differentiation is a solution to boosting learner confidence in mathematics and achievement. According to Tomlinson (2005), it is necessary for students to feel reassured and confident about their abilities in an era where anxiety around math runs high. Tomlinson notes, "Our success as teachers in helping students see themselves as competent in the subjects we teach will affect the rest of their lives" (p. 13) Because of this, using a traditional one-size-fits-all approach to mathematics instruction is not sufficient in building the confidence students need in order to achieve success in mathematics. Tomlinson continues this thought when she says, "self-efficacy is born only when any student encounters something that the student believes to be out of reach" (p. 13). Meeting the needs of all students in the classroom in order to build that confidence requires teachers to differentiate their instruction. This can be challenging in a secondary setting where instruction is often limited by time and quantity of content.

In response to this challenge, Ollerton (2014) suggests that differentiation happens no matter what the teacher intends to do with his or her instruction. He mentions that even when a closed question is asked in the classroom, students inevitably process the solution at different rates and with different magnitudes of confidence. Similarly, Ollerton suggests that offering three tiers of instruction to students is also not practical. He states that there are more than three levels of cognition and students will need opportunities to learn according to their readiness. Because of this, Ollerton states, "Differentiation, therefore, is probably the most complex and important issue for teachers to engage with" (p. 43)

In order for teachers to differentiate instruction in the classroom effectively, Ollerton (2014) suggests that teachers be more cognizant of how they select tasks for students. Simon and Tzur (2004) would also seemingly agree with Ollerton that having teachers select meaningful and appropriate tasks for students to complete will allow for the mathematics to be more engaging and will highlight the usefulness of mathematics (Simon & Tzur). Von Glasersfeld (2013) would further suggest that teacher expertise in the content, in conjunction with intentional and strategic planning around high quality mathematical tasks, is also essential in order to differentiate instruction. He would suggest that the teacher has to be able to think on his or her feet in order to ask appropriate questions that deepen the students' thinking and help to develop the mathematical concepts and connections. Without the expertise of the content on the teachers' part, thoughtful questions cannot be asked (Glasersfeld, 2013). Similarly, since student experiences, and how they will personally interpret the experiences in the classroom, cannot be scripted or anticipated. It is the expertise of pedagogy, student learning, and content knowledge on the teacher's part that makes it necessary for them to stay flexible and adaptable to new situations (Schifter, 1996).

The question then becomes, aside from intentional and strategic planning around appropriate mathematical tasks, how can teachers maximize class time in order to provide the opportunities to differentiate for all students? One such method that has grown in popularity has been the flipped classroom approach to instruction. According to current research, this model has the potential to maximize instructional time and provide students more opportunities for discourse and modeling during the school day (Strayer, 2007; Tucker, 2012).

History has shown that teachers have continuously experimented with changing the nature of the traditional classroom. The traditional classroom is typically defined as an environment where a teacher delivers new content to learners with the intention that learners will then practice the new information on their own, usually outside of the structured class time (Hunter, 1982).

Flipped Classroom Research

One of the most popular approaches in recent times has become known as flipping the classroom. The "flipped classroom" has recently become an educational phenomenon where teachers utilize and integrate technology in their classrooms by changing the traditional classroom setup (Brunsell & Horejsi, 2013). Instead of students entering class, reviewing a previous lesson, taking notes over new material, and working on practice problem sets at home for homework, teachers are recording their traditional lectures and allowing students to view them at home in place of homework. Students then are able to come into class with prior knowledge of the new learning and are able to interact with more authentic tasks and problems then they might otherwise be able to do at home on their own (Brunsell & Horejsi, 2013).

The flipped classroom has recently been defined as an instructional strategy that replaces traditional lectures with videos or screencasts that are available to students outside of class time. In class work is then devoted to more interactive and hands-on experiences (Bull, Ferster, & Kjellstrom, 2012). These hands-on or active learning experiences are consistent with constructivist principles in that they support the process in which students construct their own understandings based upon existing knowledge and

their own experiences (Bruner, 1960). Flipped learning has also been defined by the Flipped Learning Network 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 Flipped Learning Network, 2014).

Ideas surrounding the flipped classroom approach to instruction are hardly new in the sense that many educators have experimented with inverting the role of traditional content delivery with the role of practice or homework. Many have argued that the mainstream definition of the flipped classroom is just "a repackaging of old ideas" (Bergmann & Sams, 2014). Bergmann and Sams (2014), two of the pioneers of the flipped classroom approach, agree that the ideas of pre-teaching content match very closely with the strategies surrounding the flipped classroom.

Other sources have noted that many teachers have been "flipping" their classrooms for years in terms of expecting students to read novels outside of class time in order to explore text features and discuss ideas during class time (Berrett, 2012). Some have stated, "Classes in history and literature have long used the 'flipped' method requiring reading outside of class in preparation for in-class discussion" (Datig & Ruswick, 2013).

The major difference with those approaches in other content areas and the approaches involved in current flipped classroom methods tend to primarily refer to the role of technology in classroom instruction. According to *Principles to Actions:*

Ensuring Mathematical Success for All by NCTM (2014), "An excellent mathematics program integrates the use of mathematical tools and technology as essential resources to help students learn and make sense of mathematical ideas, reason mathematically, and communicate their mathematical thinking" (NCTM, p. 5). Bergmann and Sams (2014) state that educators that flip their classrooms "…are simply leveraging emerging technology to deliver instruction in a way that was not possible before" (p. 20).

The flipped classroom approach to instruction, as it is currently defined, has been dated back to the early 1990s. The first record of a flipped classroom began in a Harvard University physics classroom with Professor Erik Mazur, who is now the Dean of Applied Physics at Harvard (Mazur, 2005). Mazur structured his course in such a way that allowed students to choose how they learned in a manner that met their learning needs. Since this took place in the early 1990s, technology was limited and as technology improved over the years, several of Mazur's colleagues adapted this instructional style (Mazur, 2005).

After Mazur's instructional experiment, little research on the implementation of the flipped classroom model, specifically in a mathematics classroom, was found (Pugalee, 2001; Wilson, 2013; Strayer, 2012). Research involving the approach across content areas was more prevalent. Much of the research centered on high school or university level courses. Throughout the research found on the flipped classroom approach, several key ideas were clear. Students engaged in a flipped classroom typically had increased achievement on formative or summative assessments (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013). Students generally disliked the

format initially, but by the end of the experience reflected that their understanding had increased (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Strayer, 2012). Teachers implementing the strategy were able to devote in-class time to the use of case studies or project-based learning tasks (Herried & Schiller; 2013; Pierce & Fox, 2012). The research also discusses potential drawbacks to the approach and the need for meaningful in-class experiences in order to support the strategy (Herried & Schiller, 2013; Strayer, 2012).

Little scientific evidence about the effectiveness of the current definition of the flipped classroom approach to instruction exists in current research (Goodwin & Miller, 2013). According to some nonscientific data sources, teachers who have utilized the flipped classroom approach to instruction have seen an increase in student achievement on tests, an improvement in student attitudes, and a decrease in the failure rate of some courses (Goodwin & Miller, 2013). Based on these anecdotal and survey reports, researchers have determined that flipping the classroom may have benefits to student learning if implemented effectively (Goodwin & Miller, 2013).

Elements of the flipped classroom have been studied in isolation, which have also led to some of the scientific research designs surrounding the flipped classroom. For example, according to a study by Pugalee (2001) out of the University of North Carolina that focused on high school Algebra 1 students, participants who were shown to be struggling math learners that were engaged in classrooms involving constructivist principles and the use of graphing technology, were found to provide a more meaningful way for students to conceptualize concepts of linearity. This particular study highlighted

themes related to the role of technology in the mathematics classroom and the importance of classroom learning experiences designed to promote exploration and mathematical discourse. Both ideas surround the rationale for instructors experimenting with moving direct-instruction outside of the classroom in a 21st century way in order to maximize class time for more meaningful learning experiences (Pugalee, 2001).

Several studies have highlighted increased student achievement on assessments as a result of the flipped classroom implementation. Flumerfelt and Green (2013) conducted a study to determine if using the flipped classroom approach in a secondary government class in conjunction with the Lean Model for increasing productivity in the business world would increase student achievement by reducing course failure rates. Researchers found that failure rates in the course decreased and overall student achievement increased by 11% in the flipped classroom. Another study focused on implementing the flipped classroom approach with renal pharmacology students at the university level and found that final exam scores improved overall from the previous year by 3.9% (Pierce & Fox, 2012).

A third study, also at the university level, focused on students learning about technology through the use of a flipped classroom, traditional or simulation-based classroom design. Results of this study overwhelmingly supported the use of the flipped classroom approach over the other two methods in terms of increasing student achievement (Davies, Dean, & Ball, 2013). The study utilized pre- and post-assessment data to compare all three methods and found that students in all three courses began with pre-test scores between 30% and 40% demonstrating that students came into the course with similar prior knowledge. The post-test data highlighted increased improvement by

students in the flipped classroom and the regular classroom with students improving scores by 50% or more where improvements in the simulation-based classroom showed an approximate 40% improvement (Davies, Dean, & Ball, 2013).

Similar to the other studies, but grounded in a mathematics classroom, one study focused on implementing the flipped classroom model with an introductory college level statistics course. The instructor used the method in two of his statistics courses and utilized a traditional approach in two other statistics courses. He found that overall course grades were almost ten points higher in the two courses that utilized the flipped classroom model than those that did not (Wilson, 2013).

A fifth study at the university level, focused on comparing three types of classroom instruction in nursing courses, traditional lecture only (LO), lecture and lecture-capture back-up (LLC), and the flipped classroom approach (LCI) (Missildine, Fountain, Summers, & Gosselin, 2013). The LLC approach consisted of traditional lecture supplemented with instructional videos to be viewed outside of class time, where the LCI approach consisted of the lecture videos to be viewed prior to class time so that class time could be devoted to active learning activities. Researchers reported that student achievement in the LCI classroom was significantly higher than in the other two classrooms in terms of examination scores for students (Missildine, Fountain, Summers, & Gosselin, 2013).

Along with student achievement, much of the research examined student perceptions of the flipped classroom approach. In the study that focused on renal pharmacology students, researchers conducted a ten-question opinion survey using a five-point Likert scale to determine students' perceptions of the model (Pierce & Fox, 2012).

Response to the survey was voluntary with 73% of the students responding. Of those that responded, 80% said the flipped classroom approach increased their confidence on the final exam, 78% said that being able to view class lectures prior to class was extremely important, and 62% would have liked more teachers to use the strategy in other courses (Pierce & Fox, 2012).

The study that examined the flipped classroom approach, a simulation-based classroom approach, and a traditionally based classroom approach to teach students about technology also surveyed student opinions about the various methods (Davies, Dean, & Ball, 2013). This study concluded that students in the flipped classroom reflected that the method was a better way to facilitate learning and differentiate instruction whereas opinions in the traditional classroom were less favorable and the simulation-based classroom was negative (Davies, Dean, & Ball, 2013).

In the study that focused on comparing the LO, LLC, and LCI approaches to instruction with college level nursing students, student perceptions were that the LCI approach was much more work and their satisfaction scores were less high. Researchers noted that "student satisfaction may not be a good indicator of learning" (Missildine, Fountain, Summers, & Gosselin, 2013).

A fourth study, also at the college level, focused on graduate students. Researchers compared three groups of students, full time graduate students, graduate students with jobs, and Ph.D. students (Chen, Wang, Kinshuk, & Chen (2014). They focused on creating a learning experience through an online learning platform that could complement in class activities. The videos they created tended to span two hours and students reflected that the course-load was too heavy and the material presentation was

difficult to understand. Researchers noted that Ph.D students were more motivated to complete the content, whereas the other two groups were resistant to the new methods of instruction (Chen, Wang, Kinshuk, & Chen (2014).

Two other studies also surveyed student opinions about the flipped classroom design. Both studies focused on an introductory statistics course at the university level. The first study, aforementioned, found that students' overall view of mathematics improved (Wilson, 2013). The overall percentile rank on teacher evaluations completed by students in the flipped statistics course was 9.55% higher than traditionally taught statistics courses (Wilson, 2013). However, the second study that also focused on students in statistics did not find that students' opinions of the strategy were favorable. Students in the flipped classroom found it difficult to understand what was expected of them and felt like they were "lost" (Strayer, 2012).

A third feature of the research on flipped classrooms pertains to how class time was utilized, given that students were receiving lectures via video outside of class time. Two studies in particular described the use of case studies and project-based activities during scheduled class meetings. The first study, conducted with renal pharmacology students, described how researchers created module based podcasts to be used outside of class time by students so that during class they could engage in interactive case studies (Pierce & Fox, 2012). Students worked through patient cases that required them to intervene for patients with progressive conditions and to respond to patients in emergency situations. Because of this structure, students were able to simulate real life experiences and respond, as they would need to in the field. Students were also able to engage in discussions with other students about methods, interventions, and evaluations of patients

through the use of the simulation, which paralleled experiences they were likely to have in their careers (Pierce & Fox, 2012).

The second study surveyed several high school teachers as to the benefits of using the flipped classroom approach. Many who responded reflected that the flipped classroom strategy allowed them to use case studies and project-based learning activities during class time to deepen student understanding of content (Herreid & Schiller, 2013). Teachers in this study felt as though the strategy made it possible to embed more authentic learning opportunities and enrich student-learning experiences through the use of case studies (Herreid & Schiller, 2013).

The last key feature of the research was summarized nicely by one study in particular that discussed the potential drawbacks of the flipped classroom approach. In the survey study conducted by Herreid and Schiller (2013), teachers reported that students new to the method were resistant and uncomfortable in the initial stages. This response was supported by the research done by Strayer (2012) in the introductory, college level statistics course when students reflected that they were unhappy with the method of instruction due to the unclear nature of the approach (Strayer). Another drawback, based on Herreid and Schiller's (2013) survey data, was that the instructional videos and the in-class work needed to be carefully tailored for each course and student demographic. Researchers noted that in order for the flipped strategy to be effective, students needed to be engaged in meaningful in-class work that made it necessary to watch the custom-made video lectures outside of class time.

Advantages and Disadvantages of the Flipped Classroom

Based on the research conducted primarily in post-secondary settings and in some high school environments, several advantages and disadvantages to the flipped classroom method for instruction exist. Perceived advantages of the flipped classroom approach as discussed by several researchers and educators include the idea that due to the maximization of class time by moving direct-instruction components outside of the classroom, many note that the structure creates an environment more adept at providing opportunities for differentiated instruction (Hanover Research Council, 2013). Students have the opportunity to use class time to apply what they have learned from the videos, which allows teachers to more accurately assess whether or not students understand the content for the course and using various formative techniques to assess understanding, teachers have the ability to correct misconceptions before a summative exam occurs (Berrett, 2012). Teachers have the opportunity to provide feedback more often and in a timely manner so that teachers are engaging in more conversations with students instead of lecturing to them (Goodwin & Miller, 2013). Because of this, teachers have reported that students become more independent in their learning environments (Phi Delta Kappan, 2012).

Another advantage to the flipped classroom approach relates to the videos themselves, providing students access to lecture content via video outside of class time allows students the opportunity to pause, rewind material that they need more time with, and fast forward through material that they feel they have mastered (Horn, 2013). Several researchers and educators have noted that the flipped classroom approach is especially useful for presenting knowledge or skill based content and allow for more conceptual learning to take place within the classroom (Milman, 2012).

A third advantage to the flipped classroom method of instruction relates to the generation of learners sitting in today's classrooms. The Hanover Research Council (2013) states,

> There is a growing body of evidence suggesting that the current generation of students may learn more effectively through digital media. Today's millennial students, or "digital natives," have been exposed to technology from a very early age, fundamentally changing the way they understand and interact with the world. Not surprisingly, many theoreticians believe that the traditional model of lecture-based learning is becoming increasingly unappealing to the contemporary student and that a paradigmatic shift in pedagogy is needed to keep students engaged (Hanover Research Council, p. 8).

Along with the perceived advantages to the flipped classroom come the perceived disadvantages as well. First, disadvantages surrounding the individual student abound. Many students in public K-12 education settings still do not have access to technology outside of school. This makes it difficult for students to access the assigned videos (Horn, 2013). Others have also noted that even if technology is accessible outside of the school day, some students still do not complete the assignment of watching the videos outside of class time. It is perceived that these same students are the ones who did not complete homework in a traditional setting as well (Nielson, 2012).

Another disadvantage to the flipped classroom involves teacher preparation and planning. When creating the videos, several educators spoke to the poor quality of the videos created. If the videos were focused too much on one mathematical procedure or attempted to provide instruction conceptually, students often became lost (Hertz, 2012).

Similarly, the videos make it difficult to provide necessary scaffolding for struggling students (Milman, 2012). Creating the videos and anticipating student responses also become more labor intensive on the part of the teacher than planning for a traditional classroom environment (Hanover Research Council, 2013). Classroom environments that also do not engage students in more active learning experiences do little to improve student understanding and achievement (Nielson, 2012), however, those that do engage students in more active experiences often find that students are resistant to that environment because of engrained habits related to passive learning experiences (Berrett, 2012).

Parents of students in the flipped classroom have also reportedly offered feedback on how they perceive their students' learning experiences when their children are involved in a flipped classroom experience. Fulton (2012) interviewed several classroom teachers that had experimented with the flipped approach to classroom instruction and noted that parents were generally happy with their students' achievement. Similar to Fulton's findings of parental feedback, Alvarez (2012) noted that parents of students in the flipped classroom enjoyed going online and watching the videos themselves as a way to help their children with content at home. One parent of a student in a flipped classroom even noted,

> It's just unbelievable, from a parent perspective, just watching my daughter just totally gain confidence. It was just amazing to see her actually go from being frustrated to coming through and actually teaching her friends that were going to a different high school Math by watching his tutorial and then she would go through it with them (Pearson, 2012, p. 2).

In some instances, however, parents struggled with the approach due to the fact that it was different than how they learned math as students (Fulton, 2012). Parents also reported concerns about the higher demand the strategy placed on the families' home technology resources in order for their students to keep up in class (Fulton, 2012).

Recommendations for Implementation

Considering all of the advantages and disadvantages discussed in the current research and literature, researchers and educators made several recommendations on how to effectively implement the flipped classroom. First, teachers considering flipping their classroom should focus on the in-class experiences (Baepler, Walker, & Driessen, 2014). According to a study at the university level focused on reducing seat time and increasing depth of knowledge for students enrolling in large lecture chemistry classes, researchers stated that their success in achieving their research goals was the result of focusing less on quantity of time in the classroom and more on quality of interactions and activities that students engaged in during the class time (Baepler, Walker, & Driessen, 2014). Because of this, teachers should provide opportunities for peer interactions, discussion, and feedback (Crews & Butterfield, 2014).

Second, teachers considering the flipped method should select appropriate content that can be delivered instructionally via video. After selecting the appropriate content, it is recommended that teachers create their own videos and provided a system for accountability for students to watch the videos (Moore, Gillett, & Steele, 2014). The videos should be short in length and focus on explaining procedural content (Overmyer, 2012). The videos and in-class lesson design should also follow a guided process for students to follow with explicit and clearly stated expectations (Lasry, Dugdale, &

Charles, 2014). Similarly, students will need to learn how to actively engage in video watching for information as opposed to watching videos for entertainment (Burton, 2013). Once students enter the classroom after a video assignment, teachers should have a structure in place to assess student understanding of the video content. This will aid teachers in differentiating their instruction during the class period (Steed, 2012).

Third, educators recommend committing to the model, seeing it through, and collaborating with others (Morgan, 2014). It is recommended that teachers share videos with each other when trying to begin implementation in order to lessen some of the workload on any individual teacher. Collaborating with other educators implementing the flipped approach is also helpful to a successful implementation (Morgan, 2014). Committing to a format that is useful for students can also help promote a successful implementation. Understanding the technology students have available to them and utilizing digital resources and course management systems can provide ways for interaction beyond the classroom as well (Fulton, 2013).

Much of the research discussed focused on college level experiences with the occasional discussion of how this strategy might be utilized in a high school setting. Commentary on perceived advantages and disadvantages to the flipped classroom approach and suggestions for effective implementation are more abundant than scientific evidence currently. With the increased rigor of the Common Core State Standards for Mathematics and the focus on developing mathematically proficient students through engaging instruction that promotes the Standards for Mathematical Practice, more research on how the flipped classroom approach, in conjunction with meaningful and

intentionally planned lessons, should be conducted in middle and high school mathematics classrooms.

Explanatory Sequential Mixed Methods Research

A modified version of the explanatory sequential mixed methods research design was utilized for the purposes of this study. The explanatory sequential mixed methods research design is used as a way to utilize data collected and analyzed through one method, either quantitative or qualitative, to explain findings generated by the other type of data collected. Through this design, priority is typically given to the quantitative data and the qualitative data is used as a means to explain the results of the quantitative data analysis (Creswell & Plano Clark, 2011). Traditional explanatory sequential mixed methods research occurs in two distinct phases. During the first, quantitative, phase of the study data is collected and analyzed around the quantitative focus questions. The information gained from that collection and analysis is then used to inform the qualitative phase of the study in terms of data collection and analysis, and the two phases are connected in the third phase (Creswell & Plano Clark, 2011).

One example of a study that utilized the explanatory sequential design was a study conducted by Ivankova and Stick (2004) that sought to understand students' persistence through a doctoral program at the University of Nebraska at Lincoln. In this study, quantitative data was collected and analyzed using a student survey of current and former doctoral students. Data was analyzed with respect to multiple factors that the researchers deemed essential to student persistence in the program with the goal being to identify predictors. During the qualitative phase, four participants were selected in a

multiple case study approach to help explain the predictive variables for persistence or lack thereof in the program (Ivankova & Stick, 2004).

In another study conducted by Igo, Riccomini, Bruning, and Pope (2006), a variant of the explanatory sequential mixed methods design was used. The variant in this study was defined by Creswell and Plano Clark (2011) as the "follow-up explanations variant" (Creswell & Plano Clark, 2011). This particular study focused on quantitatively studying the effects of different note-taking strategies on student achievement as measured by classroom test scores. Researchers in this study began by collecting quantitative data using student test scores. In their second phase, they gathered interview data and student work samples in order to understand student attitudes and note-taking practices to help explain the student achievement results (Igo, Riccomini, Bruning & Pope, 2006).

According to Ivankova, Creswell, and Stick (2006), there are several advantages and disadvantages associated with the traditional explanatory sequential design model. Morse (1991) noted that advantages include the simplicity of the model and the opportunity for the researcher to explore the quantitative portion of the study in much more detail. Further, many researchers choose to implement the explanatory sequential design because of its usefulness to help explain results that are unexpected (Morse, 1991). Disadvantages of this design include the time it takes to implement the two distinct phases and the availability of resources in order to support the weight given to each phase (Ivankova, Creswell, & Stick, 2006).

In order to address the advantages and disadvantages of the traditional explanatory sequential mixed methods design model, Ivankova, Creswell, and Stick

(2006) suggest several procedural and implementation protocols along with addressing time and resource considerations. First, Ivankova et.al (2006) suggests that data priority be determined either during the research design phase, or later during the data collection and analysis phase. Second, the researchers suggest that the implementation of when the phases occur, in sequence or concurrently, needs to be determined. In a traditional explanatory sequential model, quantitative data is given priority and data collection and analysis happens in two distinct phases, however that decision should be based solely on the research objectives and the availability of the resources throughout the study process (Ivankova, Creswell, & Stick, 2006).

During the integration and data analysis phases of the research design, Ivankova, Creswell, & Stick (2006) offer further suggestions on how to integrate and perform appropriate analysis procedures given the different types of data. In this design method, quantitative and qualitative data can be connected in different parts of the study. Traditionally, the two methods are integrated after the quantitative data has been analyzed in order to inform participant selection and data collection of the qualitative phase. Participant selection could be based on extremes in represented in the quantitative data or could be random selections to account for typical cases. Variations of the explanatory sequential design include integrating the data types through the development of the collection protocols based on the quantitative results (Ivankova, Creswell, & Stick, 2006).

Analyzing the qualitative data as a means to explain, in more detail, the quantitative results is also traditionally performed using various coding methods. Creswell and Plano Clark (2011) define qualitative coding in mixed methods research as

"the process of grouping evidence and labeling ideas so that they reflect increasingly broader perspectives" (p. 208). Grounded theory is also identified by Creswell and Plano Clark as a theoretical model utilized during the qualitative data analysis phase of mixed methods research. This theory highlights the method in which researchers categorize themes or codes that emerge during the analysis (Grounded Theory Institute, 2014).

According to Merriam (2009), in order to represent and further analyze the data, open, axial, and selective coding methods can be used and tables of themes can be constructed. Open coding is defined by Merriam as the process in which the researcher is "open to anything possible" (p. 178). Once open coding has concluded, axial coding can be performed as a means to group the open codes into larger categories and to refine the categories. A third level of coding that can be performed following the open and axial coding stages is known as selective coding. This stage is where the main theme or hypothesis is developed (Merriam, 2009). These themes and hypotheses can be interpreted and connected to the quantitative data analysis through comparative figures or explanatory interpretations as well as through the use of a joint-display analysis table that merges quantitative data with qualitative for the purpose of the mixed methods design (Creswell & Plano Clark, 2011).

Summary of Literature

This study utilized a post-positivist worldview in that the researcher acknowledged the fact that theories, background, and assumptions could influence what was observed in the study (Creswell & Plano Clark, 2011). Based on this worldview, the researcher assumed that maximizing instructional time in the classroom could impact student learning as measured by course semester final exam grades and by norm-

referenced assessments. It was also the assumption of the researcher that intentionally designed lessons that met course objectives, allowed for equal access, and differentiated for learners were also essential components to impacting the same achievement as measured by the aforementioned student achievement measures. Social constructivism was also used as a theoretical foundation for the purposes of this study. Social constructivism is based on the idea that knowledge can also be shared and acquired through social experiences (Doolittle, 2015).

Based on these philosophical and theoretical foundations, it was appropriate to recognize ways in which teachers utilize instructional techniques in order to make mathematics accessible to all learners. In order to impact student achievement, teachers have to realize that they cannot use a "one-size-fits-all" approach to instruction (Tomlinson, 2005). Ollerton (2014) suggests that differentiation happens no matter what the teacher intends to do with his or her instruction, but that instructional decisions around intentional questioning practices and meaningful task selection are critical to improving student understanding in the classroom. Glasersfeld (2013) would expand on this to say that the content knowledge of the teacher is critical in developing those thought provoking questions that encourage mathematical thinking and help students to construct their own understandings.

The question then becomes how can teachers maximize their instructional time, as consistent with the researcher's first assumption, and differentiate to meet the needs of all learners through intentional questioning, lesson design, and task selection, as consistent with the researcher's second assumption? The flipped classroom approach to instruction is one such solution that, based on the research, has the potential to maximize

instructional time in order to provide students opportunities to engage in more meaningful experiences consistent with social constructivist principles inside the classroom (Strayer, 2007; Tucker, 2012).

The flipped classroom has the potential to change the nature of the traditional classroom. The flipped classroom is defined by the Flipped Learning Network (2014) as an instructional method that moves direct instruction outside of the classroom in order to make room in the classroom for a more interactive learning environment where students can actively engage in the content. Based on this definition and the philosophical and theoretical foundations, literature was reviewed regarding the method. The research found on flipped classrooms highlighted several themes, which included: increased student achievement, conflicting student opinions about the method, and implications for class time (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013).

The research also suggested several advantages and disadvantages to the method. The advantages that were highlighted included: maximized class time in order to provide more time to differentiate instruction, students have the opportunities to apply, construct meaning, and become more independent in their learning, teachers can provide more timely feedback and assess understanding more accurately, videos help connect with digital natives, provide outside differentiation, and is helpful when used for knowledge or skill based content (Hanover Research Council, 2013). The disadvantages highlighted in the research included the fact that many students still do not have access to technology outside of the classroom and some are still not completing the videos (Hanover Research

Council, 2013). Other disadvantages focused on the poor quality of the videos, confusing attempts at explaining complex content in the videos, and more labor intensive prep time on the teachers' end (Nielson, 2012). Further, the research communicated that if class time was not devoted to more active learning opportunities, then understanding and achievement would not improve, but that students could be more likely to resist attempts at more active learning experiences in the classroom (Nielson, 2012).

The literature also made several recommendations for implementation of the flipped classroom and suggested that the in-class experiences should be where teachers should spend their effort (Baepler, Walker, & Driessen, 2014). Teachers should focus less on the quantity of time and more on the quality of time. Lessons should provide opportunities for peer interactions, discussion, and feedback (Crews & Butterfield, 2014), which is consistent with the social constructivist world view associated with the study. The literature also discussed that the videos should be short in length and focus on procedural content that can be easily explained (Overmyer, 2012). For someone choosing to implement the recommendations for this approach and adhere to constructivist principles, it would be important for the video content to follow the conceptual understanding developed or for the video content to spiral review procedural content of concepts that had already been developed in the classroom (Huitt, 2003; Moore, Gillett, & Steele, 2014).

With the purpose of examining differences between the flipped secondary mathematics classroom and a more traditional secondary mathematics classroom, literature regarding the explanatory sequential mixed methods design was also reviewed. This design model prioritizes the quantitative data and uses the qualitative data as a

means to explain the quantitative data in greater detail than would have otherwise been available (Creswell & Plano Clark, 2011). Traditionally the research occurs in two distinct phases where the quantitative data is collected and analyzed first as a means to identify cases and develop protocols for the qualitative phase. The qualitative data is then coded and analyzed with the quantitative results in mind as a way to deepen the understanding and explain the quantitative results (Creswell & Plano Clark, 2011).

Advantages to using the model are that the model is simple to implement and it helps to explore quantitative results in more detail, especially if the results are unexpected (Morse, 1991). Disadvantages to using the model include the time it takes to implement because of the two distinct phases and resource availability to carry out the traditional model (Ivankova, Creswell, & Stick, 2006). Due to these disadvantages, the literature suggested variations of the method based on the research objectives and the available resources for the study. Variations include the timing of the data collection components, when and how often qualitative and quantitative data are connected, and how and when participants will be determined for the study (Ivankova, Creswell, & Stick, 2006). Based on this literature and the research goals for the study, a variant of the explanatory sequential mixed methods design was selected.

Chapter 3 - Methodology

Overview of the Research Design

This study was conducted using a modified explanatory sequential mixed methods research design (Creswell & Plano Clark, 2011) in order to answer the overarching question of how do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers?

This study consisted of multiple phases. In this study, the researcher first collected quantitative data involving student achievement measures during the first semester of the school year in order to answer the following quantitative focus question:

1. How does the flipped classroom approach, in the secondary mathematics classroom, impact measures of student learning as identified by course semester final exams and NWEA Mathematics MAP data?

After an initial screening of the first semester data, it was determined that qualitative data involving a random selection of typical cases of students was appropriate for the study. Interview protocols for teachers and students were developed and administered at the end of the school year while second semester quantitative data involving student achievement measures were collected. The interview protocols were developed in order to answer the following qualitative focus questions and explain the quantitative results to the first quantitative focus question in more detail:

1. Do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?

2. Do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?

To address the post-positivist world view, researcher assumptions, and the connections that the flipped classroom had to social constructivist principles, the frequency of active learning incidents observed in classrooms were also recorded as a means to answer the following second quantitative focus question:

1. How does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom?

As part of the follow-up to this data collection and as a means to explain the quantitative data regarding active learning incidents in more detail, qualitative data were concurrently collected during classroom observations in order to answer the following third qualitative focus questions:

1. In what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom?

Quantitative data were analyzed first in each phase and the qualitative data were analyzed second as a way to explain and provide more detailed information about the quantitative results collected. The qualitative data were used to build on the quantitative data and both were connected during the middle stage of the study. The rationale for using the explanatory sequential design for mixed methods research (Creswell & Plano

Clark, 2011) in this particular study was that the quantitative data provided, and its analysis, allowed for a general understanding of the research problem that focuses on how student achievement can be explained by perceptions of learning through the flipped classroom approach to mathematics instruction. The qualitative data and its analysis sought to explain the quantitative results by reviewing student and teacher perceptions about teaching and learning mathematics along with classroom design and implementation at a greater depth. The qualitative data provided information about students' perceived motivation and learning style as a way to explain relationships between their course common final assessment grades throughout the course of a school year and their NWEA Mathematics MAP assessment scores over the course of the school year, where applicable, to determine how achievement compared between groups utilizing different instructional approaches to mathematics.

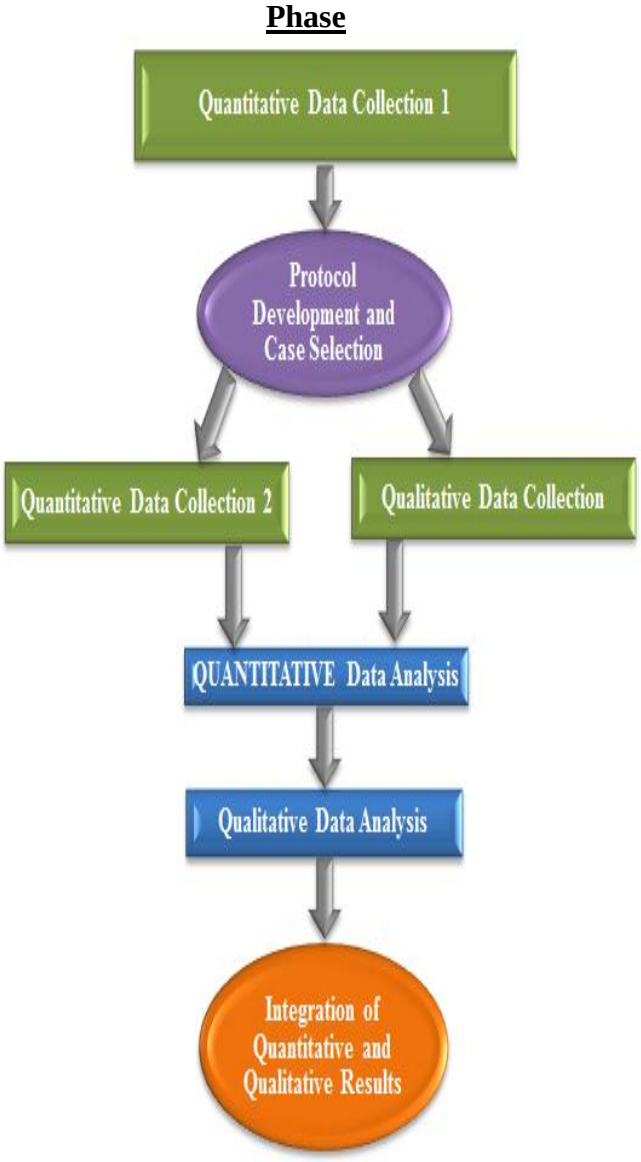
Research Method

This study was quasi-experimental in that the assignments of students to flipped versus traditional courses were outside the control of the researcher. Due to this factor, the quantitative phases of the study focused on comparing the flipped methods of classroom instruction to the traditional method of classroom instruction using independent samples t-Test analysis and analysis of covariance (ANCOVA). This analysis was appropriate for the research focus in order to determine what relationships existed between student achievement data and method of instruction. Control groups were selected based on their comparability to the treatment group.

This study utilized grounded theory as a means to describe the process by which student achievement was impacted by the flipped method of classroom instruction.

Grounded theory is defined as, “a set of rigorous research procedures leading to the emergence of conceptual categories” (Grounded Theory Institute, 2014). Using grounded theory, data was collected in order to focus on specific student and teacher perceptions through extensive audio-recorded interviews and through classroom observations. Observations focused on the prevalence of project-based learning activities, modeling activities, and opportunities for students to engage with peers in mathematical discourse. Grounded theory was an appropriate framework to utilize for this mixed methods design due to its flexibility with quantitative and qualitative data and as a means to utilize the qualitative data components to explain the relationships between student achievement and the classroom instruction students were given throughout the school year (Grounded Theory Institute, 2014).

Figure 1: Visual Model of Modified Explanatory Sequential Project Flow



Procedure	Product
• Purposefully selecting teachers in each group (N=6) • NWEA Mathematics MAP Assessment data (fall window where applicable) • Core math course common semester 1 assessment grades • Data screening (multivariate correlational analysis, factor analysis, homogeneity of slope analysis)	• Numerical Data • Categorical Data
• Developing interview questions • Defining active learning	• Interview Protocol • Active Learning Definition
• Randomly selecting ten students from all participating classrooms (N=10) • Individual, in-depth interviews (teacher and student) • Classroom observations (N=30) • Counts of active learning experiences • NWEA Mathematics MAP Assessment data (spring window) for both groups where applicable • Core math course common semester 2 assessment grades (current year)	• Interview transcripts; cases (N=16) • Observation transcripts • Numerical Data • Categorical Data
• Data screening (multivariate correlational analysis, factor analysis, homogeneity of slope analysis) • Counts of active learning experiences	• Categorical Data, two-way contingency table analysis • Descriptive Statistics, independent samples t-Test, Levene's Test for Equality of Variances, ANCOVA
• Open coding and constant comparative analysis • Axial & selective coding	• Table of themes
• Interpretation and explanation of the quantitative and qualitative results	• Joint Display • Discussion • Implications • Future Research

Population, Sample, Setting

The research study was conducted in two middle school math classrooms and four high school math classrooms in a large Midwestern suburban public school district. The school district consists of approximately 28,000 students spread over multiple cities and suburbs of Kansas City on the Kansas side of the state line. The district contains thirty-three elementary schools, five middle schools, five high schools, and one alternative high school. The school district is the third largest district in the state and reportedly graduates nearly 91% of its students (Kansas State Department of Education, 2015). The district has become increasingly diverse over the past twenty years with approximately 37% of the student population receiving free or reduced lunch benefits. Caucasian students make up approximately 66% of the student population, where 17% are reported as Hispanic, 9% as African American, and 8% reported as other. The district also supports a large population of English Language Learners (approximately 13%), speaking 78 different languages (School District Data, 2015).

Teacher participants were selected using a volunteer sample. The researcher contacted teachers in the district who were experimenting with the flipped method of classroom instruction and requested participation in the research study. Several teachers responded that they were trying this method and would volunteer for this opportunity. As a follow-up to this selection, the researcher contacted teachers within the same building, that taught the same course, and that collaborated in a Professional Learning Community (PLC) with the teachers who volunteered and asked if they would be willing to be involved in the study as a comparison group. Through that process, three teachers who were experimenting with the flipped method of classroom instruction and their PLC counterparts in their course and building volunteered and provided consent to participate in the study. Students in those courses were also provided informed

consent along with their parents for the opportunity to participate in researcher led interviews about their experiences in math classrooms during the current school year and in the previous school year. Half of the courses in the middle and high school settings that were studied utilized the flipped approach to classroom instruction where the other half of the middle and high school settings selected used a traditional approach to classroom instruction.

The middle school courses that were studied consisted solely of PreAlgebra courses. PreAlgebra is a course that consists of all of the seventh grade Common Core objectives and slightly over half (16) of the eighth grade Common Core objectives and follows the accelerated 7^{th} pathway from Appendix A in the Common Core State Standards document (The Common Core State Standards Initiative, 2014). PreAlgebra, in the school district, serves seventh grade students who are at or above the 60^{th} percentile on two of their most recent NWEA Mathematics MAP Assessments (School District Data, 2015).

High school courses that were studied include Honors Geometry and regular Geometry courses. Honors Geometry is a course that consists of the majority of the Geometry Conceptual Category Standards from the Common Core State Standards document (The Common Core State Standards Initiative, 2014) along with the inclusion of conditional probability and categorical data from the Statistics and Probability progression and honors level standards involving trigonometry. This course, in the school district, typically serves students in grades 9 and 10 at the high school level who have scored at or above the 80^{th} percentile on the NWEA Mathematics MAP Assessment and have had course grades in Algebra that are consistently at or above a B (School District Data, 2015). Regular Geometry is a standard level course that includes all of the same course objectives as Honors Geometry with the exception of the trigonometry and some conditional probability components that are denoted as honors level in the Common Core State

Standards document (The Common Core State Standards Initiative, 2014). Geometry, in the school district, typically serves any high school student who has completed Algebra 1 and earned credit for Algebra 1. Earning credit is defined as completing both semesters of Algebra 1 with a D or higher for the course grade (School District Data, 2015).

Quantitative Data Collection

For the quantitative phases of this study, quantitative data were collected in order to gain information about student achievement measures. Students involved in both the traditional and flipped classroom, and who were enrolled in grades 7-9 during the 2014-2015 school year, were engaged in the NWEA Measures of Academic Progress (MAP) Mathematics Assessment aligned to Common Core for grades six and beyond. The MAP test is a computer adaptive test that provides information about what students know, what they are ready to learn, and what they are not quite ready to learn (NWEA, 2015). The MAP test provides growth and progress data for individual students and provides information on students who are below, at, or above grade level (NWEA, 2015). This test was administered at the start of the school year to all students in the district 3-9 and again in the spring to assess student growth for students in 3-8. High school buildings were allowed to choose whether or not they administered a spring MAP assessment for freshman in their buildings in 2015, however, students beyond 9th grade that were enrolled in a tier 2 intervention course were tested, regardless of their grade level, a minimum of two times per year (School District Data, 2015). MAP typical growth norms by grade level were used as a comparison for both the traditional and flipped classroom groups at the middle school level, where fall and spring data were available.

Data on the current year's math semester common final assessment grades for all students involved in the study were also collected. As a 2014-2015 district educational services goal,

teachers in secondary mathematics courses designed and developed district level common semester assessments and scoring rubrics to be used in all courses (School District Data, 2015). Teachers collaborated on district level Professional Learning Communities (PLCs) by course and worked through a process of examining course objectives, reviewing old course assessments, and using Hess's Cognitive Rigor Matrix as a tool to identify levels of rigor in their former assessments (Hess, 2009). They developed and redesigned test items that aligned to the course objectives and the intended level of rigor, and created common scoring guides, rubrics, and assessment protocols for all teachers of the course (School District Data, 2015).

Student common assessment averages and MAP data were used to determine student achievement and student mastery of course objectives throughout the course of the study. Data for both measures of student learning were compiled with the assistance of the school district's Department of Assessment and Research. The Director of Assessment and Research for the district provided district raw data, with regards to student achievement measures and demographic information, using a multi-step process in order to ensure confidentiality of individually identifiable information. A database with all of the data fields was constructed by the Department of Assessment and Research. It included each subject's gender, race, family income level, currently enrolled math course, semester 1 common assessment score, semester 2 common assessment score, and MAP data for all testing windows that the student participated in during the last three years. Fields names and data elements for all demographic and academic variables were coded in order to maintain confidentiality of individual data elements. Translations for decoding these demographic and academic fields remain with the Department of Assessment and Research (School District Data, 2015).

As a second quantitative data set and to answer the second quantitative focus question with regards to the frequency of active learning in the classroom, classroom observational data were collected. Active learning incidents were defined as opportunities where students engaged in mathematical discourse with their peers, modeling activities, and project-based learning activities. Observations were conducted at random intervals over the course of five visits to each participating classroom and lasted an average of 47 minutes, and the incidence of the aforementioned activities was recorded based on whether or not the incidence occurred during the course of the observation.

During the quantitative phases of the study and with regards to the first quantitative focus question, student achievement data were analyzed using an independent samples t-test analysis in order to compare means between methods at individual site locations. An analysis of covariance (ANCOVA) was also used to control for covariate variables with respect to NWEA Mathematics MAP Assessment scores to determine if there were significant differences between groups at the middle school site studied. High school MAP data were not analyzed in such a manner due to the inconsistency of data available between the classrooms and the data collection. These methods were appropriate in determining responses to the research questions because they highlighted if there was a statistically significant difference in student achievement measures between the treatment group and the control group. Since the study was quasi-experimental in nature and teachers' implementation of the flipped classroom method of instruction was dependent on their philosophical beliefs and practices with respect to teaching and learning mathematics, variation between groups was anticipated.

In order to analyze quantitative data related to the second quantitative focus question involving the incidence of active learning experiences. Dichotomous, categorical variables of

yes an incident occurred or no it did not occur were recorded throughout each of the 30 randomized observations that averaged 47 minutes in length. If an active learning incident was observed during the course of an observation, a 1 was recorded and if an active learning incident was not observed during the course of the observation, a 0 was recorded. A two-way contingency table analysis was conducted in order to examine the relationship between the categorical variables. Frequency distributions were also conducted to determine how often incidents occurred throughout the course of all 30 observations and also in order to determine if multiple incidents occurred within a single observation. Frequency distributions were also used to determine which type of incident was more likely to occur during classroom observations for each classroom type.

Table 1: Quantitative Data Source Alignment to Research Questions

Quantitative Data Sources				
How do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about students' academic achievement as compared to their traditionally taught peers?				
Quantitative Focus Questions	**Data Item**	**Data Source**	**Format**	**Data Analysis**
<u>Question 1:</u> How does the flipped classroom approach, in the secondary mathematics classroom, impact measures of student learning as identified by course semester final exams and NWEA Mathematics MAP data?	**Student Achievement Measures**	**NWEA Mathematics MAP Assessment**	**Fall 2014/Spring 2015**	**ANCOVA**
		District Common Semester Assessments	**Individual Percent Scores by Course**	**Independent Samples t-Test**
<u>Question 2:</u> How does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom?	**Classroom Observation: 30 randomized classroom observations averaging 47 minutes in length**	**Incidence of peer to peer discourse or argumentation around content** **Incidence of project-based learning activities** **Incidence of modeling activities**	**Yes (1)/No (0)** **Counts of varying incidence types**	**Frequency Distributions** **Two-Way Contingency Table Analysis**

Qualitative Data Collection

For the qualitative phase of the study, qualitative data were collected in a variety of forms in order to explain the results of the quantitative student achievement measures and to determine potential differences between groups. Qualitative data were used to provide narrative details about the observable incidents of active learning experiences as well as narrative details about student and teacher perceptions with regard to the flipped classroom method of classroom instruction.

In order to answer the first and second qualitative focus questions with respect to if student and teacher perceptions about mathematical learning experiences differ, and in what ways, as a result of the flipped classroom method of instruction, the researcher conducted student and teacher interviews. Interview data were used in order to obtain information about student and teacher perceptions as they relate to mathematics teaching and learning in the classroom. Protocols were developed to help identify differences between groups and to help further explain the quantitative data analysis results.

Teachers were interviewed using a standardized interview protocol that was developed after the initial quantitative data collection regarding first semester student achievement measures. Interview protocols for teachers using a more traditional approach to classroom instruction consisted of seven questions and nine questions were used for teachers using the flipped method of classroom instruction. Questions for teachers focused on four main domains that were identified by the researcher after the initial first semester quantitative data collection to be areas that could provide insight into potential differences between the groups and that were consistent with the themes in the literature regarding increased student achievement, implications for class time, and conflicting perceptions about the method (Flumerfelt & Green, 2013; Pierce

& Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013). The domains identified were: lesson planning and classroom routines, perception of instructional effectiveness, homework completion and student effort, and reflection on changes for the future. The interview protocol for teachers was validated with two teachers, one who had flipped her classroom before and one who had not flipped. Both teachers were not involved in the study; however their responses were used to determine the effectiveness of the protocol before data collection for the study began.

Students were also interviewed using a standardized interview protocol consisting of ten questions for students in the traditionally structured classrooms and eleven questions for students in the flipped classroom. Questions for students also focused on four main domains that were identified by the researcher after the initial first semester quantitative data collection to be areas that could provide insight into potential differences between the groups and that were also consistent with the same themes identified in the literature (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013). The domains for students included: classroom routines, homework structure and completion, perception of student effort and ability, and perception of how classroom structure impacts student learning. Students were selected for the interview process randomly based on student and parent consent to the process. Once all consent forms were received from parents and students, consenting students were alphabetized and assigned a number based on their position in alphabetical order. A random number generator was used to randomly select ten students for the interview process. Based on the proportion of students enrolled in flipped classrooms as

compared to traditional classrooms and the return rate of informed consent forms, it was determined that random selection would happen across all sites equally and would not be randomly selected out of separate pools. Random selection of consenting individuals in order to obtain typical cases of participants was appropriate given that initial quantitative data screening of first semester common final assessment scores and fall NWEA MAP Assessment scores were relatively similar between groups (Ivankova, Creswell, & Stick, 2006). The student interview protocol was validated using handwritten, field note documentation with students also not involved in the study and who will remain anonymous.

All interview data collected were audio-taped by the researcher and transcribed during the data analysis stage. This data explained potential factors for variation in student achievement in their classrooms and was used to determine, qualitatively, if themes emerged related to instructional approach, perception of achievement, and the quantitative achievement results.

To address the third qualitative focus question regarding the incidence of active learning experiences in the classroom, classroom observational data in both the traditional and in the flipped classrooms were also collected. Thirty classroom observations, five visits per teacher, were conducted at random intervals throughout the course of the study and averaged 47 minutes in length. During that time, quantitative data were recorded as to whether or not any active learning incident occurred throughout the course of the observation, and then detailed narrative descriptions of the type of active learning were also recorded in order to further explain potential factors related to varying achievement levels and perceptions of effective instructional practice. Quality and length of the active learning observed was not defined and measured for the purposes of this study. Themes were coded and compared to quantitative data in order to help provide more detailed explanations to the quantitative results.

During the qualitative phase of the study, data was analyzed using the constant comparative method of data analysis in order to develop a grounded theory, through a three stage process as proposed by Glaser and Strauss (1967). Segments of data that were responsive to the qualitative focus questions of the study were analyzed through the use of open thematic coding and the constant comparative method for data analysis (Merriam, 2009). Interview transcripts were open-coded within the domains identified after the initial quantitative data screening in order to determine what themes existed. Categories were constructed after compiling units of data during the axial coding phase, based on the interview transcripts and the four main domains from each protocol. The same process was used to construct categories based on the site observation field notes. Categories were assigned codes and the codes were continually analyzed using the constant comparative method for data analysis (Merriam, 2009). Selective coding was used (Merriam, 2009) to develop the core categories and compare them to the quantitative analysis results using a joint display analysis for the incidence of active learning (Creswell & Plano Clark, 2011) and using tables of themes for the perception data (Merriam, 2009). Narrative, descriptive data were also included to help explain differences between groups as highlighted by the quantitative data analysis and to provide more detail regarding the active learning incidents observed in the classroom. Narrative data were analyzed as described by Riessman (2008) by focusing the analysis on the narrative description (Riessman). Segments of interviews were clustered specifically around explanatory themes related to the quantitative results and as highlighted by the literature (Morse & Richards, 2002).

Analysis of all codes was not subject to inter-rater reliability due to the fact that the researcher acted alone throughout the study. This process is consistent with Morse's (1994) discussion about having insights from multiple raters. Morse would argue that uniformity

amongst qualitative raters is “unrealistic” and better suited for quantitative data methods. The qualitative analysis was appropriate for the study in order to understand the quantitative results and explain differences between implementation and course groups based on student achievement results and incidents of active learning.

Table 2: Qualitative Data Source Alignment to Research Questions

Qualitative Data Sources				
How do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about students' academic achievement as compared to their traditionally taught peers?				
Qualitative Focus Questions	**Data Item**	**Data Source**	**Format**	**Analysis**
Question 1: Do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?	Student Perception of Experience	Student Interview Protocol	Audio-taped, researcher-led interviews of 10 randomly selected students over all six sites	Open Coding Axial Coding Selective Coding Constant Comparative Method Joint Display Analysis Table of Themes
Question 2: Do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?	Teacher Perception of Experience	Teacher Interview Protocol	Audio-taped, researcher-led interviews of all 6 participating teachers	
Question 3: In what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom?	Description of Active Learning Incidents	Classroom Site Observations	Description of types of active learning observed throughout the 30 randomized classroom observations averaging 47 minutes in length	

Limitations of the Data and Methodology

There are a number of limitations of the data and methodology for each of the phases of the study. With respect to the research design, resources available to the researcher, and the timeline provided by the participating school district, modifications to the design model were made. In a traditional explanatory sequential mixed methods research design, all quantitative data would have been collected and analyzed before developing the protocols for the qualitative phase of the study (Creswell & Plano Clark, 2011). For the purposes of this study, it was appropriate given the research focus and school year timeline to collect a portion of the quantitative data first, screen that data, and then use that to inform the protocol development and participant selection procedures for the qualitative phase of the study. Due to the timing of this portion, the second semester quantitative data and the qualitative data were collected concurrently.

For the quantitative collections, the data set was limited to students participating in the classrooms of six teachers that belonged to a single, large, Midwestern suburban district. Second, the common final assessments measures used as a data point and analyzed were created by teachers of the individual courses in the school district. Scoring rubrics and protocols, while consistent across all teachers of the same course, are also subject to the grading and scoring of the individual teachers with those scores reported through an online student information system. Access to item analysis of the semester common final assessments was not available to the researcher for purposes of study and was held as property of the school district. Third, the middle school site involved in the study was experimenting with integer grading during the course of the 2014-2015 school year and grades in that location were subject to the building's

interpretation of the integer system and standards based grading practices. Lastly, high school students were not consistently given the NWEA MAP assessment in all buildings due to time and space considerations and due to the onset of a newly developed state assessment, and the reliability of the data after 9th grade.

For the qualitative phase, a limitation of the study was that the definition of flipped classroom was not standardized across sites and, in itself, was subject to the interpretation of the experimenting teachers. A second limitation involved the data analysis. Analysis for the qualitative data was conducted by the researcher alone and therefore inter-rater reliability was not possible when coding for themes. Because of this, it is possible that the researcher assumptions and biases associated with the post-positivist and social constructivist world views influenced the coding decisions for the qualitative analyses.

Another limitation that impacted all phases of the study involved changes to the school structure. During the school year, sites had undergone significant changes to their in terms of a massive restructuring in district administration and supports mid-year, a full blown roll out of a one to one technology initiative, the onset of a new student information system and gradebook program, and the mid-year communication of middle school and high school schedule restructuring for the 2015-2016 school year.

Despite these limitations to the data and methodology, the results of this study have provided useful information in the discussion about effective instructional approaches in the secondary mathematics classroom and engaged more meaningful discussions about the flipped classroom method as an instructional strategy. The findings of this study can help teachers refine and retool their approach to teaching and learning

based on quantitative student achievement measures and by qualitative perceptions and descriptions of the learning experiences taking place in the classroom. They can also serve as reflection on current classroom practices and guide instructional decisions.

Summary of Methods

This study utilized a modified version of the explanatory sequential mixed methods design. Participants were selected from a large, Midwestern, suburban public school district. The study was carried out through multiple phases where quantitative first semester common assessment and fall NWEA Mathematics MAP Assessment data were collected first and screened. Means were compared to determine what variances might be present between groups at individual sites. Based on that initial screening, the researcher determined that a random selection of typical cases (Ivankova, Creswell, & Stick, 2006) would be appropriate for the qualitative phase of data collection. The researcher also determined domains for the interview protocols after the initial quantitative data collection by identifying areas that could help explain any differences that might be present when finalizing the quantitative data analysis, as well as areas that were consistent with the emergent themes from the literature (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013). The identification of these domains and development of the interview protocols were decisions made by the researcher based on the initial quantitative understanding of the instructional method being studied and were consistent with the recommendations made by Glaser and Strauss (1967) when utilizing the constant comparative method of qualitative analysis to help develop a grounded theory.

After the initial quantitative data collection and the development of the interview protocols and case selection, further quantitative common assessment and spring NWEA Mathematics MAP Assessment data were collected during second semester. Qualitative interview data were collected during second semester as well in order to answer the first two qualitative focus questions. As a separate quantitative and qualitative focus, data were collected with respect to observable active learning incidents in the classroom. Qualitative data around the type of active learning being observed was also collected concurrently during the classroom observations. The focus of this collection was to answer quantitative focus question 2 and qualitative focus question 3, and to help determine if consistent practices occurred in relationship to the social constructivist world view, researcher assumptions, and current definitions of the flipped classroom.

During the data analysis phase of the study, quantitative data were analyzed first. Independent samples t-Tests were used to compare common assessment achievement results at individual site locations. ANCOVA was used to compare NWEA Mathematics MAP Assessment data at the middle school site where data points were available. Frequency distributions and two-way contingency table analyses were used to examine quantitative data surrounding observable active learning incidents. As a follow-up to the quantitative analyses and to help explain the quantitative results in more detail, qualitative interview data and classroom observation data were coded using the constant comparative method of qualitative analysis in order to develop a grounded theory (Glaser & Strauss, 1967).

Chapter 4 - Results

Overview

The purpose of this mixed methods research study was to address how the flipped method of classroom instruction differs from traditional classroom instruction when comparing student achievement measures in middle and high school mathematics classrooms. The study utilized a modified explanatory sequential mixed methods design. Specifically, the study focused on explaining differences in student achievement measures through the use of classroom observation data and student and teacher interview data. The data collected by the researcher was based on current practices and trends within the target school district, and in no way were influenced by the researcher or the research study. Teachers involved in the study were those that were either experimenting with the flipped method of classroom instruction, by their own intention and design, or they were colleagues of like courses of those teachers within their buildings. Data relied on district available student achievement data, teacher and student perception and definition of understanding and mastery of content, along with observational data collected by the researcher during classroom visits in order to compare and explain differences in data types.

For this study, multiple settings within the same school district were researched. At the high school level, two buildings were involved and both were located in a large suburban district in eastern Kansas. The first high school had a total enrollment of 1,849 students in grades 9-12 during the 2014-2015 school year (Kansas State Department of Education, 2015). The data collected from this high school involved data from two full-time teachers of mathematics and the 175 students enrolled in their regular Geometry

courses. The second high school had a total enrollment of 1,384 students in grades 9-12 during the 2014-2015 school year (Kansas State Department of Education, 2015). The data collected from this high school involved data from two full-time teachers of mathematics and the 71 students enrolled in their Honors Geometry courses.

At the middle school level, one building was involved from the same school district as the two high school buildings, however the middle school students attending this particular building would not go on to attend high school at either of the two high schools studied. The middle school was set in a third area of the district not served by the other two high school buildings. The middle school had a total enrollment of 837 students in grades 7-8 during the 2014-2015 school year (Kansas State Department of Education, 2015). The data collected from this building involved data from two full-time teachers of mathematics and the 274 students enrolled in their PreAlgebra courses.

For the purposes of this study, teachers did not receive professional development around flipped classroom methods of instruction. Participants did also not engage in discussions with the researcher about defining the flipped method of classroom instruction or about what current definitions of the flipped method of classroom instruction existed. Teachers were solely selected based on their desire to participate and their self-reported use of the flipped classroom method, or the fact that they were colleagues of teachers reporting the utilization of the flipped method of classroom instruction. The researcher was purely interested in comparing this method with respect to student achievement and active learning as explained by currently held teacher perceptions and implementations in the mathematics classroom.

Data were collected from multiple sources that included both quantitative and qualitative measures in order to explain differences between student achievement within the targeted sites and courses. The quantitative data were collected through collaboration with the Assessment and Research Department in the participating school district. The data included information pertaining to student demographics along with individual student scores on first and second semester common district finals and NWEA Mathematics MAP assessment scores for students. The qualitative data were collected through classroom observation field note transcripts and audio-taped student and teacher interviews with the researcher. This data were collected in order to help explain the quantitative data results focused on differences in student achievement between groups. This study focused on social constructivism as a theoretical framework (Doolittle, 2015) and was grounded in a post-positivist and social constructivist world view (Creswell & Plano Clark, 2011).

Student achievement in the flipped mathematics classroom was examined through the following overarching research question:

1. How do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers?

This overarching question was further explored through quantitative and qualitative focus questions. The following focus questions were explored during the quantitative phases of the study:

1. How does the flipped classroom approach, in the secondary mathematics classroom, impact measures of student learning as identified by course semester final exams and NWEA Mathematics MAP data?
2. How does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom?

The following focus questions were explored during the qualitative phase of the study in order to explain the results of the quantitative focus questions:

1. Do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?
2. Do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?
3. In what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom?

These questions were answered through the methods described in Chapter 3 as well as through the data collected and analyzed as outlined in Table 1 and Table 2 in Chapter 3.

This chapter is divided into four sections based on the aforementioned research questions and the type of data analysis used. The first section focuses on the student achievement measures analysis. Descriptions of student characteristics in each of the

participating sites are provided based on demographic variables along with information about their achievement when compared as a whole group and as individual site groups. The comparisons include an analysis of covariance (ANCOVA) for NWEA Mathematics MAP Assessment Data in order to control for confounding demographic variables and incoming fall data. An independent samples t-test analysis is also used in order to compare means for the whole group and individual site groups. Analysis includes all 520 students in the participating classrooms as personally identifiable student information was masked by the Assessment and Research Department in the district.

The second section focuses on the active learning incidents observed by the researcher during the 30 randomized, 47 minute average, classroom observations. If an active learning incident occurred during the course of the classroom observation, the frequency of those incidents categorized by peer-to-peer discourse, modeling activities, and project-based learning opportunities was recorded along with qualitative descriptions of the incident or incidents. The quantitative frequencies of active learning incidents were analyzed through a two-way contingency table analysis to determine relationships between the frequency of active learning incidents and the method of classroom instruction. Whole groups and individual sites were analyzed in order to determine differences at multiple levels. The qualitative descriptions of the incidents were analyzed using thematic coding (Morse & Richards, 2002) in a joint analysis table display (Creswell & Plano Clark, 2011) in order to help explain differences in the quantitative results.

The third section of this chapter focuses on qualitative student perceptions with regards to learning mathematics. Students in both the flipped and traditional classrooms

were interviewed during this portion of the study. Data were collected using a standardized interview protocol for each group. Protocols were developed after the initial quantitative data collection regarding first semester student achievement measures through decisions made by the researcher regarding the researcher's initial understanding of the method being studied as highlighted by the first quantitative data screening (Glaser & Strauss, 1967). Interview question domains were developed through this process and in relationship to the emergent themes in the literature (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013).

Students were randomly selected based on their willingness to participate through informed consent and their interviews were audio-taped by the researcher. Data for this section were analyzed through a three stage coding process that utilized the constant comparative method of qualitative data analysis (Merriam, 2009) in order to develop a grounded theory (Glaser & Strauss, 1967). A table of themes was constructed in order to determine emergent themes in student responses that could explain, in more detail the quantitative results (Morse & Richards, 2002).

The final section of this chapter focuses on qualitative teacher perceptions with regards to teaching mathematics and student learning in mathematics. Teachers of both the flipped and traditional classrooms were interviewed during this portion of the study. Data were collected using a standardized interview protocol for each group. Protocols for teacher interviews were also developed after the initial first semester quantitative data collection and screening using the same methods aforementioned. All six participating

teachers were interviewed and their interviews were audio-taped by the researcher. Data for this section was also analyzed through a three stage coding process that utilized the constant comparative method of qualitative data analysis (Merriam, 2009) in order to develop a grounded theory (Glaser & Strauss, 1967). A table of themes was constructed in order to determine emergent themes in student responses that could explain, in more detail the quantitative results (Morse & Richards, 2002). These themes were also compared to the themes from the student interview data and both were used to explain, in more detail, the quantitative results (Creswell & Plano Clark, 2011).

Student Achievement Measures

In order to answer the first quantitative focus question related to how the flipped classroom approach, in the secondary mathematics classroom, impacted measures of student learning as identified by course semester final exams and NWEA Mathematics MAP data, it was appropriate to first describe the overall groups throughout all six sites and then compare means between classrooms at each of the three sites on an individual basis in order to control for variance across all three sites.

Flipped vs. Traditional Classrooms

The students enrolled in courses that were experimenting with the flipped method of classroom instruction made up 314 of the 520 overall students involved in the research and were split between three of the studies' classroom teachers. The students enrolled in courses not experimenting with the flipped method of classroom instruction consisted of 206 of the 520 overall students involved in the research, and were also split between three different classroom teachers. Flipped 1 and 2 were high school teachers experimenting with the flipped classroom and flipped 3 was a middle school teacher experimenting with

the flipped classroom. Traditional 1 and 2 were high school teachers that were not experimenting with the flipped classroom and were colleagues of the same course and building of flipped 1 and 2, respectively. Traditional 3 was a middle school teacher not experimenting with the flipped classroom and was also a colleague of the same course and building as flipped 3.

Table 3 contains descriptive characteristics for students' grade levels in the flipped classrooms as compared to the traditional classrooms. Inspection of this table reveals that the majority of students enrolled in flipped classrooms and traditional classrooms involved in the study were in either the 7th grade or the 9th grade, with 75.16% of students in the flipped classrooms enrolled in those two grade levels and 78.05% of students in the traditional classrooms enrolled in those two grade levels. Further inspection reveals that the majority of students enrolled in the traditional classrooms were 7th graders, with 66.50% of students enrolled, whereas the majority of flipped classroom students were split between the 7th and 9th grade with 43.63% enrolled as 7th graders and 31.53% enrolled as 9th graders during the 2014-2015 school year.

Table 3: Descriptive Statistics for Student Grade Level in Flipped vs. Traditional Classrooms

	Grade Level					
Group	**7**	**8**	**9**	**10**	**11**	**12**
Flipped	43.63%	0%	31.53%	21.97%	2.23%	0.64%
Traditional	66.50%	0%	11.65%	16.50%	4.37%	0.97%

Table 4 contains descriptive characteristics for students' gender in the flipped classrooms as compared to the traditional classrooms. Inspection of this table reveals that the majority of students in both the flipped and traditional classrooms were reported as

female during the 2014-2015 school year. Females consisted of 53.18% of all students enrolled in flipped classrooms and females consisted of 55.83% of all students enrolled in traditional classrooms.

Table 4: Descriptive Statistics for Student Gender in Flipped vs. Traditional Classrooms

	Gender	
Group	**Female**	**Male**
Flipped	53.18%	46.82%
Traditional	55.83%	44.17%

Table 5 contains descriptive characteristics for students' ethnicity in flipped classrooms as compared to the traditional classrooms. Inspection of this table reveals that students enrolled in both the flipped and traditional classrooms were reported as white by the district during the 2014-2015 school year, with 74.20% of students enrolled in flipped classrooms identified as white and 76.70% of students enrolled in the traditional classrooms identified as white. For students enrolled in the flipped classrooms, the second largest reported ethnicity was Hispanic, with 13.06% of students enrolled identified as Hispanic. For students enrolled in the traditional classroom, the second largest subgroup was African-American, with 9.22% of students enrolled identified as African-American.

Table 5: Descriptive Statistics for Student Ethnicity in Flipped vs. Traditional Classrooms

	Ethnicity					
Group	**White**	**African-American**	**Hispanic**	**Asian**	**Native American or Pacific Islander**	**Multi-Ethnic**
Flipped	74.20%	5.73%	13.06%	0.64%	2.23%	4.14%
Traditional	76.70%	9.22%	8.74%	0%	2.43%	2.91%

Table 6 contains descriptive characteristics for students receiving special services in the flipped classrooms as compared with the traditional classrooms. Inspection of this table reveals that 23.57% of students enrolled in the flipped classrooms had received free or reduced lunch services as compared with 17.96% of students enrolled in the traditional classrooms receiving free or reduced lunch services during the 2014-2015 school year. Students receiving services based on their non-native English speaking status made up 8.28% of the students in the flipped classrooms as compared with 5.83% in the traditional classrooms. Students receiving gifted services in the flipped classrooms made up 7.01% of all students enrolled as compared with 5.34% of students receiving such services in the traditional classrooms. Students receiving services for physical or learning disabilities made up 2.23% of students in the flipped classrooms, where as 15.05% of students enrolled in the traditional classrooms were receiving special education services as reported by the school district during the 2014-2015 school year.

Table 6: Descriptive Statistics for Student Services in Flipped vs. Traditional Classrooms

	Student Services			
Group	**Free/Reduced Lunch**	**English Language Learners**	**Gifted**	**Special Education**
Flipped	23.57%	8.28%	7.01%	2.23%
Traditional	17.96%	5.83%	5.34%	15.05%

High School Site 1: Regular Geometry

The regular Geometry classes that were involved in the study included 175 of the 520 overall students involved in the research and were split between two classroom teachers. Flipped 1 taught five sections of regular Geometry and instructed 129 of the students involved in the study. Traditional 1 taught three sections of regular Geometry and instructed 46 of the students involved in the study. Flipped 1 was experimenting with the flipped classroom, while traditional 1 was not.

Table 7 contains descriptive characteristics for students' grade levels in each teacher's classroom. Inspection of this table reveals that the majority of the students in the flipped Geometry classes were either freshmen or sophomores during the 2014-2015 school year, with 93.02% of all students falling in those categories. For the traditional Geometry classes, more students were enrolled as sophomores and juniors, with 86.96% falling in those two categories during the 2014-2015 school year.

Table 7: Descriptive Statistics for Student Grade Level in Regular Geometry

	Grade Level			
Group	**9**	**10**	**11**	**12**
Flipped	40.31%	52.71%	5.43%	1.55%
Traditional	8.70%	67.39%	19.57%	4.35%

Table 8 contains descriptive characteristics for students' gender in each group. Inspection of this table reveals that the students in the flipped classrooms had a female majority in all classes, with 57.36% of students reported as female. The traditional classrooms had a male majority in all classes, with 56.52% reported as male during the 2014-2015 school year.

Table 8: Descriptive Statistics for Student Gender in Regular Geometry

	Gender	
Group	**Female**	**Male**
Flipped	57.36%	42.64%
Traditional	43.48%	56.52%

Table 9 contains descriptive characteristics for students' ethnicity in the flipped and traditional Geometry classes. Inspection of this table reveals that the 55.81% of the students enrolled in the flipped Geometry classes were reported as white with the next largest subgroup reported as Hispanic, with 23.26% of all students identifying themselves as that ethnicity, according to district reports for the 2014-2015 school year. The traditional Geometry classes largest subgroup of students were reported as African-American at 39.13% and the next largest subgroup was reported as white, with 36.96% of students identifying themselves as that ethnicity according to district reports for the 2014-2015 school year.

Table 9: Descriptive Statistics for Student Ethnicity in Regular Geometry

	Ethnicity					
Group	**White**	**African-American**	**Hispanic**	**Asian**	**Native American or Pacific Islander**	**Multi-Ethnic**
Flipped	55.81%	12.40%	23.26%	1.55%	2.33%	4.65%
Traditional	36.96%	39.13%	17.39%	0%	2.17%	4.35%

Table 10 contains descriptive characteristics for students receiving special services in flipped and traditional Geometry classes as reported by the school district. Inspection of this table reveals that the flipped Geometry classes had 45.74% of students receiving free or reduced lunch services as compared with the traditional Geometry classes having 60.87% of students receiving free or reduced lunch services during the 2014-2015 school year. Students receiving services based on their non-native English speaking status made up 16.28% of the students in the flipped Geometry classes as compared with 21.74% in traditional Geometry classes. A small percent of students in the flipped Geometry classes received gifted services at 1.55% as compared with 0% of students receiving such services in the traditional Geometry classes. Students receiving services for physical or learning disabilities made up 3.88% of students in the flipped Geometry classes as compared with 58.70% of students in the traditional Geometry classes receiving such services as reported by the school district during the 2014-2015 school year.

Table 10: Descriptive Statistics for Student Services in Regular Geometry

	Student Services			
Group	**Free/Reduced Lunch**	**English Language Learners**	**Gifted**	**Special Education**
Flipped	45.74%	16.28%	1.55%	3.88%
Traditional	60.87%	21.74%	0%	58.70%

Groups administered common, district generated, semester 1 and semester 2 finals during the 2014-2015 school year. The expectation from the district was for teachers of the same course to administer the same semester finals and use an agreed upon scoring guide in order to report student results for grading purposes. Table 11 includes descriptive statistics about average student achievement on both semester 1 and semester 2 exams for each group. Inspection of this table reveals that students in the flipped Geometry classes had a higher overall mean on both the semester 1 and semester 2 final exams as compared to students in the traditional Geometry classes, with the difference of means being 15.62% and 18.36% respectively.

Table 11: Descriptive Statistics for Final Exam Scores in Regular Geometry

	Common Assessment	
Group	**Semester 1 Final Mean**	**Semester 2 Final Mean**
Flipped	68.76%	72.44%
Traditional	53.14%	54.08%

When comparing the flipped classroom to the traditional classroom for the regular Geometry courses at this particular building, a comparison of the means of the semester 1 and semester 2 final exam scores was conducted. Figure 2 represents the final exam scores for semester 1 common finals in regular Geometry as compared to semester 2

common final exam scores in regular Geometry between the two groups. Inspection of this figure highlights that the flipped classroom had a steeper slope on average and more students clustered above the total course means for both exams.

Figure 2: Scatterplot of Final Exam Data for Regular Geometry

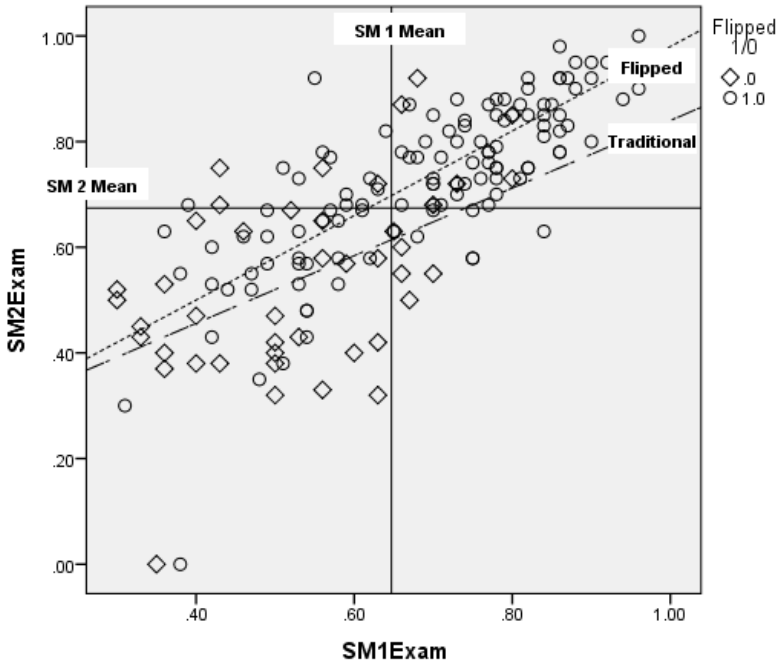


Figure 2. Scatterplot showing the differences between exam scores, as compared to the means for the entire course, separated by classroom type.

Provided this data regarding the difference of means, an independent samples t-test was conducted to compare the semester one regular Geometry final exam scores in the flipped regular Geometry classroom and in the traditional regular Geometry classroom. Table 12 shows Levene's Test for Equality of Variances for both the semester 1 and semester 2 common final assessments in regular Geometry. Table 13 shows the independent samples t-test statistics for the equality of means.

Table 12: Levene's Test for Equality of Variances for Regular Geometry

		Levene's Test for Equality of Variances	
Exam		**F**	**Sig.**
Sem 1	Equal Variances Assumed	.629	.429
	Equal Variances Not Assumed		
Sem 2	Equal Variances Assumed	.885	.348
	Equal Variances Not Assumed		

Table 13: Independent Samples t-Test for Regular Geometry

	t-Test for Equality of Means				
Exam	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Sem 1	5.949	162	.000	.15620	.02626
Sem 2	6.531	171	.000	.18362	.02512

Inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 1 common final, we can assume equal variances since p=.429 and is therefore greater than .05. There was a significant difference in the scores for the flipped classroom (M=.6876, SD=.15127) and the traditional classroom (M=.5314, SD=.13783) conditions; t(162)=5.949, p=0. These results suggest that there was a significant difference between student achievement in the flipped classroom as compared to student achievement in the traditional classroom as measured by the regular Geometry semester 1 final. Specifically, the results suggest that differences between the two groups existed and therefore there was an increase in student achievement in the flipped classroom as measured by the semester 1 regular Geometry final.

Further inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 2 common final, we can also assume equal variances since

p=.348 and is therefore greater than .05. There was a significant difference in the scores for the flipped classroom (M=.7244, SD=.15932) and the traditional classroom (M=.5408, SD=.17426) conditions; t(171)=6.531, p=0. These results suggest that there was a significant difference between student achievement in the flipped classroom as compared to student achievement in the traditional classroom as measured by the regular Geometry semester 1 final. Specifically, the results suggest that differences between the two groups existed and therefore increase student achievement in the flipped classroom as measured by the semester 2 regular Geometry final.

Figures 3 and 4 represent the comparison of the two groups' mean scores and independent samples t-Test.

Figure 3: Error Bar Graph for the Sem 1 Common Final for Regular Geometry

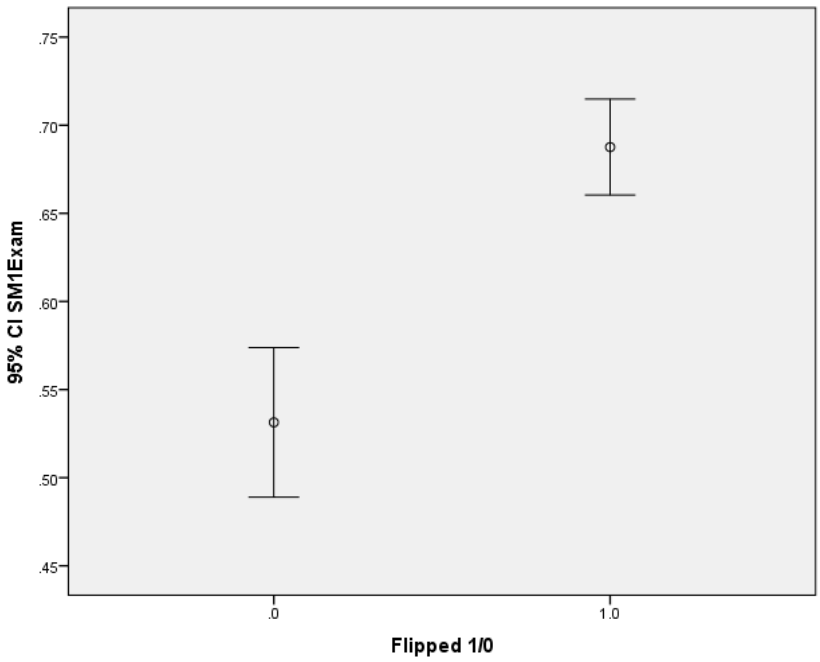


Figure 3. Error bars (at the 95% confidence interval) for the semester 1 exam scores in regular Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=43 students and Flipped n=121 students. Independent samples t-test, 162 df, p<.05

Figure 4: Error Bar Graph for the Sem 2 Common Final for Regular Geometry

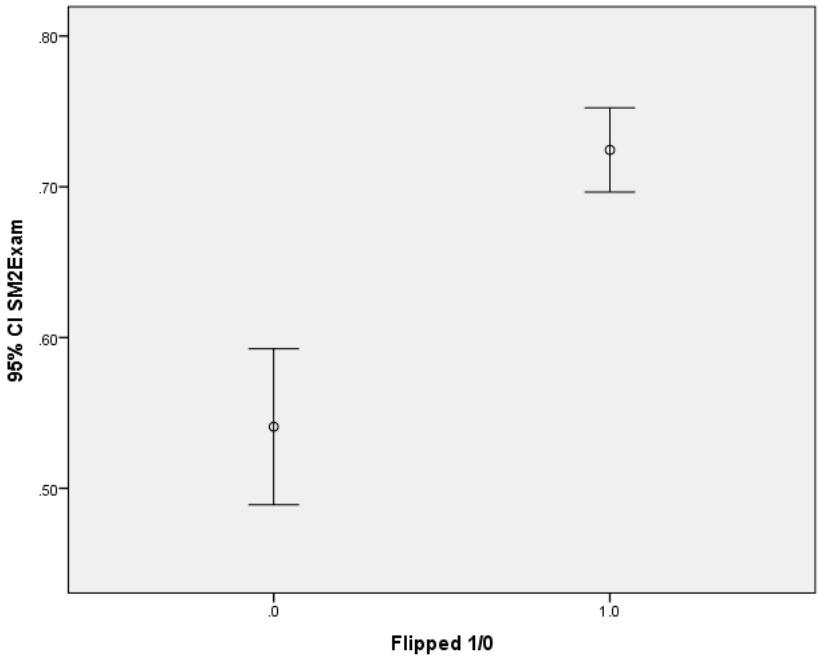


Figure 4. Error bars (at the 95% confidence interval) for the semester 2 exam scores in regular Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=46 students and Flipped n=127 students. Independent samples t-test, 171 df, p<.05

High School Site 2: Honors Geometry

The Honors Geometry classes that were involved in the study included 71 of the 520 overall students involved in the research and were split between two classroom teachers. Flipped 2 taught two sections of Honors Geometry and instructed 48 of the students involved in the study. Traditional 2 taught one section of Honors Geometry and instructed 23 of the students involved in the study. Flipped 2 was experimenting with the flipped classroom, while traditional 2 was not.

Table 14 contains descriptive characteristics for students' grade levels in both the flipped and traditional classrooms. Inspection of this table reveals that the majority of the students in both the flipped and traditional classes were freshmen, with 97.92% of the students in the flipped Honors Geometry classes enrolled in 9th grade and 86.96% of the

students in the traditional Honors Geometry class enrolled in 9th grade during the 2014-2015 school year. Neither classroom had any students enrolled as juniors or seniors during the 2014-2015 school year.

Table 14: Descriptive Statistics for Student Grade Level in Honors Geometry

	Grade Level			
Group	**9**	**10**	**11**	**12**
Flipped	97.92%	2.08%	0%	0%
Traditional	86.96%	13.04%	0%	0%

Table 15 contains descriptive characteristics for students' gender in both the flipped and traditional Honors Geometry classes. Inspection of this table reveals that exactly half of all students enrolled in the flipped Honors Geometry classes were reported as female and a majority of the students enrolled in the traditional Honors Geometry class, at 73.91%, were reported as female during the 2014-2015 school year.

Table 15: Descriptive Statistics for Student Gender in Honors Geometry

	Gender	
Group	**Female**	**Male**
Flipped	50.00%	50.00%
Traditional	73.91%	26.09%

Table 16 contains descriptive characteristics for students' ethnicity in both the flipped and traditional Honors Geometry classrooms. Inspection of this table reveals that both groups had a majority of students labeled as white, as reported by the school district, with 83.33% of students enrolled in the flipped Honors Geometry classes identified as white and 73.91% of students enrolled in the traditional Honors Geometry class identified as white during the 2014-2105 school year. The next largest reported subgroup in the

flipped Honors Geometry classes was Hispanic, with 10.42% of students identifying themselves in that ethnic group. In the traditional Honors Geometry class, equal numbers of students were reported as Hispanic, Native American or Pacific Islander, and Multi-Ethnic, with 8.70% of enrolled students identifying themselves in those ethnic groups.

Table 16: Descriptive Statistics for Student Ethnicity in Honors Geometry

	Ethnicity					
Group	**White**	**African-American**	**Hispanic**	**Asian**	**Native American or Pacific Islander**	**Multi-Ethnic**
Flipped	83.33%	2.08%	10.42%	0%	2.08%	2.08%
Traditional	73.91%	0%	8.70%	0%	8.70%	8.70%

Table 17 contains descriptive characteristics for students receiving special services in both the flipped and traditional Honors Geometry classes as reported by the school district. Inspection of this table reveals that the 8.33% of students enrolled in the flipped Honors Geometry classes received free or reduced lunch services as compared with 0% of students enrolled in the traditional Honors Geometry class receiving free or reduced lunch services during the 2014-2015 school year. Students receiving services based on their non-native English speaking status made up 4.17% of the students in flipped Honors Geometry classes as compared with 8.70% in the traditional Honors Geometry class. Students receiving gifted services in the flipped Honors Geometry classes made up 20.83% of all students enrolled as compared with 13.04% of students receiving such services in the traditional Honors Geometry class. Students receiving services for physical or learning disabilities made up 0% of students in both groups classes as reported by the school district during the 2014-2015 school year.

Table 17: Descriptive Statistics for Student Services in Honors Geometry

	Student Services			
Group	**Free/Reduced Lunch**	**English Language Learners**	**Gifted**	**Special Education**
Flipped	8.33%	4.17%	20.83%	0%
Traditional	0%	8.70%	13.04%	0%

Groups administered common, district generated, semester 1 and semester 2 finals during the 2014-2015 school year. The expectation from the district was for teachers of the same course to administer the same semester finals and use an agreed upon scoring guide in order to report student results for grading purposes. Table 18 includes descriptive statistics about average student achievement on both semester 1 and semester 2 exams for each group. Inspection of this table reveals that students in the flipped Honors Geometry classes and the traditional Honors Geometry classes had very similar means on both exams. The flipped Honors Geometry classes reflected a slightly higher overall mean on the semester 1 common final, with a mean difference of 0.07%. The traditional Honors Geometry classes had a higher mean, however, on the semester 2 final exams, with the difference of means being 2.81%.

Table 18: Descriptive Statistics for Final Exam Scores in Honors Geometry

	Common Assessment	
Group	**Semester 1 Final Mean**	**Semester 2 Final Mean**
Flipped	87.49%	81.75%
Traditional	87.42%	84.56%

When comparing the flipped classroom to the traditional classroom for the Honors Geometry courses at this particular building, a comparison of the means of the

semester 1 and semester 2 final exam scores was conducted. Figure 5 represents all of the final exam scores for semester 1 common finals in Honors Geometry as compared to semester 2 common final exam scores in Honors Geometry between the two groups. Inspection of this figure highlights that the flipped classroom had a steeper slope on average, but the traditional Honors Geometry class had more students clustered above the total course means for both exams.

Figure 5: Scatterplot of Final Exam Data for Honors Geometry

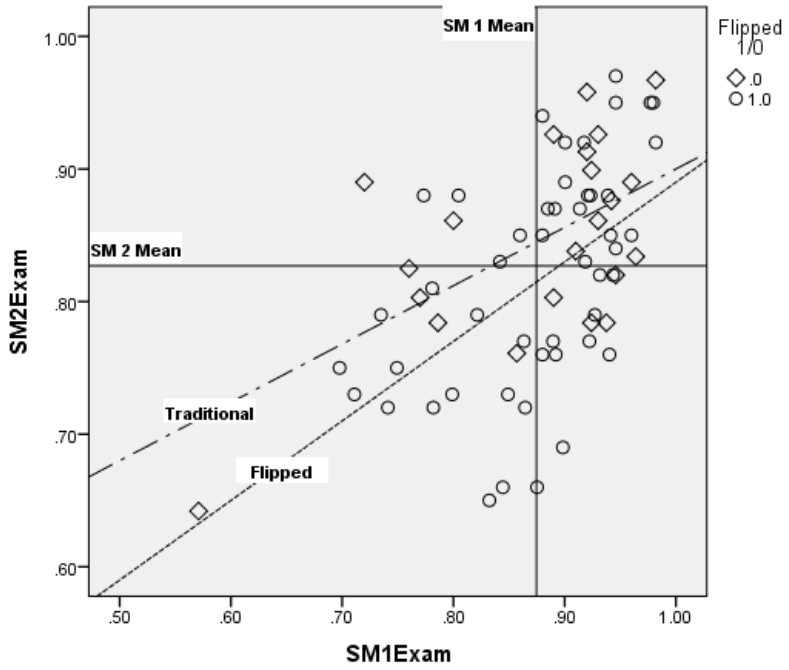


Figure 5. Scatterplot showing the differences between exam scores, as compared to the means for the entire course, separated by classroom type.

Provided this data regarding the difference of means, an independent samples t-test was conducted to compare the semester 1 Honors Geometry final exam scores in the flipped Honors Geometry classroom and in the traditional Honors Geometry classroom. Table 19 shows Levene's Test for Equality of Variances for both the semester 1 and

semester 2 common final assessments in Honors Geometry. Table 20 shows the independent samples t-test statistics for the equality of means.

Table 19: Levene's Test for Equality of Variances for Honors Geometry

		Levene's Test for Equality of Variances	
Exam		**F**	**Sig.**
Sem 1	Equal Variances Assumed	2.348	.130
	Equal Variances Not Assumed		
Sem 2	Equal Variances Assumed	1.379	.244
	Equal Variances Not Assumed		

Table 20: Independent Samples t-Test for Honors Geometry

	t-Test for Equality of Means				
Exam	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Sem 1	.032	68	.975	.00068	.02123
Sem 2	-1.365	69	.177	-.02807	.02057

Inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 1 common final, we can assume equal variances since p=.130 and is therefore greater than .05. There was not a significant difference in the scores for the flipped classroom (M=.8749, SD=.07313) and the traditional classroom (M=.8742, SD=.10027) conditions; t(68)=.032, p=.975. These results suggest that the methods used in the flipped classroom did not have an effect on student achievement as measured by the Honors Geometry semester 1 final when compared to the traditional Honors Geometry class. Specifically, the results showed no significant difference between students' achievement on the exams between the two groups.

Further inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 2 common final, we can also assume equal variances since p=.244 and is therefore greater than .05. There was not a significant difference in the scores for the flipped classroom (M=.8175, SD=.08431) and the traditional classroom (M=.8456, SD=.07378) conditions; t(69)=-1.365, p=.177. These results suggest that the methods used in the flipped classroom did not have an effect on student achievement as measured by the Honors Geometry semester 2 final. Specifically, the results suggest no significant difference between students' achievement on the exams between the two groups.

Figures 6 and 7 represent the comparison of the two groups' mean scores and independent samples t-Test.

Figure 6: Error Bar Graph for the Semester 1 Common Final for Honors Geometry

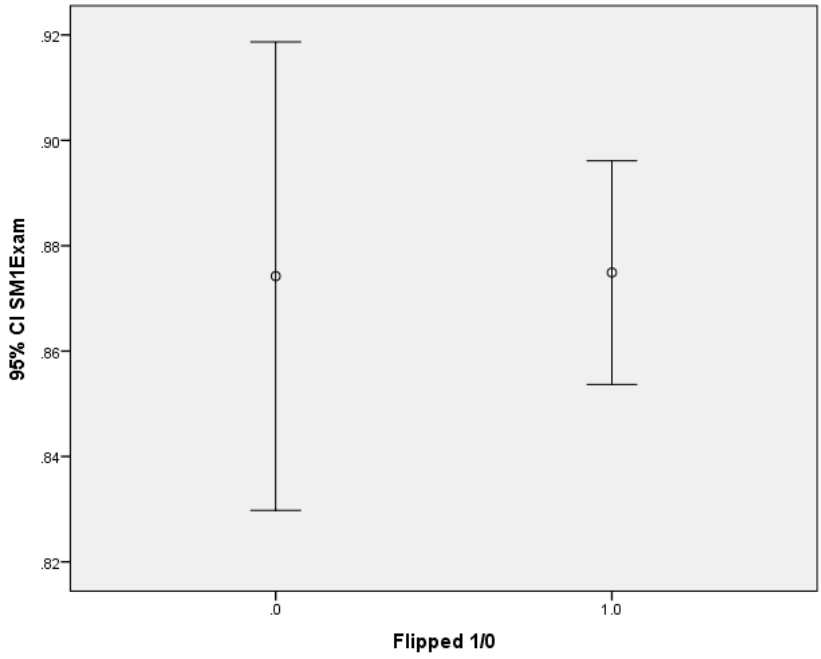


Figure 6. Error bars (at the 95% confidence interval) for the semester 1 exam scores in Honors Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=22 students and Flipped n=48 students. Independent samples t-test, 68 df, p<.05

Figure 7: Error Bar Graph for the Semester 2 Common Final for Honors Geometry

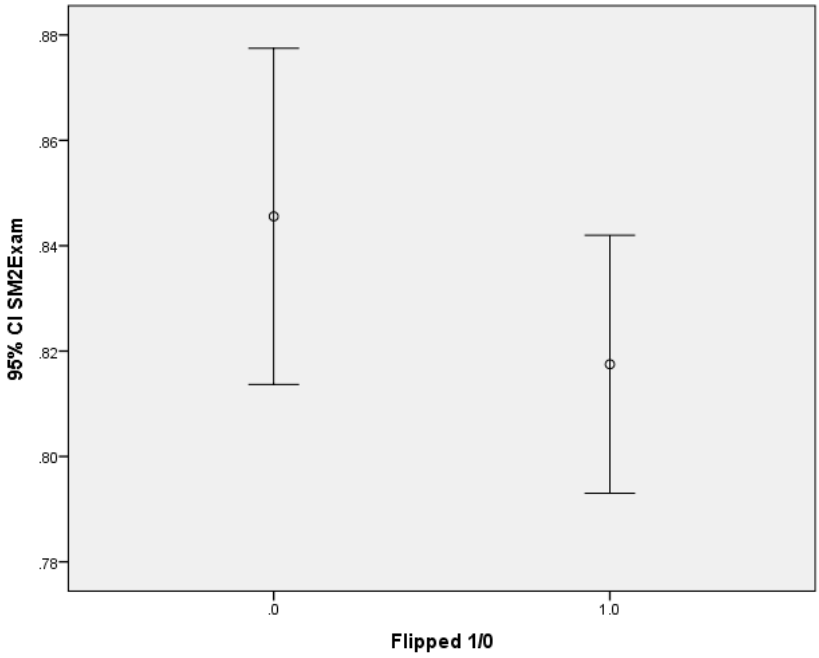


Figure 7. Error bars (at the 95% confidence interval) for the semester 2 exam scores in Honors Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=23 students and Flipped n=48 students. Independent samples t-test, 69 df, p<.05

Middle School Site: PreAlgebra

The PreAlgebra classes that were involved in the study included 274 of the 520 overall students involved in the research and were split between two classroom teachers. Flipped 3 taught six sections of PreAlgebra and instructed 137 of the students involved in the study. Traditional 3 also taught six sections of PreAlgebra and instructed 137 of the students involved in the study. Flipped 3 was experimenting with the flipped classroom, while traditional 3 was not.

Table 21 contains descriptive characteristics for students' grade levels in both the flipped and traditional PreAlgebra classrooms. Inspection of this table reveals that the all of the students in the flipped and traditional classes were enrolled in the 7th grade during

the 2014-2015 school year. Neither classroom had any students enrolled as eighth graders during the 2014-2015 school year.

Table 21: Descriptive Statistics for Student Grade Level in PreAlgebra

	Grade Level	
Group	**7**	**8**
Flipped	100%	0%
Traditional	100%	0%

Table 22 contains descriptive characteristics for students' gender in both the flipped and traditional PreAlgebra classrooms. Inspection of this table reveals that the flipped PreAlgebra classes had a slight majority of females enrolled, with 50.36% of students enrolled reported as female. The traditional PreAlgebra classes had a larger majority of females enrolled, with 56.93% of students enrolled reported as female during the 2014-2015 school year.

Table 22: Descriptive Statistics for Student Gender in PreAlgebra

	Gender	
Group	**Female**	**Male**
Flipped	50.36%	49.64%
Traditional	56.93%	43.07%

Table 23 contains descriptive characteristics for students' ethnicity in both the flipped and traditional PreAlgebra classrooms. Inspection of this table reveals that both groups had a majority of students labeled as white, as reported by the school district, with 88.32% of students enrolled in the flipped PreAlgebra classes identified as white and 90.51% of students enrolled in the traditional PreAlgebra classes identified as white during the 2014-2105 school year. The next largest reported subgroups in the flipped

PreAlgebra classes were both the Hispanic and Multi-Ethnic subgroups, with 4.38% of students identifying themselves in those ethnic groups. The next largest subgroup in the traditional PreAlgebra classes was the Hispanic subgroup, with 5.84% of students identifying themselves in that subgroup during the 2014-2015 school year.

Table 23: Descriptive Statistics for Student Ethnicity in PreAlgebra

	Ethnicity					
Group	**White**	**African-American**	**Hispanic**	**Asian**	**Native American or Pacific Islander**	**Multi-Ethnic**
Flipped	88.32%	0.73%	4.38%	0%	2.19%	4.38%
Traditional	90.51%	0.73%	5.84%	0%	1.46%	1.46%

Table 24 contains descriptive characteristics for students receiving special services in each teacher's classroom as reported by the school district. Inspection of this table reveals that 8.03% of students enrolled in the flipped PreAlgebra classes received free or reduced lunch services as compared with 6.57% of students enrolled in the traditional PreAlgebra classes having received free or reduced lunch services during the 2014-2015 school year. Students receiving services based on their non-native English speaking status made up 2.19% of the students in the flipped PreAlgebra classes as compared with 0.73% in the traditional PreAlgebra classes. Students receiving gifted services in the flipped PreAlgebra classes made up 7.30% of all students enrolled as compared with 5.84% of students receiving such services in the traditional PreAlgebra classes. Students receiving services for physical or learning oriented disabilities made up 1.46% of students enrolled in the flipped PreAlgebra classes and 2.92% in of students

enrolled in the traditional PreAlgebra classes as reported by the school district during the 2014-2015 school year.

Table 24: Descriptive Statistics for Student Services in PreAlgebra

	Student Services			
Group	**Free/Reduced Lunch**	**English Language Learners**	**Gifted**	**Special Education**
Flipped	8.03%	2.19%	7.30%	1.46%
Traditional	6.57%	0.73%	5.84%	2.92%

Groups administered common, district generated, semester 1 and semester 2 finals during the 2014-2015 school year. The expectation from the district was for teachers of the same course to administer the same semester finals and use an agreed upon scoring guide in order to report student results for grading purposes. Table 25 includes descriptive statistics about average student achievement on both semester 1 and semester 2 exams for each group. Means for these assessments were reported on a 1-4 integer scale due to a pilot grading system that was enacted at the beginning of the 2014-2015 school year for this particular middle school. Inspection of this table reveals that students in the flipped PreAlgebra classes had slightly higher means on both the semester 1 and semester 2 final exams for PreAlgebra, with a difference of means being .0708 and .1311 respectively.

Table 25: Descriptive Statistics for Final Exam Scores in PreAlgebra

	Common Assessment	
Group	**Semester 1 Final Mean**	**Semester 2 Final Mean**
Flipped	3.2708	2.7276
Traditional	3.20	2.5965

When comparing the flipped classroom to the traditional classroom for the PreAlgebra courses at this particular building, a comparison of the means of the semester 1 and semester 2 final exam scores was conducted. Figure 8 represents all of the final exam scores for semester 1 common finals in PreAlgebra as compared to semester 2 common final exam scores in PreAlgebra between the two groups. Inspection of this figure highlights that the flipped classroom had a steeper slope on average; however both groups appear equally distributed about the means for both exams.

Figure 8: Scatterplot of Final Exam Data for PreAlgebra

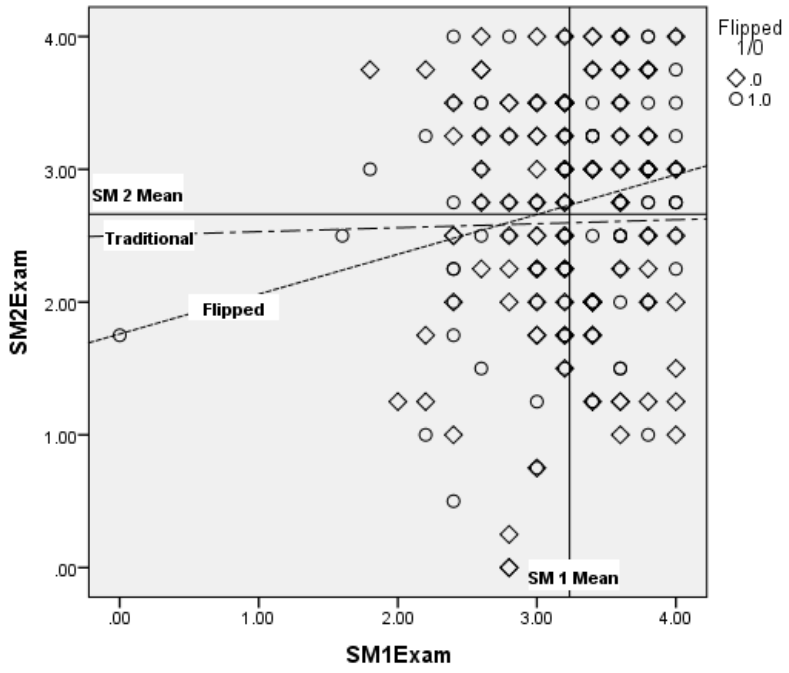


Figure 8. Scatterplot showing the differences between exam scores, as compared to the means for the entire course, separated by classroom type.

Provided this data regarding the difference of means, an independent samples t-test was conducted to compare the semester 1 PreAlgebra final exam scores in the flipped PreAlgebra classroom and in the traditional PreAlgebra classroom. Table 26 shows Levene's Test for Equality of Variances for both the semester 1 and semester 2 common

final assessments in PreAlgebra. Table 27 shows the independent samples t-test statistics for the equality of means.

Table 26: Levene's Test for Equality of Variances for PreAlgebra

		Levene's Test for Equality of Variances	
Exam		**F**	**Sig.**
Sem 1	Equal Variances Assumed	1.579	.210
	Equal Variances Not Assumed		
Sem 2	Equal Variances Assumed	2.108	.148
	Equal Variances Not Assumed		

Table 27: Independent Samples t-Test for PreAlgebra

	t-Test for Equality of Means				
Exam	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Sem 1	.947	221	.344	.07080	.07473
Sem 2	1.157	235	.248	.13115	.11337

Inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 1 common final, we can assume equal variances since p=.210 and is therefore greater than .05. There was not a significant difference in the scores for the flipped classroom (M=3.2708, SD=.61116) and the traditional classroom (M=3.2, SD=.49733) conditions; t(221)=.947, p=.344. These results suggest that the methods in the flipped classroom did not have an effect on student achievement as measured by the PreAlgebra semester 1 final when compared to the traditional PreAlgebra class. Specifically, the results showed no significant difference between students' achievement on the exams between the two groups.

Further inspection of these tables reveals that using Levene's Test for Equality of Variances for the semester 2 common final, we can also assume equal variances since p=.148 and is therefore greater than .05. There was not a significant difference in the scores for the flipped classroom (M=2.7276, SD=.82296) and the traditional classroom (M=2.5965, SD=.92202) conditions; t(235)=1.157, p=.248. These results suggest that the methods in the flipped classroom did not have an effect on student achievement as measured by the PreAlgebra semester 2 final. Specifically, the results suggest no significant difference between students' achievement on the exams in the two groups.

Figures 9 and 10 represent the comparison of the two groups' mean scores and independent samples t-Test.

Figure 9: Error Bar Graph for the Semester 1 Common Final for PreAlgebra

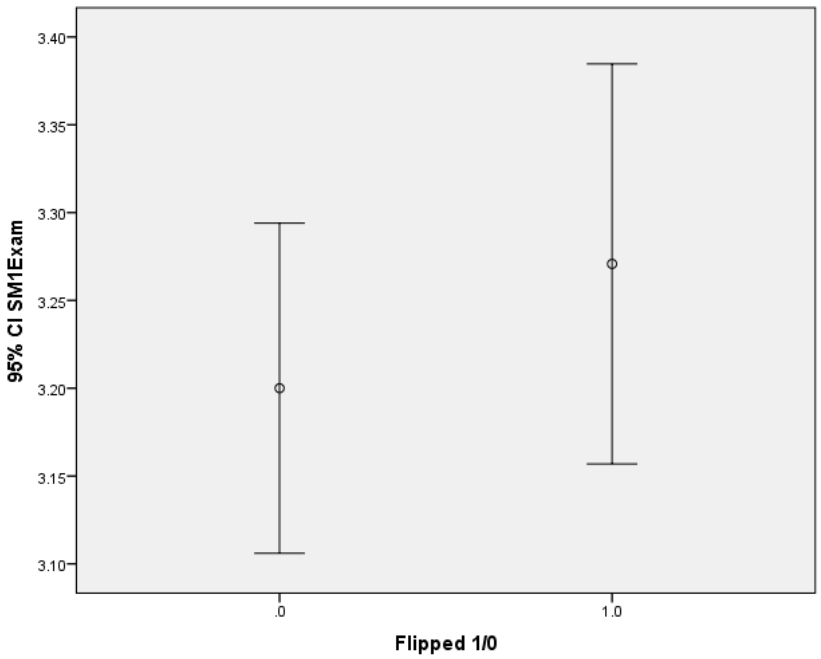


Figure 9. Error bars (at the 95% confidence interval) for the semester 1 exam scores in Honors Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=110 students and Flipped n=113 students. Independent samples t-test, 221 df, p<.05

Figure 10: Error Bar Graph for the Semester 2 Common Final for PreAlgebra

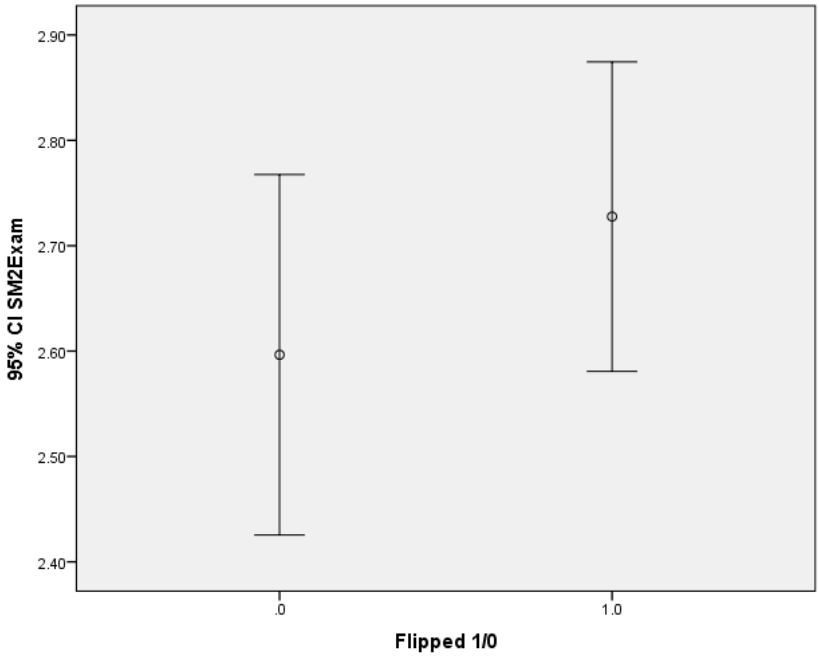


Figure 10. Error bars (at the 95% confidence interval) for the semester 2 exam scores in Honors Geometry for each classroom group (flipped = 1, traditional = 0). Traditional n=114 students and Flipped n=123 students. Independent samples t-test, 235 df, p<.05

Groups in middle school building also administered the NWEA Mathematics MAP assessment during the fall 2014 and spring 2015 window for the 2014-2015 school year. Table 24 includes descriptive statistics about average student achievement on both the fall 2014 and spring 2015 exams for each group. Means for these assessments were reported through Rasch Unit (RIT) scores. RIT scores are normative scores that indicate the level of question difficulty that any given student can answer correctly 50% of the time on the given assessment (NWEA, 2015). Table 28 below details average RIT normative range scores throughout given grade levels, as reported by NWEA (2015). Table 29 details mean RIT scores for both the flipped and traditional PreAlgebra classes involved in the study. Inspection of this table reveals that students in the flipped

PreAlgebra classes had slightly higher means on both the fall 2014 and spring 2015 NWEA Mathematics MAP assessments, with the difference of means being .216 and .564 respectively.

Table 28: NWEA 2015 Math Norms (NWEA, 2015).

	Begin Year		Mid Year		End Year	
Grade	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
K	136.5	19.11	150.2	14.73	158.7	14.21
1	162.4	12.87	173.8	12.96	180.8	13.63
2	176.9	13.22	186.4	13.11	192.1	13.54
3	190.4	13.10	198.2	13.29	203.4	13.81
4	201.9	13.76	208.7	14.27	213.5	14.97
5	211.4	14.68	217.2	15.33	221.4	16.18
6	217.6	15.53	222.1	16.00	225.3	16.71
7	222.6	16.59	226.1	17.07	228.6	17.72
8	226.3	17.85	229.1	18.31	230.9	19.11
9	230.3	18.13	232.2	18.62	233.4	19.52
10	230.1	19.60	231.5	20.01	232.4	20.96
11	233.3	19.95	234.4	20.18	235.0	21.30

**Adapted from the NWEA 2015 Mathematics Student Status Norms White Paper (NWEA, 2015)*

Table 29: Descriptive Statistics for MAP Scores in PreAlgebra

	NWEA Mathematics MAP Assessment			
Group	**Fall 2014 Mean RIT**	**SD**	**Spring 2015 Mean RIT**	**SD**
Flipped	236.263	6.7762	241.895	7.7315
Traditional	236.047	7.3563	241.331	7.5002

When comparing the flipped classroom to the traditional classroom for the PreAlgebra courses at this particular building, a comparison of the means of the NWEA

Mathematics MAP Assessment for the fall 2014 and spring 2015 windows was conducted. Figure 11 represents all of the fall 2014 RIT scores as compared to all of the spring 2015 RIT scores between the two groups. Inspection of this figure highlights that the traditional classroom had a steeper slope on average, however both groups appear equally distributed about the means for both assessments.

Figure 11: Scatterplot of NWEA Math MAP Assessment Data for PreAlgebra

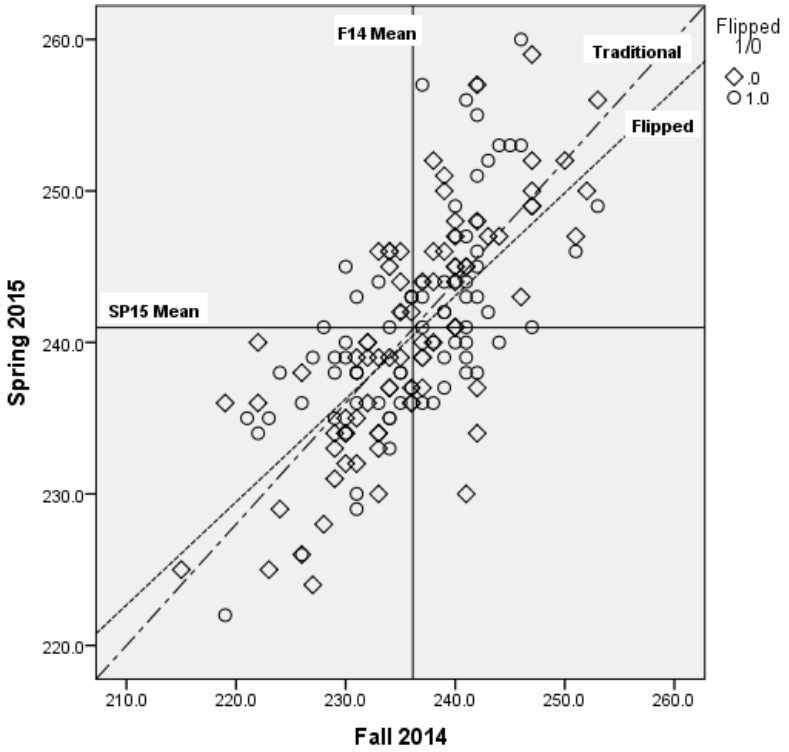


Figure 11. Scatterplot showing the differences between assessment scores, as compared to the means for the entire course, separated by classroom type.

Provided this data regarding the difference of means, a one-way analysis of covariance (ANCOVA) was conducted. Table 30 describes the results of the tests of between subjects effects for the ANCOVA. Upon inspection of this table, the independent variable, flipped classroom, included two levels: flipped (1) or traditional (0). The dependent variable was the spring 2015 NWEA Mathematics MAP Assessment RIT scores for all students involved and the covariate was the fall 2014 NWEA

Mathematics MAP Assessment RIT scores for all students involved. A preliminary analysis evaluating the homogeneity-of-slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variable, $F(1,158)=.551$, $MSE=26.61$, $p=.459$, partial $\eta^2=.003$. The ANCOVA was not significant, $F(2,159)=.600$, $MSE=26.54$, $p>.01$. The strength of the relationship between the flipped factor and dependent variable was very weak, as assessed by a partial η^2, with the flipped factor accounting for 0.4% of the variance of the dependent variable holding constant the fall 2014 NWEA Mathematics MAP Assessment scores.

Table 30: ANCOVA for NWEA MAP

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4353.205[a]	2	2176.602	82.014	.000	.508
Intercept	677.396	1	677.396	25.524	.000	.138
Fall 2014	4322.133	1	4322.133	162.858	.000	.506
Flipped 1/0	15.936	1	15.936	.600	.440	.004
Error	4219.740	159	26.539			
Total	9416249.000	162				
Corrected Total	8572.944	161				

a. R Squared = .508 (Adjusted R Squared = .502)

Active Learning Incidents

For the purposes of this study, active learning incidents were analyzed first quantitatively to answer the second quantitative research focus question that asked, how does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom? As a follow-up to the quantitative analysis and as a means to explain the quantitative results, the descriptive data around the active

learning incidents was also analyzed in order to answer the third qualitative research focus question that asked, in what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom? This section will begin with the quantitative analysis.

Quantitative Active Learning Incidents

In order to determine how the flipped classroom approach to instruction differed in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom, the researcher first defined the parameters of active learning. Active learning incidents were defined in three categories: peer-to-peer discourse, modeling activities engaged in by the students, and project-based learning opportunities. Peer-to-peer discourse was counted as observed if the researcher witnessed mathematical discussions, conjectures, justifications of thinking and reasoning, or argumentation and analysis between students regarding the course objective during the time of observation. Modeling activities were counted as observed if the students were actively engaged in activities that allowed them to demonstrate their understanding through mathematical representations, whether they be algebraic, pictorial displays, simulations, or other facets (The Common Core State Standards Initiative, 2014). Project-based learning opportunities were counted as observed if the students were actively engaged in real-world, complex tasks that involved multiple solution pathways and multiple objectives (Edutopia, 2015). Length of active learning observed was not measured or validated as a means of identifying quality of experiences for the purposes of this study.

The researcher alone observed all 6 classrooms on 5 different occasions each for a total of 30 classroom observations. Dates and times for the observations were selected based on when teachers were teaching their assigned courses, when building schedules allowed visitation, and when building administrators granted permission for such observations to take place. Teachers were given very little notice of upcoming observation times in order for the researcher to conduct observations in a more natural setting. The 30 classroom observations averaged 47 minutes in length throughout the course of the study.

Table 31 represents the observed counts of active learning incidents throughout the 30 classroom observations by group. A count of yes was recorded when any active learning incident was observed. The counts do not represent the frequency of active learning incidents in the classroom and solely represent that active learning took place in that observable time frame. Table 32 represents the percentage of observed active learning incidents throughout the 30 classroom observations by group. Inspection of these tables suggests that active learning incidents occurred in 53.33% of all flipped classroom observations and they occurred in 40% of all traditional classroom observations.

Table 31: Active Learning Incidents Observed by Count

Group	**ALI Observed**		**Total**
	Yes	**No**	
Flipped	8	7	**15**
Traditional	6	9	**15**
Total	**14**	**16**	**30**

A two-way contingency table analysis was conducted to evaluate whether observations of flipped classrooms involved in the study were more likely to yield the observation of an active learning incident throughout the course of a lesson. The two variables were active learning incidents observed having two levels (observed, not observed) and classroom type having two levels (flipped or traditional). Active learning incident occurrence and classroom type were found not to be significantly related, Pearson χ^2 (1, N=30) =.536, p=.46, Cramér's V=-.13. The proportion of flipped classrooms that yielded an observed active learning incident during a given observation was .27 as compared to the proportion of traditional classrooms that yielded an active learning incident being .20. Table 32 highlights the results of the contingency table analysis.

Table 32: Active Learning Incidents Observed by Percent

Group	**ALI Observed**		**Total**
	Yes	**No**	
Flipped	53.33%	46.67%	**100%**
Traditional	40%	60%	**100%**
Total	**46.67%**	**53.33%**	**100%**

Table 33 represents information related to the frequency of each individual type of active learning incident that was observed throughout the 30 classroom observations. This table accounts for the possibility that multiple active learning incidents took place within a single observable time frame. Inspection of this table suggests that peer-to-peer discourse was the type of active learning incident observed most frequently over the course of the 30 classroom observations between both the flipped classrooms and the traditional classrooms. This table also suggests that 12 incidents of active learning were

observed in flipped classrooms throughout the course of 15 observations and 6 incidents of active learning were observed in traditional classrooms over the course of 15 observations. It is important to note that incidents of active learning were only observed in 53.33% of flipped classrooms, however, which suggests that multiple incidents occurred within a single observation.

Table 33: Active Learning Incidents by Type

Group	Discourse	Modeling	Project-Based Learning	Total
Flipped	8	2	2	12
Traditional	6	0	0	6
Total	**14**	**2**	**2**	**18**

A two-way contingency table analysis was conducted to evaluate whether teachers experimenting with the flipped classroom method of instruction were more likely to engage students in active learning incidents throughout the course of a lesson. The two variables were the number of active learning incidents observed within the classroom having four levels (no incidents, one type of incident, two types of incidents, all three types of incidents), and the flipped classroom variable having two levels (flipped or traditional). Active learning incident count and the classroom type were found not to be significantly related, Pearson χ^2 (3, N=30) =3.34, p=.34, Cramér's V=.33. The proportion of flipped classrooms that engaged students in zero, one, two, or three active learning incidents during a given observation were .23, .17, .7, and .03 respectively. Table 34 highlights the results of the contingency table analysis.

Table 34: Two-Way Contingency Table Analysis of Active Learning Incidents

	Active Learning Incidents in One Observation				
Classroom	**0**	**1**	**2**	**3**	**Total**
Flipped	23.33%	16.7%	6.7%	3.3%	50%
Traditional	30%	20%	0%	0%	50%

Qualitative Descriptions of Active Learning Incidents

Through the quantitative analysis of the active learning incidents observed between the flipped classrooms and the traditional classrooms, data suggested that there was not a significant relationship between classroom type and whether or not an active learning incident occurred. Analysis further suggested that peer-to-peer discourse was the most frequent mode of active learning incident observed during the course of the 30 classroom observations. Further qualitative analysis of the active learning incidents was conducted to determine in what ways the observed active learning incidents in the flipped classroom compared to the observed active learning incidents in the traditional classroom. Quality of active learning incidents was not defined or measured for the purposes of this study and variation between incidents in length and quality did occur.

Field note transcripts of the 30 classroom observations were recorded and analyzed using a three stage thematic coding process and the constant comparative method of qualitative data analysis (Merriam, 2009) in order to develop a grounded theory (Glaser & Strauss, 1967). Open coding was used during the first stage of qualitative data analysis in order to locate any data that might be relevant to the qualitative focus question related to active learning incidents. Once data was coded in the first stage, axial coding was used to construct categories based upon emergent themes

(Merriam, 2009). The third phase of coding consisted of selective coding. Selective coding was used to develop the core categories related to the quantitative data analysis related to active learning incidents (Glaser & Strauss, 1967). Table 35 represents the open, axial, and selective codes identified through this analysis of the classroom observation field notes.

Table 35: Open, Axial, and Selective Codes for Active Learning

Classroom Observation Qualitative Codes		
Open Codes	**Axial Codes**	**Selective Codes**
Students seated in 6 rows of 5 working off of a projector screen with instructions for the day Students in 5 rows of 6 and moved desks together to work on a worksheet Students in 5 rows of 6 and moved desks together or found common white-board space to work on problems Students seated in rows and worked on guided notes following the teacher's example Teacher seated at desk and working off a document camera while students were seated in rows Students seated in groups of 3 working with whiteboards to complete problems written on the board Students seated in groups of 2 working together on a "must do" and a "can do" with partners; small group rotations with the teacher at the back of the room working on mini-lessons	Students seated in pairs or groups Students moved desks or changed space to work together Students seated in rows and turned to talk during directed times	Physical space/classroom setup
Teacher led whole-class lesson with instructions on the projector and students following along with the teacher Teacher led whole-class lesson with a transition to group/pair work practice Group work around opener or bell work problems	Teacher direct instruction followed by student practice Group or pair work followed by direct	Lesson design

Classroom Observation Qualitative Codes		
Open Codes	**Axial Codes**	**Selective Codes**
followed by whole-class lesson Group work around opener or bell work problems followed by whole-class lesson and then more group work around examples Pair work throughout the whole class time with concurrent small group rotations and mini-lessons directed by the teacher at the back of the room	instruction or mini lessons and/or followed by more group work Pair work and small group rotations with mini-lessons	
Teacher passed out cookies to those that won a Kahoot Teacher asking students to work out problems and having class give "snaps" for demonstration Teacher asking students to get class started and take attendance Teacher asking students to help others and provide explanations Teacher had students fill in data points at the board for the whole class to see Teacher used cartoons to begin the class period Students checked their own answers to assignments during independent work time Students given roles for picking up and collecting supplies Students expected to use their resources before asking the teacher for help which included assisting each other and asking questions of peers Students checked their own homework from the night before and scored their own work Teacher conferenced with students about their independent projects	Teacher praise/rewards and recognition of work Student ownership of classroom routines Student ownership of grading for homework Use of cartoons Peer tutoring Teacher and student conferences	Classroom culture

Through this process, three themes emerged in relationship to the frequency of active learning incidents. Themes consisted of physical space/setup of the classroom, implemented lesson design, and classroom culture. Five of the six classrooms observed (flipped 1, flipped 2, flipped 3, traditional 2, and traditional 3) engaged students in active learning incidents related to these themes during the course of at least two classroom observations throughout the course of the study. One classroom, traditional 1, had no observable incidents of active learning during the course of the five classroom visits by the researcher. Table 36 represents the joint display analysis relating the quantitative analysis of the active learning incidents to the qualitative theme data (Creswell & Plano Clark, 2011).

Table 36: Joint Display of Quantitative Active Learning Data and Qualitative Theme

Quantitative Data	**Qualitative Theme**		
Active Learning Frequency	**Physical Space**	**Lesson Design**	**Classroom Culture**
Peer-to-Peer Discourse Count = 14 out of 18 observed incidents	Collaborative Groups: Students seated in pairs (4 of 14 counts) Students seated in groups of 3 (4 of 14 counts) Students moved desks or changed space to work together (4 of 14 counts) Students seated in rows and turned to talk during directed times (2 out of 14 counts)	Teacher led whole-class lesson, then group/pair work practice (9 out of 14 counts) Group/pair work first, teacher led whole-class lesson, then more group work (1 out of 14 counts) Group/pair work first, teacher led whole-class lesson (1 out of 14 counts) Group/pair work throughout class time, concurrent small group rotations (2 out of 14 counts)	Student ownership of classroom routines (5 out of 14 counts) Private discussions about student issues (1 out of 14 counts) Treats (1 out of 14 counts) Use of comic strips and experiments (2 out of 14 counts)

Quantitative Data	Qualitative Theme		
Active Learning Frequency	**Physical Space**	**Lesson Design**	**Classroom Culture**
		Teacher mini lesson, then group/pair work with concurrent small group rotations (1 out of 14 counts)	Peer-tutoring (9 out of 14 counts)
Modeling Activities Count = 2 out of 18 observed incidents	Students seated in pairs (2 of 2 counts)	Modeling concept in group work with concurrent small group mini lesson rotations (2 out of 2 counts)	Peer-tutoring (2 out of 2 counts)
Project-Based Learning Count = 2 out of 18 observed incidents	Students seated in pairs (2 of 2 counts)	Teacher mini-lesson, then continued work time on project (1 out of 2 counts) Project group work with concurrent small group mini lesson rotations (1 out of 2 counts)	Peer-tutoring (2 out of 2 counts)

Inspection of this table and the joint analysis reveals similarities between classrooms where active learning incidents occurred. The first similarity between classrooms where active learning incidents were observed involved the physical arrangement of the classrooms. In classrooms where active learning incidents occurred, classrooms were arranged so that the physical setup was conducive to collaboration between students. Evidence of this could be seen in two of the classrooms where active learning incidents were observed. Flipped 3 and traditional 2, had student desks arranged in pairs or groups of three. Two other classrooms where active learning incidents were observed, flipped 1 and flipped 2, had students arranged in rows, however, during the course of the lesson, had their students physically rearrange their desks or themselves in manner that was more conducive to collaboration.

The second similarity between classrooms where active learning incidents were observed involved the lesson design implemented during those observable instances. All of the classrooms where active learning incidents were observed utilized a lesson design, during one or more of their observations, in which the teacher began with direct-instruction of the course objective for the day, or a mini-lesson around a particular concept, and then transitioned students to group work or practice around the topic learned, resulting in peer-to-peer discourse around the course objective. Evidence of this could be seen in two of the five classrooms where active learning incidents were observed. Traditional 2 and flipped 3, utilized a lesson design that began with students working collaboratively in groups around problems where initial teacher-led instruction was not observed. In some cases, the same two classrooms aforementioned moved students fluidly between group work to begin the class time, teacher led direct instruction, and more collaborative group work following. One classroom, flipped 3, utilized a lesson design where students also moved through small group rotations throughout the course of the class time in order to receive instruction that was varied by student need.

The third similarity between classrooms where active learning incidents were observed involved positive classroom culture experiences in those observable instances. All of the classrooms where active learning incidents were observed engaged students in peer-tutoring around the focus objective for the learning. Evidence of these opportunities included: having students re-teach components of the lesson (flipped 1, observation 4, flipped 3, observation 3), having students ask each other questions they had about the lesson and to agree or disagree (traditional 2, observation 2, 4, and 5; flipped 3,

observation 2; traditional 3, observation 1 and 5), and allowing students to choose their partners during collaborative worktime (flipped 1, observation 3 and 4; flipped 2, observation 1 and 3). Three of the classrooms observed involved students in taking ownership of classroom routines. Evidence of this included: having students take attendance or passing out and picking up materials needed for the lesson (flipped 1, observation 3 and 4; traditional 2, observation 2). Other evidence of positive classroom culture included the use of comic strips and visual experiments for advanced organizers (flipped 2, observation 1 and 3), treats (flipped 1, observation 4), and personal discussions with students when they were having personal issues (flipped 1, observation 4).

Student Perceptions

As a follow-up to the quantitative research focus question devoted to student achievement measures and as a means to provide further explanation to the overarching research question of, how do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers, the first qualitative focus question around student perceptions was developed. This qualitative question asked do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?

In order to answer this question and explain the quantitative results surrounding student achievement measures, student interviews were conducted across all three research sites. A standard interview protocol was developed for students in flipped and

in traditionally instructed classrooms around four major domains: classroom routines, homework structure and completion, perception of student effort and ability, and perception of how classroom structure impacts student learning. Domains were identified by the researcher after the initial first semester quantitative data collection to be areas that could provide insight into potential differences between the groups and that were consistent with the themes in the literature regarding increased student achievement, implications for class time, and conflicting perceptions about the method (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013).

Students and parents were then provided informed consent forms about the research study and asked for students' participation in audio-taped interviews with the researcher about their experiences in mathematics courses this year and last year. Out of the 520 students involved in the study, 27% returned informed consent forms. Of the 27% that returned forms and agreed to participate in the study, students were alphabetized and assigned a number. Using a random number generator, ten students from across all three sites and six classrooms were selected to be interviewed. Random selection of these students across all sites was appropriate in order to achieve accurate and natural feedback around learning experiences in mathematics and to be consistent with the proportion of students enrolled in flipped versus traditional classrooms. Students were then interviewed at a time convenient for their schedules and as not to interfere with their school day or academic priorities. All interviews were audio-taped by the researcher and transcribed for data analysis.

Of the ten participants selected, 60% of them were in classrooms where the teacher was experimenting with the flipped approach to classroom instruction and 40% were in classrooms where teachers were using more traditional methods. This proportion of students selected matched the proportion of students overall that were represented in the flipped (60.38% of all studied) and the traditional (39.62% of all studied) classrooms. Disaggregated by site, 50% of the students that were selected attended high school site 1, 20% attended high school site 2, and 30% attended the middle school site. Student interview transcripts were first coded within the identified domains using an open coding method (Merriam, 2009), where responses to the questions related to the identified domains were read multiple times in order to summarize and chunk information more specifically. Quotes from the interview transcripts were trimmed after the open coding stage during the axial coding stage in order to establish themes and categories for each group (flipped and traditional) of students. A table of themes was constructed first by group and then selective coding was used through a constant comparative data analysis process in order to compare responses around consistent themes between groups and develop a grounded theory and more general themes (Glaser & Strauss, 1967). Tables 37-41 show a table of themes for each selective code and organized by axial code based on this analysis.

Table 37: Student Interview Class Routines Table of Themes

Selective Code: Classroom Routines		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"She does PowerPoints and board works. We could like go back and watch things that I didn't really understand, it made it a lot easier instead of reading more technical words." "The teacher explains a lot more and she helps us with everything. If we have questions, she'll help us in class instead of making us come later." "She goes over [the lesson] during class, then we go home and we watch a video, and that's during taking notes like. We go over the notes the next day." "We usually start off with a bell work and then we go to check homework and at the end, she just writes board work."	"This year, every day we practice and after the classes she gave us homework every day."
HS 2	"We do like a daily quiz for class and then we take notes at home and we do the homework at school."	"We usually just like do a warm-up and then we like a review sort of what she taught the previous day, and then we do a lesson and then we go home and do our homework."
MS	"We have a must-do and a can-do and she will call us when we do that when we're not in group and in group we talked about homework."	"We go over the warm-ups and then we check over our homework and she goes around and writes down the grades for everybody on their homework. She goes over the lesson with us and we take notes and then she gives us time in class to work on homework." "It's basically the same thing [as last year]. We would do a warm-up problem, then we would check our homework from the night before, the duties, the lesson and we would take notes with spirals."

Table 38: Student Interview Homework/Videos Table of Themes

Selective Code: Homework/Videos		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"[videos for new content] It was probably for every little thing we did." "Yes [I watch them]." "I like that you kind of can re-watch it a lot." "I don't really like that it's not in person. I feel more comfortable being in class so I can ask questions there." "[Videos] It was more like a few times, maybe once or twice a week. If we needed help we could go back to it and pause it." "I do watch the videos." "It's great and organized, and she knew what she was doing." "We usually get a packet and then the packet is like a good 30 pages. I would say like 5-10 pages that we have a new video." "I do [watch the videos]." "I like it because you could say it's extra learning but it really isn't because you have more time." "[We have new videos] mostly every day." "I watched them because it give you good practice." "She explained very well about what you're supposed to be taught."	"This year, [we get homework] like every day, every single day." "I usually do it every day." "[Homework is] like geometry stuff, just numbers."
HS 2	"[We have new videos] most of the time, like three or four times a week." "I do watch some for the course." "I like that it's like easy to do at home and I don't have to like trying to figure it out at home. I don't like that if I don't get it, I can't' like have her rephrase it."	"[Homework is] pretty much every day." "[I complete it] pretty much every night." "It's usually like 10-15 problems. It's a mix of both, just numbers or shapes or whatever and then one or two word problems like critical thinking."
MS	"It used to be like every day, but sometimes we do a video and then two days of worksheet and then a video again." "Yeah [I watch them]." "I like how they can be short and they're easy to do."	"I'd say [homework is] usually every day." "I complete it always." "We usually do even numbers out of the book." "[Homework is] often every day." "Normally [I complete it] all the time unless there's a question that I don't understand." "She gives us a book assignment and then we fill it out on our iPads."

Table 39: Student Interview Effort Table of Themes

Selective Code: Effort		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"I have a lot better grade than I did last year and I enjoy it more, so I have more of a reason to do the work." "I feel like I've tried hard to pass, but it's a lot easier to do the work and everything because the teacher helps us a lot more. She's better at explaining things, so I tried more." "I think it's a lot easier because if I don't get it and I don't get the notes that are already in the packet or that we already did then I can actually just re-watch the video. She explains it to everybody so it makes sense." "[My effort this year is] pretty ok."	"This year it was great. I get straight A's and it's really good."
HS 2	"It's kind of easier [than last year] with the notes being at home and everything. It's easy to get the homework done in class and not have much to do at home."	"It's about the same [as last year]. Like you're trying to complete your assignments every night so you don't get behind and you still are understanding the concepts."
MS	"I think I tried harder [this year]. I guess because the videos were kind of easy and they [made it] a lot easier to like try harder I guess."	"It's really good and it's kind of like the same. I asked questions and then she answers them or if she asks us to guide her through the steps, I raised my hand and then she might call on me and I tell her the steps." "It's pretty much the same [as last year]."

Table 40: Student Interview Ability Table of Themes

Selective Code: Ability		
Site	**Flipped Axial Code**	**Traditional Axial Code**
HS 1	"I 'm more confident, like I'll talk in class, but last year I didn't want to be noticed at all." "I feel like just the way she teaches, like it's not only the videos, it's just like her personality with that. She's better with like helping. She really wants us to pass and to understand it. She just doesn't want us to have an A and not know anything. And this year it's a lot better." "The fact that you can actually have a video and go home and watch it if you actually want to take the time to learn about it." "This year's a little bit harder for me than last year dealing with figures, like how the diameter and radius. Even like the degrees or so, it's harder."	"Last year it was horrible, to be honest." "This year is better." "The reason to me is because I used to hate math classes. That, like, teacher is really nice so it make you like to love the subject, and this makes me like math, again, it's really good."
HS 2	"I was kind of good at math [last year]." "[This year is the] same."	"I'd say [my ability] it's about the same [as last year] except for geometry. Like I think that we learn a lot about lots of different sections of geometry."
MS	"I think it's just easier to understand the videos rather than a teacher like talking for half an hour about what we're going to be learning for the next week or so."	"I feel like this year was easier than last year." "I don't know, it might just be the teaching method or something." "It's harder stuff this year, but I like the things that we're doing better." "Probably this year, we're like working on harder stuff and we just do different things than like last year."

Table 41: Student Interview Structure for Learning Table of Themes

Selective Code: Structure for Learning		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"At home I feel comfortable, so I don't feel like I'm in competition to anyone, so if I want to take notes a few more times I don't feel like I'm holding up the class at all." "It helped me a lot like it's helped me learn it, like understand it more because she puts examples with the videos. If we don't understand it, we can re-watch it." "I like it because you can actually learn it when you like get home. If you don't understand it and you can go back and watch it." "It goes a little slower so you get to understand the content she's teaching, plus the videos help out too."	"It's helped me a lot. The teacher is really nice too but classes the numbers and everything just like when you get older you get smarter and stuff. It's just like that, it's really good."
HS 2	"It's okay. It doesn't help that I can't ask during notes but I can ask when doing the homework which is fine. If I learn it wrong the first time, it's kind of hard to correct it so it does."	"I like it because we have the packet and we have all the assignments like right there so you don't have to like remember to look it up in a book. Also the answer keys, it's kind of nice because you can see how the teacher worked out the problem, and you can also go back, and refer to that if you need help."
MS	"It's just easy, like it's really easy to access and it doesn't take long and it's easy to understand."	"I really like how our teacher goes over. We'll go over the examples. She'll have problems for us to try. Sometimes we do it with a partner, and then sometimes, we just do it by ourselves and then she goes over them." "It's easier to learn the content when we're able to take more notes easily and so I think that's helpful to be able to go back, look through the iPad and look at all the things that we learned that day. It's easier than just having to like do everything in one day."

Inspection of the qualitative student interview data tables reveals several similarities between both the flipped classroom groups and the traditional classroom groups. In both groups, students reported that practice took place inside the classroom and then homework took place outside the classroom. The major difference, reported by students, was that students in the flipped classroom tended to watch videos and take notes outside of class as their homework. Evidence of this response can be seen in Table 36 where students noted, "…we take notes at home" (flipped high school site 2) and "…we go home and we watch a video" (flipped high school site 1).

Students reported, in both groups, that homework was assigned almost every night. Students in the traditional classroom settings reported that most of the homework was from a worksheet or a textbook and mostly involved numbers. Evidence of this can be seen in Table 37 where students reported, "We usually do even numbers out of the book" (traditional middle school site) and "[Homework is] like geometry stuff, just numbers" (traditional high school site 1). Students in the flipped classroom settings reported that most of the homework consisted of a video and note-taking. Evidence of this can also be seen in Table 37 where students reported, "It used to be like every day, but sometime we do a video and then two days of a worksheet and then a video again" (flipped middle school site) and "[We have new videos] mostly every day" (flipped high school site 1).

Regarding student effort and student ability, both student groups reported that their effort and ability in their math classrooms was either about the same or better than it had been the previous year. Student reasons about why their effort or ability improved or stayed constant varied slightly amongst individual students. Some students cited teaching

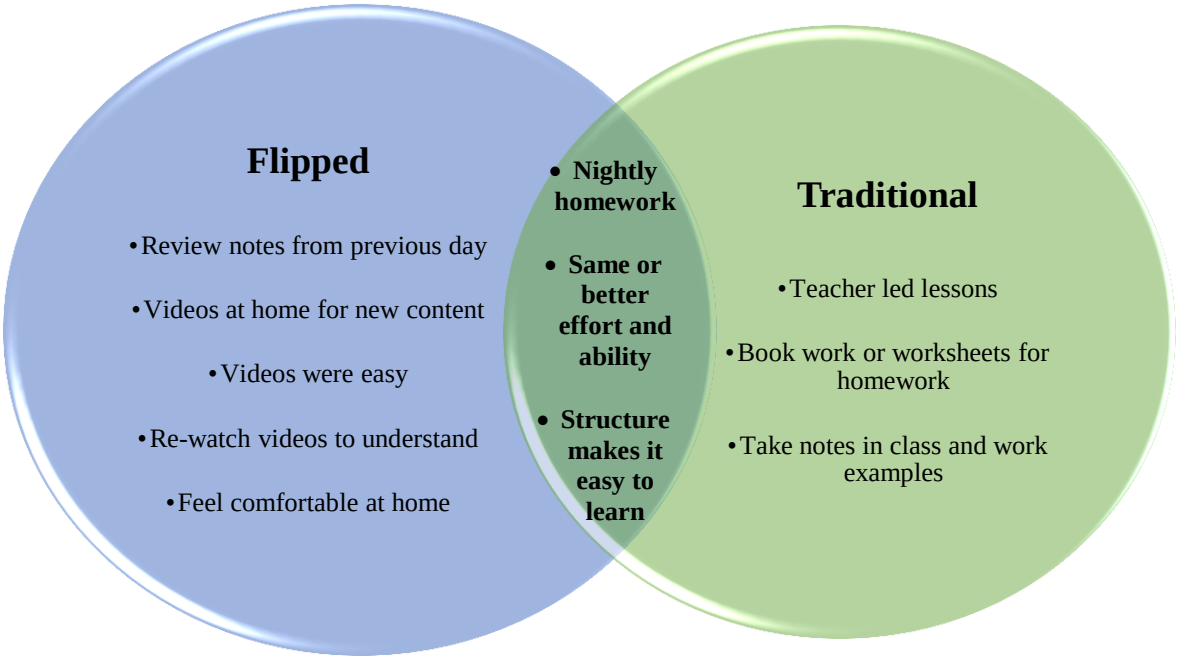
method or teacher personality as factors, while others contributed their effort and ability to their feeling of being "good at math" (flipped high school site 1). Evidence of these similarities can be seen in Tables 38 and 39 where students reported, "I have a lot better grade than I did last year and I enjoy it more" (flipped high school site 1), "I used to hate math classes. That, like, teacher is really nice so it make you like to love the subject, and this makes me like math, again, it's really good" (traditional high school site 1), "It's kind of easier with the notes being at home and everything" (flipped high school site 2), "It's about the same. Like you're trying to complete your assignments every night so you don't get behind and you still are understanding the concepts" (traditional high school site 2), "I think it's just easier to understand the videos rather than a teacher like talking for half an hour about what we're going to be learning for the next week or so" (flipped middle school site), and "I feel like this year was easier than last year. I don't know, it might just be the teaching method or something" (traditional middle school site).

Lastly, several similarities existed between both groups with regards to student perception around the structure for learning in their math classrooms. Most students in the flipped classrooms reported liking the use of the videos. Evidence of this can be seen in Table 40 where students reported, "At home I feel comfortable, so I don't feel like I'm in competition to anyone" (flipped high school site 1), "If we don't understand it, we can re-watch it" (flipped high school site 1), "It's just easy, like it's really easy to access and it doesn't take long and it's easy to understand" (flipped middle school site). Most students in the traditional classrooms also reported liking the classroom structure in their math classes. Evidence of this can also be seen in Table 40 where students reported, "I like it because we have the packet and we have all the assignments like right there so you

don't have to like remember to look it up in a book" (traditional high school site 2), "I really like how our teacher goes over. We'll go over examples. She'll have problems for us to try. Sometimes we do it with a partner, and then sometimes, we just do it by ourselves and then she goes over them" (traditional middle school site 1), and "It's easier to learn the content when we're able to take more notes easily and so I think that's helpful to be able to go back, look through the iPad and look at all the things that we learned that day" (traditional middle school site 1).

Figure 12 represents a visual display of the similarities and differences between theme elements generated from the interview coding process in the student responses and perceptions around their mathematics learning experiences.

Figure 12: Student Interview Theme Similarities and Differences between Groups



Teacher Perceptions

As a second follow-up to the quantitative research focus question devoted to student achievement measures and as a means to provide further explanation to the overarching research question of, how do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers, the second qualitative focus question around teacher perceptions was developed. This qualitative question asked do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?

In order to answer this question and explain the quantitative results surrounding student achievement measures, teacher interviews were conducted across all three research sites. Teachers were interviewed using a standardized interview protocol that consisted of seven questions for teachers using a more traditional method of classroom instruction and nine questions for teachers using the flipped method of classroom instruction. Questions for teachers focused on four main domains that included: lesson planning and classroom routines, perception of instructional effectiveness, homework completion and student effort, and reflection on changes for the future. Domains were identified by the researcher after the initial first semester quantitative data collection to be areas that could provide insight into potential differences between the groups and that were consistent with the themes in the literature regarding increased student achievement, implications for class time, and conflicting perceptions about the method (Flumerfelt &

Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013).

Teachers were provided informed consent forms about the research study and asked for their participation in audio-taped interviews with the researcher about their experiences in teaching mathematics and student learning in mathematics courses they taught. All six teachers agreed to participate in the study and they were all interviewed at a time convenient for their schedules and as not to interfere with their school day or academic priorities. All interviews were audio-taped by the researcher and transcribed for data analysis.

Of the six teachers selected, 50% of them were experimenting in the flipped approach to classroom instruction and 50% were colleagues of those teachers of the same courses and buildings, but were not experimenting with the flipped method of classroom instruction. Teacher interview transcripts were first coded within the identified domains using an open coding method (Merriam, 2009), where responses to the questions related to the identified domains were read multiple times in order to summarize and chunk information more specifically. Quotes from the interview transcripts were trimmed after the open coding stage during the axial coding stage in order to establish themes and categories for each group (flipped and traditional) of teachers. A table of themes was constructed first by group and then selective coding was used through a constant comparative data analysis process in order to compare responses around consistent themes between groups and develop a grounded theory and more general themes (Glaser

& Strauss, 1967). Tables 42-47 show a table of themes for each selective code and organized by axial code based on this analysis.

Table 42: Teacher Interview Class Routines Table of Themes

Selective Code: Classroom Routines		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"The routine is usually, they come to class and we discuss what did the video look like just very brief and any big questions that they have over the practice problems that were in the video, then either split them into smaller groups. Sometimes based on ability as in up with the highest with highest and lows with lows. Other times I'll let them pick their own groups and other times I will purposely intermingle so that they just do practice problems. Other times they'll be up at the windows in the back or we have whiteboards so they can sit at their desk and then we come back together at the end of the class period to review what we had done that day."	"They come in, if they had an assignment I check it. I usually put the answers on the board before they leave now, because a lot of these guys, if they don't know where to start most of the time they don't start, that's what I'm finding out. But sometimes if they have an answer they're more likely to start. I, they don't have as much take homework. It's a lot, like I give them time in class to work on it so they can get the help they need. We do, this semester we've done more note taking, practicing that, which I think is good, because it's closer with the other geometry classes, And I think they need to be prepared for that future."
HS 2	"Most days [last year] we started out with a daily quiz. I would ask questions, 'Did you have any questions on your homework?' They would say yes or no, and knowing what my day was going to look like depends on how many questions I would answer. They'd hand it in, I would lecture, they have to take notes on guided notes because I grade their guided notes and then they would have a homework assignment." "This year, it's half and half. Half my days are like I just described. The other half of the days are flipped classroom where their homework is to go home and with the guided note sheet, take notes that I've prerecorded for them and they can access through Google Classroom. They come to school the next day, we do take a daily quiz which probably covered something from a few days before and then they can work on the	"Routines, I think that I have two ways of starting a typical day. One is a quick review of lessons leading into the concept that would help the students grab onto what I'm teaching that day. And then into what we're covering for the day. The other way is maybe I might just have a little opener kind of question, not a physical get your whiteboards out and review, but just kind of an opener kind of questions and, and then lead into the lesson for the day. There's note taking and practice just about every day. And um, lots of, OK, what would we do for this problem? Work with your partner, um, and compare answers and asking questions. After feeling like we've walked through the assignment or walked through the lesson and that there's some good understanding, you know, if I need to do a couple more

Selective Code: Classroom Routines		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
	homework during class. And depending on my class, some of them get to work in groups because they know how to handle it. "	practice problems I'll do that. Then the assignment very much reflects the practice problems that we've done."
MS	"My kid's usually for homework would watch a video five to seven minutes on whatever we're going to cover the next day. So, they would have some sort of pre-knowledge coming in, and then the first five minutes of class they're on Khan Academy getting some spiral review from stuff we've done over the year. With their homework they do some like four or five problems just to make sure they're doing make sure they're processing it, not just pushing play and leaving. We go over those couple of questions and then we have small group and so they are working on something independently or they're with me in a small group. My small groups are based on abilities, so my highest group meets last so that they work on stuff independently first in my lowest group goes first, so they have instruction first. During that 10 minutes it's a small group we're working on that skill that they watched. Making sure they've got it, lets me work one-on-one, okay, this person really doesn't get it. I need to explain it in a different way, and then when they're working independently I try to find things that are a good balance between some rote practice of what they need to able to complete the skill accurately every time and then some application they need to figure out how they can use this skill to do something more than just the skill. That takes 30 minutes, three group of 10, and then our last five I go run and check that they've done their class work and any little clean up stuff we do in that last five minutes, and then we work it."	"Pretty structured. So, again, they still have a warm-up problem when they come in. We grade homework. It may be different just depending on what questions that they might ask. So, it will change based on their needs. So, I try to, I'd introduce the lesson. I keep in mind what I want them to take away before they leave the classroom. What is it that I want them to learn, how am I going to approach it. So, I try to give them concrete, give them in manipulatives, where I try to let them discover, make conclusions on their own. Try to let them make connections on their own. And then, I do like to have them start their homework prior to leaving, and then that way if they have any questions, they can ask before they leave. I make adjustments as needed"

Table 43: Teacher Interview Lesson Planning Process Table of Themes

Selective Code: Lesson Planning Process		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"My lesson planning process would be to get that packet ready. To get that to all the people that I collaborate with so they can start doing their part which is making the answer keys, putting together some of the board work problems, and all that stuff. Then from there a day to two days before every lesson I just make sure that I get a presentation ready. So that I got different slides that I can run through and which more just helps me stay organized and gives the kids a visual to have at the front of the room. So as we're moving through things with the board work problems on it there as a visual for them and constantly reminds me and keeps me organized." "I'm doing the same problems on the video talking through the same concepts but that way it keeps them engaged and there is something for them to do."	"I start with the packet and the notes that Laura gave, and then I go through it and pick the big ideas and try to space it out more. Usually it's pretty much the same notes. Then I find either using KUTA, although KUTA does not have very much with chords, but I found some good things on the internet. Like something, I need to search up worksheets, or I made a couple to try to give them more spacious problems to work with just like the basic idea so they can get that before we go on to some of the harder stuff. I try to get to the same level of difficulty, but we don't always, just because of time. But the idea is by the time I see Laura's test, I make sure my kids have seen everything on that. Sometimes I do modify the test. But I make sure they've been exposed to it and have tried it."
HS 2	"Because we have a new curriculum with common core in terms of some of the objectives we have to teach, my lesson planning process now is to pull up the materials we received from Mr. Patterson and evaluate whether what I did in previous years was better than what he did or my stuff is better. So I decide whether I'm going to teach the material using my old stuff and rearrange my old stuff to fit common core better, or to pick what he did and rearrange his stuff to suit what I think is better. For homework, he has fantastic homework so I just pretty much give his homework assignments. I make new pop quizzes because his are harder than what I use to give, and I like his. And daily quizzes are probably things I use to give because it's adequate for that."	"I start by figuring out how long is the unit, what all am I going to include in that, and then I do long range planning. I go from the big picture down to scheduling, to each day determining what particular objective or skill that I'm going to teach. Then individually, it can be watching some of the Mike Patterson videos. I'm watching somebody present something in a different way. It might give me a new idea. I try to plan things so that there's a flow from one day to the next so that there's some continuity or pulling in something from the previous lesson or even a skill that they learned last year. But that said, I fill out my packet, as I'm working through the unit so I don't miss something while I'm teaching. Then I have put everything on Smart Notes."

Selective Code: Lesson Planning Process		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
MS	"Okay, I start with the kind of the application piece of what kind of project, to what kind of problem, or something that's a little more complex. I look for that first with mostly my resources of blogs I follow and things. I put that piece in, and then I look for something skill based, they just need practice finding the area of a circle. Where can I put practice, whether it's a worksheet or whether it's Khan Academy or IXL or something that they can get that practice. So, I put that piece in and then I look at what am I going to do to the small group. What do I need for each of the three small groups, what do my basics when my kids who need the foundations, what kind of problems are we going to do, and I usually put them on transparencies so that I can use them for all six classes. What I am going to do with my middle group that's a little bit harder that still gets the basic concept, and then with my high group, what do they still need even if they're flying through things. What do they still need and then what can I do to challenge them. I start with the independent work and then I work on small group stuff. Most of my video lessons I'm remaking this year, but in the future I think I'll be able to reuse them just to interview such concepts, to that interview."	"I keep the long range plans in mind, so, based on that. Then for specific lesson plan, I keep the end result in mind. What is it I want them to learn. I try to give them guided practice, let them work on their own. And then I also, the discovery, I want them to learn and figure out some of the process on their own. So there's a lot of questions on my end of it, as needed. We do group or partner work. Work with your partner, have discussion. I like to hear good conversations between two or three in a group. And I do try to get them up and moving to where they are just not sitting the whole time. So, whatever lessons are conducive to that, I try to work that into the process. And then, I like for them to start their homework, you know, three to five minutes prior to leaving the class, just to make sure they don't have any questions or they can get all those questions answered, prior to leaving."

Table 44: Teacher Interview Effective Instructional Strategies Table of Themes

Selective Codes: Effective Instructional Strategies		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"The instructional strategies with the flipped classroom and putting the lessons on videos, they have the options to pause and rewind and replay it. And I'll even push them in the videos. I'll coach them to, 'Okay, why don't you pause this video now, try the next 2 problems.' Hopefully they'll fall for that. But I have heard kids that will watch it two times or will watch it three times. There are some kids that can just watch it once and they get it and they're good and there's other kids that need to watch it a couple of times. So when you have those different abilities in your room, it's much better to put that on a video so they can go at their pace, than you trying to do it in the classroom and they're all over the place. Another really effective thing about this strategy is when kids are absent they actually tend to make up the work when it's a video."	"Well, I think all students, I don't want to just say my students, because I think this is a universal thing, I think they respond better in a conversation. And so I call kids out by name on a regular basis. We all have a good enough rapport that I don't, I can't think of one time this year where a student seemed kind of like annoyed or upset that I called on them and they didn't know. They seem to handle that really well. So it's a way to kind of keep them involved and interacting with the material and like on their toes, so to make them more of active participants versus um, not, like kind of passive and things like that. So OK, so I know it kind of seems like well, giving notes, you know, but it's not just that. It's more of, I really do think of it as a conversation. It would be, I don't think I would teach it as well if my students weren't there, to be honest."
HS 2	"I think I keep kids engaged. When I'm giving the lecture during class, I can time it to the minute. I know, if they're getting me off track, when to get back on track. I have a good back and forth with the kids during class and I can tell if they know what I'm trying to teach or not, and if I ask the right kind of question, we have a great time. When they're doing the flipped lesson at home, even when I give the flipped lesson prerecorded, I ask those same kind of questions and give wait time, and I've got the same inflections in my voice, it probably helps that I was a forensics coach for 29 years, you know. And so I think they learn better when I'm teaching them directly, but they certainly do much better on homework if they have class time to work on it."	"I think I do a good job of breaking things down for my students and showing them ways to learn the things that might otherwise be difficult. [I] try and figure out where the stumbling blocks might be. I think the guided notes and the practice and the working together gives the students who care, the students who want to feel confident before they leave, I think it gives, they have lots of opportunities to do that, whether it's asking a partner or somebody at their table for help, or I feel like I'm pretty good about perusing the room and checking as they're practicing their problems and they can ask me questions too."

Selective Codes: Effective Instructional Strategies		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
MS	"I think that the flipped classroom allows them have information ahead of time, so that they at least have an exposure to it. They might have had no earthly clue what it was talking about. They might have really struggled through the four problems, and they're still just like, what is this. But at least they have some like, okay I know today in class we're looking at area, I don't know how to do it. I think it kind of preps them for class. I like small group because I know my kids often will do a pre-test, so I know my kids who have no clue, and so I'm able to work with that group on things that are going to let them be successful. I also know my kids who could have gotten it two weeks ago with no instruction. I like that they have to work independently because how often is it I do a problem than you sit there and you do the exact same problem with different numbers, and you don't have to think anything, you just have to repeat what I did. Whereas if they're sitting there by themselves they have to figure out how to do something that might not be just like something they just saw, and that, they are always in partners, and I like that because they have a conversation. I walk around and I hear a lot of -- I don't know how to do this one, can you explain it, and it's not to me it's to a peer. It gives their peer a chance to have to explain something versus me always explaining everything. We talked about at the beginning of the year, you remember 90% of what you teach someone else. Don't deprive your partner of the chance of remembering 90%. If you don't ask them, they don't get to practice."	"I think providing a comfort level for them. So, I think, classroom management is a huge, has a huge impact. If they feel comfortable in your classroom, then they're going to ask questions, they're going to succeed, they're going to do well. And then also, so they way it's structured, if they're working with somebody else in the classroom, they're going to learn how to work with somebody else, how to ask questions or this is what I got, this is why I got this, or I didn't get that, or anyway. So, I think it's all about setting that comfort level in your classroom. And then just make sure I provide them with what they need to succeed."

Table 45: Teacher Interview Videos/Homework Table of Themes

Selective Code: Videos/Homework		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"Every concept that is new [has a video]. Concepts can be described as what we uses to call a section of the textbook type thing. Chapter 1 had section 1, section 2, section 3. That chapter would have gotten around 3 videos. I will go back and add videos if needed." "I do check [for completion] but probably not as often as I should because it's all about how well do they do on the formative. If I have a parent or a student talk to me about how a grade's lower than they want it to be, the first thing I say is, 'Are you watching the videos, let's see your packet, do you actually have the notes pages filled out?'"	"I call it practice, they have practice every day after our notes and a lot of kids can finish it before we leave." "With my classes this year, students who take work home and bring it back completed is low, it's really low. And I hesitate to give like a number, but I would say under 10 percent to be honest with you. They work like crazy during class time."
HS 2	"About half the time [I make videos]." "I don't have any way of finding out on Google Classroom if they've clicked on the video or not. But I do every once in a while, say, 'Pull out your notes. Let me look at them.' Now, that doesn't mean that they actually watched the video. They may have just paused, wrote down everything they saw, kept going. I know I have some kids who don't do it at all. But when it comes to the next day and they have to work on their assignment during class, I can tell who watched and who didn't based on the kinds of questions I get."	"They're assigned homework pretty much every single day." "It seems like when I check off packets that um I would say, I'm guessing, but I would say about 80 percent of the students complete 80 to 90 percent of the packet. So I think it's a pretty good rate."
MS	"It really depends on the unit [how often I make videos], because I think some things lend itself better. For units that I use it a lot, it will be three to four days a week they're watching a video." "Some of them will skip the video and see if they can do it and if they can't, they'll go back and watch the video, which I can't really fault them for. If you can do it, do it."	"Generally, they're assigned homework daily." "I'd say we have good homework completion. It varies. I'd say we have, I don't know, 80% homework completion which I think is high."

Table 46: Teacher Interview Student Effort Table of Themes

Selective Code: Student Effort		
Site	**Flipped Axial Codes**	**Traditional Axial Codes**
HS 1	"I would say, my kids do great, the fact that I get them out of their seats that I let them stand up at a window with the dry erase marker. The fact that I make it fun and I walk through the room as we're working on problems and it's not a sit and get type of situation, I think that they really put forth effort and I can very quickly partner them up with someone for accountability. I rarely have students not doing practice problems or board work and they just sit there and they don't participate."	"Overall the majority of them try so hard. I love these kids. They're CT, I mean I think we all know this as teachers, like to be in CT geometry that means they made it through Algebra 1. so I get the kids that had to work really hard to make it through Algebra 1. So they have learned by now that to do well in math it requires work. They are so good at getting their notes out and having that right next to them while they work on their homework. Sometimes they're a little too good, because I'm worried they're just not really learning, they're just copying it."
HS 2	"This year, it's fantastic. I just cannot believe. I still have four or five kids who don't do homework. And I know they're not doing well in other classes, but they're so bright, they're still As, Bs or Cs, not As, Bs or Cs in my class. But this year, the effort is amazing. I'm not sure what the deal is, but I see -- I give hard assignments and they're doing them for the most part. I'd say I have 70 kids putting forth as much effort as I could expect. 70%. 30% are not putting forth that kind of effort and they're cramming before the test, I see it on pop quizzes, but they're just great this year."	"I think that their effort is pretty good, especially when they're in class. And you know, I do a lot of perusing. I think, you know, somebody who might not otherwise work might work a little bit more or pick up their pencil because I am standing near them and can see where, you know, see them from where I'm standing. I don't spend a lot of time in the front of the classroom. So I think it's, you know, for the majority of the students it's a pretty good effort. Not everybody, but for the majority."
MS	"It took a while to build some of that effort, because they're not used to working independently without a teacher standing over their shoulder. It took awhile of this is what it should look like when you're working independently. If I wasn't going to check, they probably wouldn't do it, but over the course of the year, they've started putting out more effort. I try to make them interesting things. Like their independent application piece."	"I would say their effort is good overall, for the most part. I see kids trying, I see them asking questions and I, you know, I'd feel like I'm available for kids to come in before and after school if they do need extra help, so I feel like they try hard."

Table 47: Teacher Interview Changes for Next Year Table of Themes

Selective Code: Changes for Next Year		
Site	**Flipped Axial Code**	**Traditional Axial Code**
HS 1	"What I would change for next year, is the same thing that I've been working on trying to get better at all year and it is the differentiation within my classroom. Geometry is full of 9th through 12th graders. There's a lot of varying abilities there. Which I talked about the videos and I'm definitely hitting their different abilities in that because like I said a higher level kiddo can watch the video once and their homework's done. Where as a lower level kiddo I would hope that I can coach them to watch the video multiple times until they understand it. But, in the classroom I would love to differentiate a little bit more."	"I think I would like um, more time to plan. And maybe that's probably like the number one thing teachers say, now that I'm thinking about it. But that's something where if I have a slow week and I can take a Monday night to put together the next unit's lessons, it goes so much better than if it's a week where there's a lot going on and I just can't." " would do more groups. I like groups a lot, but like I'm kind of an optimist. I like to think that I'm going to have great ideas when I have the time to think about what I'll do with groups. What would I do with groups? I would love to have less topics so we could have more time really getting them."
HS 2	"I'm going to do more flipping next year of material and to rather than have them come in the next day and do a homework assignment, I'm going to have them come in and do an activity. And then maybe homework will be cut in half in terms of how much time they -- how much work they have to do repetition of structures. But I think we're going to do organized activities next year, at least that's my hope, is to do organized activities next year."	I would like to find the time to answer questions from the assignment the day before. I don't do a very good job of that, and I think that I put a lot on the students to approach me for help. I think that there are sometimes students that are frustrated. I would probably try to institute board where students can say I didn't get number 7. If I don't have time for them in class, I could always videotape and post that on Google Classroom.
MS	"I'm thinking about changing that every class has some sort of exit formative assessment of some variety, and somehow tying that into the amount of outside practice they have to get, but I haven't quite figured out how to make that work. Especially with the videos, because they still have to watch the video whether or not they got in class, but I want to do something with formative assessments at the end of class, so I know if they're really getting it."	"I know as we've gone through the year, this year, we've made changes, you know, the quizzes, or lessons, what worked, what didn't work. I've made notes in my lesson plan as far as content area, so, maybe just revamping some of the content just, oh I need to spend three days on this instead of two days, so just looking at the, maybe just planning and looking at the lesson a little bit more in depth, as needed."

Teacher interview qualitative perception data was analyzed around similar themes to the student interview perception data. Inspection of the qualitative teacher interview data tables also reveals several similarities between both the flipped classroom groups and the traditional classroom groups. In both groups, teachers reported that practice took place inside the classroom and then homework took place outside of the classroom. Evidence of this response can be seen in Table 41 where teachers reported, "…I'll let them pick their own groups and other times I will purposely intermingle so that they just do practice problems" (flipped high school site 1), "I give them time in class to work on it so they can get the help they need" (traditional high school site 1), "...we do take a daily quiz which probably covered something from a few days before and they they can work on the homework during class" (flipped high school site 2), "There's note taking and practice just about every day" (traditional high school site 2), "...we have small group and so they are working on something independently or they're with me in a small group" (flipped middle school site), and "I do like to have them start their homework prior to leaving and then that way if they have any questions, they can ask before they leave" (traditional middle school site).

When discussing the lesson planning process, teachers in both groups varied their approach to planning for upcoming units. At the high school sites, teachers in both groups mentioned working through packets of materials that were adopted for their curriculum. Evidence of this can be seen in their responses in Table 42 where teachers responded, "My lesson planning process would be to get that packet ready. To get that to all the people I collaborate with so they can start doing their part, which is making the answer keys, putting together some of the board work problems, and all that stuff"

(flipped high school site 1), "I start with the packet and the notes that Laura gave, and then I go through it and pick the big ideas and try to space it out more" (traditional high school site 1), "My lesson planning process now is to pull up the materials we received from Mr. Patterson and evaluate whether what I did in previous years was better than what he did or my stuff is better" (flipped high school site 2), and "I start by figuring out how login is the unit and then I do long range planning. I fill out my packet as I'm working through the unit so I don't miss something while I'm teaching" (traditional high school site 2).

At the middle school site, lesson planning looked very different between the two groups as reported by the teachers. Evidence of this can also be seen in the responses in Table 42 where teachers reported, "I start with the kind of application piece of what kind of project, to what kind of problem, or something that's more complex. I look for that first with mostly my resources of blogs I follow and things. I put that piece in, and then I look for something skill based. [Then I ask myself] What do I need for each of the three small groups, what do my basics when my kids who need the foundations, what am I going to do with my middle group that's a little bit harder that still gets the basic concept, and then with my high group, what do they still need even if they're flying through things" (flipped middle school site), and "I keep the long range plans in mind. Then for the specific lesson plan I keep the end result in mind. What is it I want them to learn. I try to give them guided practice, let them work on their own" (traditional middle school site).

Teachers discussed their perceptions of what was effective about the instructional strategies they used in the classroom with students. Teachers experimenting with the

flipped classroom discussed that they felt as though students were more successful when they had the opportunities to pause, rewind, and replay portions of the videos (flipped high school site 1), that students seem to do better on their homework when they have class time to work on it (flipped high school site 2), and that the flipped classroom allows them to have the information in advance so they are prepared for class (flipped middle school site). Evidence of these responses can be seen in Table 43.

Teachers who were not experimenting with the flipped classroom also noted various reasons for their perception of what they do that is effective in their classrooms. Two of the three teachers noted rapport and comfort level as reasons why their instructional strategies were effective, where the third teacher cited her ability to explain content. Evidence of these responses can also be seen in Table 43 where teachers noted, "I think they respond better in a conversation and so I call kids out by name on a regular basis" (traditional high school site 1), "I think I do a good job of breaking things down for my students and showing them ways to learn the things that might otherwise be difficult" (traditional high school site 2), and "I think providing a comfort level for them. So, I think, classroom management is a huge, has a huge impact" (traditional middle school site).

A fourth theme that emerged throughout the coding process of teacher interviews involved the videos used in the flipped classrooms or the homework assigned in the traditional classrooms. Teachers in both groups reported that homework or videos were assigned most of the time there was a new concept. The major difference between the two groups involved the student accountability portion of the assignments. Teachers in the flipped classrooms reported that they mostly did not attempt to find out if students

had watched the videos, but could typically tell who had or who had not watched them. Teachers in the traditional classrooms reported various completion rates from their students, but that they did check to see if students were finishing their assignments. Evidence of these responses can be seen in Table 44 where teachers reported, "I do check, but probably not as often as I should because it's all about how they do on the formative" (flipped high school site 1), "...students who take work home and bring it back completed is low, it's really low, and I hesitate to give it like a number, but I would say under 10 percent to be honest" (traditional high school site 1), "I don't have any way of finding out on Google Classroom if they've clicked on the video or not, but when it comes to the next day and they have to work on their assignment during class, I can tell who watched and who didn't based on the kinds of questions I get" (flipped high school site 2), "It seems like when I check off packets, I would say 80 percent of students complete 80 to 90 percent of the packet" (traditional high school site 2), "Some of them will skip the video and see if they can do it and if they can't they'll go back and watch the video, which I can't really fault them for" (flipped middle school site), and "I'd say we have, I don't know, 80% homework completion, which I think is high" (traditional middle school site).

The fifth theme that emerged through the teacher interview coding process involved teacher perception of student effort in their mathematics classrooms. Teachers in both groups reported feeling as though their students put forth a lot of effort to learn in their classes this year. Evidence of this can be seen in Table 45 where teachers reported, "...I think they really put forth effort and I can very quickly partner them up with someone for accountability" (flipped high school site 1), "Overall the majority of them

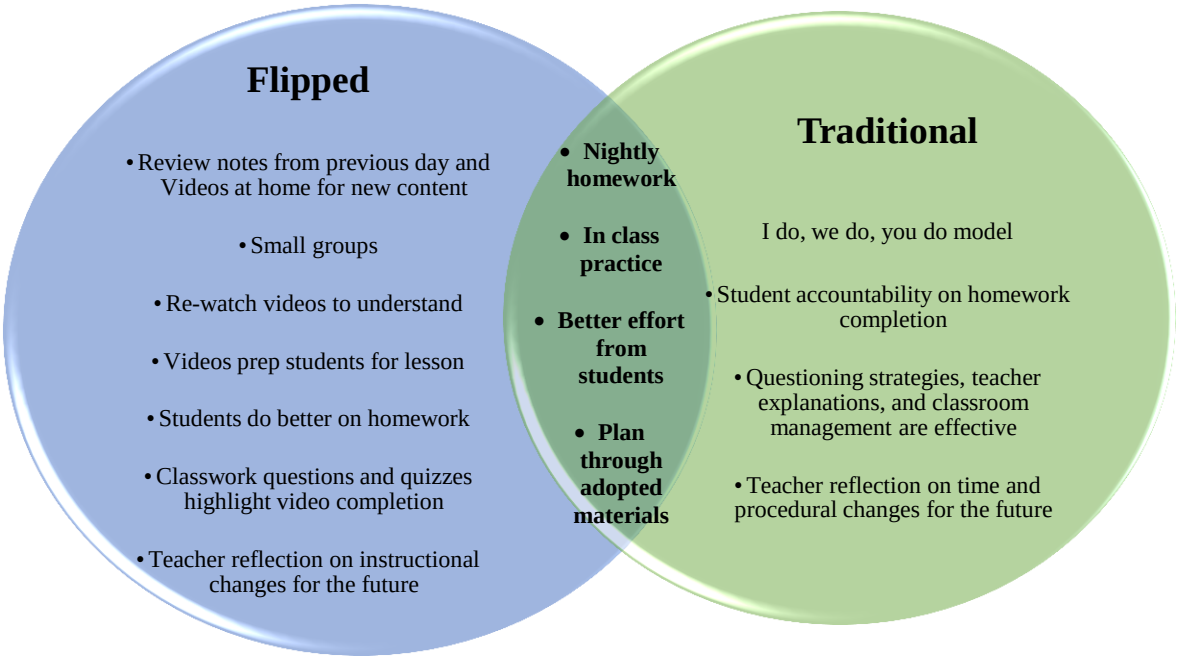
try so hard" (traditional high school site 1), "...this year the effort is amazing" (flipped high school site 2), "I think the effort is pretty good, especially when they're in class" (traditional high school site 2), "It took a while to build some of the effort because they're not used to working independently with a teacher standing over their shoulder, but over the course of the year they've started putting out more effort" (flipped middle school site), and "I would say their effort is good overall" (traditional middle school site).

Lastly, themes emerged around teacher reflections about changes they would like to make for the upcoming school year. Teachers utilizing a more traditional approach to classroom instruction cited changes involving time and procedures, where teachers utilizing the flipped method of classroom instruction discussed items related to instructional strategies. Evidence of responses from teachers using a more traditional model of instruction can be seen in Table 46 where teachers reported, "I think I would like more time to plan. I would love to have less topics so we could have more time really getting them" (traditional high school site 1), "I would like to find time to answer questions from the assignment the day before" (traditional high school site 2), and "..maybe just revamping some of the content just, oh I need to spend three days on this instead of two days" (traditional middle school site). Evidence of responses from teachers using the flipped method of classroom instruction can also be seen in Table 46 where teachers reported, "What I would change for next year is the same thing I've been working at trying to get better at all year and it is the differentiation in my classroom" (flipped high school site 1), "I'm going to do more flipping next year of material and to rather have them come in the next day and do a homework assignment, i['m going to have them come in and do an activity" (flipped high school site 2), and "I'm thinking about

changing that every class has some sort of exit formative assessment of some variety and somehow tying that into the amount of outside practice they have to get" (flipped middle school site)

Figure 13 represents a visual display of the similarities and differences between theme elements generated from the interview coding process in the teacher responses and perceptions around their mathematics teaching and student learning experiences.

Figure 13: Teacher Interview Theme Similarities and Differences between Groups



Summary of Findings

The quantitative focus question analysis regarding student achievement measures, with respect to common semester final exams and NWEA Mathematics MAP Assessments for students at the middle school site, and the incidence of active learning in classrooms revealed no significant differences between the flipped mathematics classrooms and the traditional classrooms at two out of three sites studied. An

independent samples t-test amongst individual sites was used to determine differences between groups on the common semester final exams. Analysis revealed no significant differences between groups, with the exception of student semester final exam results at high school site 1. An ANCOVA was used to test for differences between groups at the middle school site with respect to the NWEA Mathematics MAP Assessment data collected. The results of that analysis also revealed no significant differences between groups.

A two-way contingency table analysis was constructed to determine differences between groups in the frequency of observable active learning incidents over the course of the 30 classroom observations. Once again, analysis revealed no significant differences between groups for the frequency of active learning incidents, but did, however, reveal that if an active learning incident occurred, then it was likely peer-to-peer discourse that was observed. Quality and length of active learning incidents were not defined for the purposes of this study and variation between both in all classrooms did occur.

Using this quantitative analysis to guide the analysis of the qualitative research focus questions as a secondary means of explaining the lack of differences between the two groups, qualitative analysis of the active learning incidents revealed a higher frequency of peer-to-peer discourse incidents across all sites and classrooms with the exception of no notable active learning incidents through the course of the classroom observations in traditional high school site 1.

Further analysis of student and teacher interview data revealed several similarities between student and teacher perceptions across all sites. Both groups revealed similar

perceptions of frequency of assignments, whether they be traditional book work or worksheet homework, or videos with note taking responsibilities. Both groups also reported in class practice experiences around mathematical concepts and a perception that a strong effort was made on behalf of the students to learn the mathematical concepts at hand. Students, in both groups, also noted that the structure their teacher had in place in the classroom made it easy to learn. Teachers, in both groups, also reported planning their lessons by utilizing adopted materials for their course, with the exception of the flipped middle school site.

Chapter 5 - Summary, Conclusions, Recommendations

Overview

The purpose of this study was to examine how the flipped method of classroom instruction differs from traditional classroom instruction when comparing student achievement measures in middle and high school mathematics classrooms and how that data could be explained by student and teacher perceptions about teaching and learning mathematics, and observable and descriptive incidents of active learning. This study used a modified explanatory sequential mixed methods design which involved collecting quantitative data around student achievement measures and the frequency of active learning experiences in the classroom, and then explaining the quantitative results with in-depth qualitative data focused on student and teacher perceptions, and descriptions of the active learning incidents that were observed.

The study examined the following research questions in order to examine the differences between the flipped classrooms and the traditionally instructed classrooms:

1. Overarching Question:

   How do middle school and high school math students' and their teachers' perspectives about learning mathematics in a flipped classroom support the quantitative results about their academic achievement as compared to their traditionally taught peers?

   a. Quantitative Focus

      i. How does the flipped classroom approach, in the secondary mathematics classroom, impact measures of student learning as

identified by course semester final exams and NWEA Mathematics MAP data?

ii. How does the flipped classroom approach to instruction differ in terms of the frequency of observable active learning incidents as compared to the frequency of observable active learning incidents in the traditional classroom?

b. Qualitative Focus

i. Do student perceptions about their learning in a flipped mathematics classroom differ from student perceptions about their learning in a traditionally instructed classroom, and in what ways?

ii. Do teacher perceptions about their teaching and their students' learning in a flipped mathematics classroom differ from teacher perceptions about their teaching and their students' learning in a traditionally instructed classroom, and in what ways?

iii. In what ways do the active learning incidents observed in a flipped classroom compare to the active learning incidents observed in a traditionally instructed classroom?

The study utilized a post-positivist and social constructivist world view and as such was conducted under the hypothesis that teachers utilizing the flipped method of classroom instruction would have more time in their classrooms to implement learning experiences for students that were active in nature. Active learning incidents were defined in three categories: peer-to-peer discourse, modeling activities engaged in by the students, and project-based learning opportunities. Peer-to-peer discourse was counted as

observed if the researcher witnessed mathematical discussions, conjectures, justifications of thinking and reasoning, or argumentation and analysis between students regarding the course objective during the time of observation. Modeling activities were counted as observed if the students were actively engaged in activities that allowed them to demonstrate their understanding through mathematical representations, whether they be algebraic, pictorial displays, simulations, or other facets (The Common Core State Standards Initiative, 2014). Project-based learning opportunities were counted as observed if the students were actively engaged in real-world, complex tasks that involved multiple solution pathways and multiple objectives (Edutopia, 2015).

Significant Findings and Discussion

During the quantitative phases of data analysis, an independent samples t-Test was performed to determine if differences between flipped classrooms and traditional classrooms existed with regards to student achievement on district common semester final exams. The independent samples t-Tests were done on a site by site basis in order to account for variances between sites and were also conducted individually for each of the semester exams. Levene's test for equality of variances was performed first to determine if equal variances between groups could be assumed. At all sites, Levene's test resulted in p-values that were greater than .05 revealing that equality of variances could be assumed between the two groups at each individual site. Further analysis around the frequency of observable active learning incidents was conducted to determine if flipped classrooms engaged students in active learning incidents more often than traditional classrooms. Qualitative data surrounding descriptions of the observed active learning incidents, and student and teacher perception data, was then used to further explain any

differences or significant findings resulting from the quantitative analysis in order to determine possible causes for the results and to eventually answer the overarching research question that explored how the qualitative data could support the quantitative results about the academic achievement of students in the flipped classroom as related to their traditionally instructed peers.

High School Site 2

At high school site 2 no significant difference between groups were noted on either exam on the resulting independent samples t-Test. The mean exam score on the semester 1 exam was slightly higher (.07%) in the flipped classrooms than the mean exam score in the traditional classrooms. However, on the semester 2 exam, the traditional classroom's mean exam score was higher (2.81%) than the mean exam score in the flipped classroom. Descriptive statistics regarding the demographic makeup of the two groups revealed comparable class profiles.

Investigation of the incidence of active learning experiences at high school site 2 revealed that the traditional classroom and the flipped classroom engaged students in peer-to-peer discourse throughout the duration of the study, however the traditional classrooms had double the observable peer-to-peer discourse incidents recorded as compared to the flipped classrooms at that site. Qualitative analysis of the active learning incidents revealed that the traditional classrooms were arranged so that students were always sitting in groups of three throughout the class period. The flipped classroom was arranged so that students were sitting in rows. During the observable peer-to-peer discourse opportunities, students in the flipped classrooms would turn their desks together in order to engage in discourse, but this happened with 50% less frequency than

it did in the traditional classrooms at this site. This result was contrary to the initial hypothesis that more active learning would occur in the flipped classrooms.

Middle School Site

At the middle school site, quantitative analysis of the semester final exams also revealed no significant difference between the two groups on the resulting independent samples t-Test. The mean exam score on the semester 1 and the semester 2 exam were slightly higher (.07 on the integer scale for semester 1 and .13 on the integer scale for semester 2) in the flipped classrooms than the mean exam score in the traditional classrooms.

The middle school site also used NWEA Mathematics MAP Assessments as a pre- and post-test to determine student growth at the building level for any given year. An ANCOVA was used to determine if differences existed between groups at the middle school site based on this assessment data. Analysis once again revealed no significant differences between the two groups. Mean growth for students in the flipped classroom resulted in 5.632 RIT points of growth during the 2014-2015 school year and mean growth for students in the traditional classroom resulted in 5.284 RIT points of growth during the same school year. Typical RIT growth for a 7th grader, as reported by NWEA, was approximately 6 RIT points for the year (NWEA, 2015). Descriptive statistics regarding the demographic makeup of the two groups revealed comparable class profiles.

Investigation of the incidence of active learning experiences at the middle school site revealed that the flipped classroom and the traditional classroom engaged students in peer-to-peer discourse throughout the duration of the study, but the flipped classroom

also engaged students in modeling activities and project-based learning experiences where the traditional classrooms did not. The flipped classrooms also had double the observable peer-to-peer discourse incidents recorded as compared to the traditional classrooms at that site. The flipped classrooms also utilized small group mini-lessons on a regular basis as consistent with differentiated instructional practices. Qualitative analysis of the active learning incidents revealed that the flipped classrooms were arranged so that students were always sitting in groups of two throughout the class period. The traditional classrooms were arranged so that students were sitting in rows. During the observable peer-to-peer discourse opportunities, students in the traditional classrooms would turn to their sides, but they never physically rearranged their desks in order to engage in discourse. The turn and talk approach in the traditional classroom also happened with 50% less frequency than it did in the flipped classrooms at this site. Further, the flipped classrooms at the middle school level were the only classrooms that engaged students in modeling and project-based learning activities allowing for more meaningful construction of knowledge. This result was supportive of the initial hypothesis and of constructivist principles.

High School Site 1

At high school site 1, significant differences between groups were noted on both the semester 1 and semester 2 exam from the independent samples t-Test. The mean exam score on the semester 1 exam and the semester 2 exam were significantly higher (15.62% on semester 1 and 18.36% on semester 2) in the flipped classrooms when compared to the mean exam scores in the traditional classrooms. However, descriptive statistics regarding the demographic makeup of the two groups revealed significant

differences in class profiles. Students in the traditional classrooms were more likely to have an IEP indicating a physical or learning disability (58.70% of students versus 3.88% of students) and they were more likely to be receiving free or reduced lunch services (60.87% versus 45.74%) than their peers enrolled in the flipped classrooms at that site. Specific data on what the learning disabilities were of the students in the traditional classroom were not collected, but could imply that the students enrolled in the traditional classroom were more likely to have disabilities related to math than their flipped classroom counterparts.

The grade levels of the students enrolled in the traditional classes also revealed that a large population of students was classified as juniors and seniors (23.92%) as compared to a smaller population in those same classifications in the flipped classes (6.98%). For the purposes of this study, data regarding course consumption of these students was not collected. It is possible that students in the traditional classes were more likely to have been repeating the course or had been enrolled in multiple years of courses that were prerequisites of Geometry, which could imply that the students enrolled in the traditional classrooms were more likely to struggle in their math classes as compared to the students enrolled in the flipped classrooms. How these students were scheduled into each course was determined by the individual building administration and counseling departments, and to the researcher's knowledge were randomly assigned.

Investigation of the incidence of active learning experiences at high school site 1 revealed that the flipped classrooms engaged students in peer-to-peer discourse throughout the duration of the study and the traditional classrooms did not engage students in any observable active learning incidents throughout the classroom

observations. Qualitative analysis of the active learning incidents revealed that both the flipped and traditional classrooms were arranged so that students were always sitting in rows throughout the class period. During the observable peer-to-peer discourse opportunities, students in the flipped classrooms would turn their desks together, or physically move to an area more conducive to collaboration, in order to engage in discourse. Students in the traditional classrooms remained in their seats throughout the course of the observations with the exception of when they all might go to the boards to work practice problems. During these times, students were working independently and not engaging in mathematical, peer-to-peer discourse. This result was in support of the initial hypothesis that assumed more active learning would occur in the flipped classrooms.

Emergent Themes

After the initial quantitative analysis was conducted, analysis around qualitative themes emerging from the student and teacher interviews was conducted in order to further explain the possible reasons for no significant differences between student achievement measures at two of the three sites and to also explain potential differences in student achievement at high school site 1.

A three phase system of open coding, then axial coding, and then selective coding was used through a constant comparative data analysis structure (Merriam, 2009) in order to determine a grounded theory (Glaser & Strauss, 1967). Open coding was conducted within the identified question domains that were developed after the initial quantitative data collection and screening and that were consistent with the emergent themes from the literature (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013;

Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013). Categories and themes were further constructed during the axial and selective coding stages for student and teacher interview transcripts. Analysis of interview data revealed several common themes between teachers and students. Common themes were similar to those identified in the literature and initially through the interview question domains, but became more specific and separated through the analysis. Themes for student perception data involved: classroom routines, homework/videos, student effort, student ability, and the structure for learning. Themes for teacher perception data involved: classroom routines, the lesson planning process, effective instructional strategies, videos/homework, student effort, and changes for next year.

Throughout the analysis of the common themes, both students and teachers of the flipped and traditional classrooms reported perceptions and experiences that were similar to each other. Students and teachers in both groups discussed practice of mathematics skills and concepts as being part of the daily routine. Both students and teachers also highlighted perceptions of increased effort in their classrooms during this school year as compared to other school years. Both students and teachers reported perceptions of effective instructional practices in their classrooms whether they were in a flipped classroom or not, as well. Reports of outside of class work frequency were also unchanged between groups, however the students and teachers in the flipped classrooms reported a focus on note taking whereas the students and teachers in the traditional classrooms reported a focus on book work or worksheet problems.

The similarities of the perceived efforts from students and the perceived effectiveness of the teachers' structure and instructional approach to teaching and learning mathematics could potentially explain why no significant differences in student achievement measures were present. Overall, teachers and students in both groups seemed fairly comfortable with the learning experiences taking place in their math classrooms, which could have potential implications for their achievement on district common semester final exams and for the performance at the middle school site on the NWEA Mathematics MAP Assessment.

Interestingly, differences between groups were noted with respect to teacher reflection on changes for next year. Teachers experimenting with the flipped classroom were more likely to identify instructional strategy changes they would like to implement for the upcoming school year than their traditional classroom counterparts. Teachers using a more traditional approach to classroom instruction were more likely to identify time or procedural type changes that they would like to happen for the upcoming school year. Although differences in student achievement were not noted as a result, the initial discussion from the literature with regards to maximizing instructional time and providing students more opportunities for discourse and modeling during the school day (Strayer, 2007; Tucker, 2012) as a rationale for implementing the flipped classroom approach to instruction, has potential implications for this emergent theme. Teachers concerned with time and procedures were disproportionately represented in the traditional classrooms where teachers in the flipped classrooms did not report that as being a concern. This reflection was consistent with the post-positivist world view and first

assumption by the researcher that the flipped classroom method of instruction would allow teachers to maximize class time.

A second difference reported through the emergent themes around the student interview data, specifically at high school site 1 where a difference in student achievement was noted, involved how students described the structure for learning and their resulting effort and ability in their math classrooms. Students in the flipped math classrooms at high school site 1 were more likely to describe their environment in terms of how the teacher explained the material. Several students reported that their teacher did a good job of explaining concepts on the videos and in class. Their perception was that she wanted them to do well. Students in the traditional classrooms at high school site 1 were more likely to describe their environment in terms of their teacher's personality. Students in that classroom described the teacher as being "nice" and reported feeling like that was why their effort and ability was better.

Implications for Student Achievement and Classroom Instruction

The findings from this study neither supported nor negated the implementation of the flipped classroom method of instruction in secondary mathematics classrooms over a more traditional approach to classroom instruction. Results indicate that students in flipped classrooms perform at comparable levels on district common assessments to students in classrooms not utilizing the flipped approach to instruction when means are compared.

Results also indicate that the flipped method of classroom instruction does not change the frequency of active learning incident opportunities in the secondary mathematics classroom. Similarly, the active learning incidents utilized in the flipped

classrooms were comparable in type to those incidents observed in the more traditional models of classroom instruction. These results highlight a disconnect between the flipped classrooms involved in this study and the implementation of the current definition of the flipped classroom being an instructional method that moves direct instruction outside of the classroom in order to make room in the classroom for a more interactive learning environment where students can actively engage in the content (The Flipped Learning Network, 2014). These results also indicate that constructivist principles identified in the literature (Huitt, 2003; Moore, Gillett, & Steele, 2014) were not implemented during the in-class experiences, with the exception of the middle school site.

Student and teacher perceptions surrounding teachers' instructional experiences and the resulting students' mathematical learning experiences also indicates no significant difference between groups. This indicates that the flipped classroom method of instruction as implemented in this study is similar to other instructional approaches used throughout the study in the secondary mathematics classroom.

Based on these results, the only perceived impact that the flipped classroom seemed to have involved the instructional time. Teachers not experimenting with the flipped method of classroom instruction were more likely to cite concerns about instructional time than teachers who were experimenting with the flipped classroom. This suggests that teachers in the flipped classroom were not as concerned with maximizing in class time, which could have been a result of the instructional model they were using. Although time was not a concern for teachers experimenting with the flipped method of classroom instruction, that component did not seem to translate into increased

student achievement when compared to teachers who were concerned about not having enough instructional time.

This concern does not support the researcher's assumption that maximizing instructional time in the classroom could impact student achievement as measured by course grades and by norm-referenced assessments. This concern is, however, consistent with the research that suggests that utilizing the flipped method of classroom instruction frees up instructional time within the class period (Strayer, 2007; Tucker 2012; Milman, 2012). Based on these results, it is important to note that maximizing class time alone does not translate into increased student achievement as measured by course common semester assessments between groups and further supports the research by Herreid and Schiller (2013) that suggested that in order for the flipped strategy to be effective, students need to be engaged in meaningful in-class work as well.

Further, it was the assumption of the researcher under the post-positivist and social constructivist world views that intentionally designed lessons that meet course objectives, allow for equal access, and differentiate for learners was also an essential component to impacting that same achievement. Throughout the course of the study, one classroom consistently engaged students in differentiated classroom experiences. At the middle school site, the teacher of the flipped classroom reflected that:

> It took a while to build some of that effort, because they're not used to working independently without a teacher standing over their shoulder. It took awhile of this is what it should look like when you're working independently. If I wasn't going to check, they probably wouldn't do it, but over the course of the year,

they've started putting out more effort. I try to make them interesting things. Like their independent application piece (Interview Transcript Flip 3).

This reflection was consistent with the research that suggested that students can be dissatisfied initially with a new classroom structure and resistant to new methods initially (Herreid & Schiller, 2013). Although, the data analysis did not support increased student achievement when the flipped middle school classroom was compared with the traditional middle school classroom, the qualitative data suggests that any change in traditional structure will take time for students and teachers to adapt.

Similar to these results, research by Nielson (2012) suggested that classroom environments that do not engage students in more active learning experiences do little to improve student understanding and achievement. Baepler, Walker, & Driessen (2014) also suggested that focusing less on quantity of time in the classroom and more on quality of interactions and activities that students engaged in during class time are more important to impacting student achievement. These could be potential factors in the difference between groups at high school site 1 where a significant difference in student achievement was noted. This site was the only site where active learning experiences were not observed in one of the classrooms and was also the only site that noted a difference in student achievement.

It is important to recognize that the high school classrooms utilizing the flipped method of classroom instruction throughout this study tended to operate very similarly to the traditional classrooms in that some direct instruction, guided practice, and independent practice still took place. The opportunities to embed practices in the classroom consistent with social constructivism (Doolittle, 2012) were limited. In terms

of implementation, however, the results further suggest that teachers wanting to experiment with the flipped classroom could start by supplementing their traditional instruction with video lessons and student achievement would likely not be impacted negatively as a result. Once teachers became more comfortable with that substitution process, they could then work to embed more active learning experiences consistent with the social constructivist world view identified in this study and focus more on the quality of those in-class experiences (Baepler, Walker, & Driessen, 2014).

Limitations of the Study

Several limitations to the research design and method were present throughout the course of the study. Due to the nature of this study being conducted in classrooms where teachers chose to experiment with the flipped classroom approach to instruction in mathematics, the results cannot be generalized or transferred beyond the specific population from which the sample was drawn. Also due to the variances between teachers using the flipped classroom approach to instruction, results cannot be generalized or transferred to all flipped classrooms as compared to what the researcher defined as traditionally structured mathematics classrooms. Because the methods in which teachers implemented the flipped classroom approach to secondary math instruction varied significantly between sites, it is important to note that some implementations, controlling for confounding variables, could have had more of an impact on student achievement than occurred during the course of this study.

A third limitation of the research study was access to usable quantitative data. NWEA Mathematics MAP Assessment data was used to account for variances in student ability upon entering the flipped mathematics classroom, however data for that

assessment were only consistently available for the middle school site. School officials did not require the assessment for both fall and spring windows at the high school level making the data unreliable for analysis purposes. Similarly, common semester fall and spring assessment data were available from the district, however item analysis results and item descriptions were not allowed for analysis purposes limiting the discussion to overall score on the assessments.

A fourth limitation of the research study involved quantitative and qualitative data collection and analysis. Students were randomly selected for the interview process based on consent and the proportion of consenting students enrolled in either the flipped or traditional classrooms. Since the pool of consenting students was limited to 27% of the overall student population involved, and that 60% were from flipped classrooms as compared to traditional classrooms, it is possible that the data did not represent all perspectives in all classrooms. Additionally, throughout the data collection and analysis phases, the researcher acted alone. Because of this, inter-rater reliability during the coding process was not conducted. Further, domains around for the interview protocols were determined after the initial first semester quantitative data collection and screening, and consistent with the emergent themes from the literature (Flumerfelt & Green, 2013; Pierce & Fox, 2012; Davies, Dean, & Ball, 2013; Wilson, 2013; Missildine, Fountain, Summers, & Gosselin, 2013; Chen, Want, Kinshuck, & Chen, 2014; Strayer, 2012; Herried & Schiller, 2013). This process could have led to researcher bias around emergent themes throughout the coding stages.

A fifth limitation of the study involved the implementation of several new district initiatives during the 2014-2015 school year when the study was conducted. Per district

directive, all classrooms at the middle school site involved were piloting the use of an integer-based and standards based grading system that resulted in varied score reporting on semester common assessments. The district also implemented a full-scale one-to-one technology initiative district-wide where all high school students received MacBook Air laptops and all middle school students received iPad Air devices to use throughout the school year. It was also an expectation for teachers to subsequently reduce their paper usage with the onset of the one-to-one initiative. Because of these potential confounding variables, results from the current school year could not be compared to past school years or other classrooms utilizing similar instructional approaches.

Recommendations for Future Study

The results of this study suggest that the flipped method of classroom instruction as implemented in this study neither improves nor decreases student achievement in the secondary mathematics classroom, however several notable findings did emerge throughout the course of the study that should be researched further.

First, although significant differences in student achievement occurred only at high school site 1, it was impossible for the researcher to determine if the flipped classroom alone was the resulting cause of the difference. High school site 1 was also the only site in the study where demographic classroom profiles were significantly different between groups and students appeared to be scheduled into the groups based more on their demographic characteristics than on their course enrollment. Students in the traditional class were more likely to be juniors and seniors, which may suggest that students enrolled in the traditional sections were more likely to be repeating the course or have taken alternate course pathways. Data was not collected regarding the frequency of

enrollment in the current course for students enrolled. Similarly, historical data on individual student achievement was not available at the time of this study and could have offered further insight into potential differences regarding student achievement measures. Students in the traditional classroom at this site were also more likely to be receiving free and reduced lunch services, or have learning disabilities. It is also important to note that this was the only site where classroom observations of one group resulted in zero observable active learning incidents. Because of this, future research on flipped classroom implementation in the secondary math classroom should be conducted to control for demographic factors and course consumption, as well as historical achievement comparisons, so that group profiles are more similar, much like they were in high school classroom site 2 and the middle school site.

Future research should also be conducted to control for differences in implementation. Teachers implementing the flipped classroom model should be provided with or develop a common definition of what it means to flip their classroom and utilize a standardized instructional model in order to more consistently compare groups, much like was utilized in the research conducted by Flumerfelt and Green (2013), but in the secondary math setting. This process would also allow for constructivist principles to be embedded more consistently during the in-class experiences as consistent with the research that highlighted more project-based learning experiences and case study experiences (Herried & Schiller; 2013; Pierce & Fox, 2012).

Similarly, more research should be conducted around active learning incidents. One notable finding in high school site 1 was that, although only present in 40% of the classroom observations, the flipped classrooms engaged students in peer-to-peer

discourse where the traditional classrooms did not engage students in peer-to-peer discourse. Peer-to-peer discourse also occurred more often in classrooms where the physical arrangement of the space was conducive to group work, as could be seen in high school site 2's traditional classrooms and the middle school site's flipped classrooms. As part of the flipped implementation, protocols should be developed to include a definition of meaningful peer-to-peer discourse and a structure in which to embed more opportunities for discourse in order to research impact on student achievement. To further this discussion and research, quality active learning experiences should be defined in terms of content and length and studied further. This was not included or measured for the purposes of this study.

One component that was not included for the purposes of this study involved parent perceptions of their student learning in the flipped classroom or how students perceived their parents' responses to the flipped method of classroom instruction. A common, pervasive, issue surrounding math education in the United States involves parents' feelings of inadequacy about their own math abilities and further limitations on being able to assist their students with mathematics assignments (Vawter, 2013). Further research around parent perceptions of the flipped secondary mathematics classroom and how that impacts student perceptions should be explored.

As a fourth area of interest, the qualitative theme surrounding how students described their teachers in the learning environment when discussing their own effort, ability, and the structure for learning in which they were engaged should be researched further. Students that were interviewed throughout the course of the study often perceived their teachers as wanting them to do well or being nice. Although no

significant increases in student achievement were noted between groups, it is also important to note that students in both groups provided similar descriptions of their teachers. This is consistent with research conducted by Yeager, et. al (2013), surrounding the power of messages and feedback that teachers relay to students in their classrooms. Further research should be conducted on how students perceive their teachers wanting them to do well and student achievement in the secondary mathematics classroom.

Concluding Thoughts

With the onset of the 21st century, technology has rapidly changed how business is conducted. It is often thought that in order for students to be college and career ready, and for education to be able to prepare students for tomorrow's world, it is necessary to meet them on their own terms and utilize technological tools in manner that enhances instruction. How that technology is implemented and whether or not it increases student achievement remains to be seen. Several recent reports indicate that when implemented effectively, technology can increase student achievement in mathematics, however when it is used for "drill and kill," it does not have the same result (Alliance for Excellent Education, 2014).

Considering that recent research, it is not surprising that the results of this study concluded no significant results between student achievement measures. The definition of the flipped classroom as identified by the Flipped Learning Network (2014) was not implemented in two out of the three sites and the in-class experiences were not consistent with the social constructivist world view. When looking at differences between groups on classroom structures and the inclusion of active learning incidents throughout the

lesson design, little notable differences were observed between individual sites. Classrooms seemed to function relatively similarly to each other with the most notable difference being what took place outside of class time. The exception to this rule was apparent at the middle school level where the lesson planning descriptions from the teacher and the descriptions of student effort involved a very detailed response that highlighted the use of tiered differentiation techniques (Tomlinson, 2005) and the explicit instruction surrounding student roles in the classroom. It would be interesting to research course consumption in the future of those students as compared to others that were not involved in such explicit practices.

This dissertation was grounded in a social constructivist theoretical foundation and post-positivist world view. Results of this study suggested, however, that implementing technology or experimenting with the flipped method of classroom instruction by moving direct instruction components outside of the classroom alone is not enough to increase student achievement in the secondary mathematics classroom when compared to other methods of instruction in comparable areas. While the flipped method of classroom instruction may make it easier to differentiate outside of the classroom environment with respect to repetition of exposures (Kuhn & Dempsey, 2011), it did not show significant differences in student achievement through the course of this study and further suggested that the flipped classroom method as implemented in this study is not congruent to constructivist principles and methods.

It was the initial assumption of the researcher that maximizing instructional time within the classroom would lead to more opportunities for students within the class period to engage in constructing their own meaning and understanding through authentic

and intentionally designed lessons that maximized opportunities for active learning to occur. It is possible that coupled with social constructivist principles that involve designing instructional experiences that increase collaboration and peer-to-peer discourse and increasing the relevancy to students (Kuhn & Dempsey, 2011) could more positively impact student achievement measures, but more research should be conducted in order to validate those hypotheses.

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Appendix A - Research Instruments

Parent Informed Consent

Dear Parent:

Heather Ramaglia, Math Resource Specialist for the XXXXXX, invites your child to participate in a research study entitled *The Flipped Mathematics Classroom: A Mixed Methods Study Examining Achievement, Active Learning, and Perception.* You and your child are being contacted because your child is a student in a math classroom in the district that has been implementing a flipped approach to classroom instruction or because your student is in a math classroom that is similar to one using the flipped approach to classroom instruction.

I would like to talk with your child about their experiences in this classroom and how they might feel about their learning in mathematics this year. The purpose of this study will be to understand how the flipped method of classroom instruction impacts student achievement in middle and high school mathematics classrooms as compared to other mathematics classrooms.

If you agree, your child may be selected to talk to an interviewer about topics such as how his/her class is structured, what they like or dislike about their math class, and how homework, or outside of class work, is utilized. An interviewer will come to your child's school to conduct the interview at a time convenient for the child and his/her teacher. The interview is expected to take about 10 to 15 minutes to complete. Yours and your child's identity will remain anonymous. If you would like to discuss your child's responses to the interview questions, please let me know.

This interview will be conducted on a voluntary basis using random selection across all participating classrooms so compensation for this study will not be provided. While your child may not directly benefit from this study, it is my hope that it will lead to improved

understandings about how students learn mathematics in order to advance instruction in that area.

By signing this form, you will indicate your willingness to have your child involved in this study and to have the information gained from this study utilized in publications or presentations. You may ask any questions and withdraw from this study at any time.

If you have questions about this research, you may contact Dr. David Allen, dallen@k-state.edu, at the Kansas State University. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher or the professor of this course, please contact the Kansas State University Institutional Review Board at (785) 532-3224.

Sincerely,

Heather Ramaglia.
Math Resource Specialist
XXXXXX

Parental Permission

By signing this document, you are agreeing to allow your child,_____, to be part of the study entitled *The Flipped Mathematics Classroom and its Impact on Middle & High School Student Achievement*. Your child's participation in this study is completely voluntary. If you allow your child to be part of the study, you may change your mind and withdraw your approval at any time. Your child may choose not to be part of the study, even if you agree, and may refuse to answer an interview question or stop participating at any time.

You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that the questions you have asked about the study have

been answered and that you understand what your child will be asked to do. You may contact the researcher if you think of a question later.

I give my permission for my child to participate in this study.

_____

Signature

I give my permission for the interview with my child to be audiotaped.

_____

Signature

Student Informed Consent

Dear Student:

Heather Ramaglia, Math Resource Specialist for the XXXXXX, invites you to participate in a research study entitled *The Flipped Mathematics Classroom: A Mixed Methods Study Examining Achievement, Active Learning, and Perception.* You are being contacted because you are a student in a math classroom in the district that has been implementing a flipped approach to classroom instruction or you are a student in a math classroom that is similar to one using the flipped approach to classroom instruction.

I would like to talk with you about your experiences in this classroom and how you might feel about your learning in mathematics this year. The purpose of this study will be to understand how the flipped method of classroom instruction impacts student achievement in middle and high school mathematics classrooms as compared to other mathematics classrooms.

If you agree, you may be selected to talk to an interviewer about topics such as how your class is structured, what you like or dislike about your math class, and homework, or outside of class work, is utilized. An interviewer will come to your school to conduct the interview at a time convenient for you and your teacher. The interview is expected to take about 10 to 15 minutes to complete. Your identity will remain anonymous. If you would like to discuss your responses to the interview questions, please let me know.

This interview will be conducted on a voluntary basis using random selection across all participating classrooms so compensation for this study will not be provided. While you may not directly benefit from this study, it is my hope that it will lead to improved understandings about how students learn mathematics in order to advance instruction in that area.

By signing this form, you will indicate your willingness to be involved in this study and to have the information gained from this study utilized in publications or presentations. You may ask any questions and withdraw from this study at any time.

If you have questions about this research, you may contact Dr. David Allen, dallen@k-state.edu, at the Kansas State University. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher or the professor of this course, please contact the Kansas State University Institutional Review Board at (785) 532-3224.

Sincerely,

Heather Ramaglia.
Math Resource Specialist
XXXXXX

Student Permission

By signing this document you are agreeing to be part of the study entitled *The Flipped Mathematics Classroom and its Impact on Middle & High School Student Achievement*. Your participation in this study is completely voluntary. You may change your mind and withdraw your approval at any time. Parental consent is also necessary before you may participate in this study.

You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that the questions you have asked about the study have been answered and that you understand what you will be asked to do. You may contact the researcher if you think of a question later.

I give my consent to participate in the study.

_____

Signature

I give my consent for the interview to be audiotaped.

_____

Signature

Teacher Informed Consent

Dear Teacher:

Heather Ramaglia, Math Resource Specialist for the XXXXXX, invites you to participate in a research study entitled *The Flipped Mathematics Classroom: A Mixed Methods Study Examining Achievement, Active Learning, and Perception.* You are being contacted because you are using the flipped classroom approach to instruction or because you teach a course where a colleague is using the flipped classroom approach to instruction.

I would like to observe your classroom and talk with you about your instructional techniques and your experiences in teaching mathematics at the middle or high school level. The purpose of this study will be to understand how the flipped method of classroom instruction impacts student achievement in middle and high school mathematics classrooms as compared to other mathematics classrooms.

If you agree, you will talk to an interviewer about topics such as your lesson planning process, routines and procedures, homework policy, and perception about student effort and achievement. Students choosing to participate in the study will also be interviewed regarding their perceptions about mathematics and the instruction they receive. An interviewer will come to your school to conduct interviews with you and your students that agree to be interviewed at a time convenient for you and the students involved. The interview is expected to take about 10 to 15 minutes to complete. Yours and your students' identities will remain anonymous. If you would like to discuss your students' responses to the interview questions, please let me know.

This interview will be conducted on a voluntary basis so compensation for this study will not be provided. While you or your students may not directly benefit from this study, it is my hope that it will lead to improved understandings about how students learn mathematics in order to advance instruction in that area.

By signing this form and completing the interview process, you will indicate your willingness to be involved in this study and to have the results of the study used for publication and presentation purposes. You may ask any questions and withdraw from this study at any time.

If you have questions about this research, you may contact Dr. David Allen, dallen@k-state.edu, at the Kansas State University. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher or the professor of this course, please contact the Kansas State University Institutional Review Board at (785) 532-3224.

Sincerely,

Heather Ramaglia.
Math Resource Specialist
XXXXXX

Permission

By signing this document, you are agreeing to be part of the study entitled *The Flipped Mathematics Classroom and its Impact on Middle & High School Student Achievement*. Your participation in this study is completely voluntary. You may change your mind and withdraw your approval at any time.

You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that the questions you have asked about the study have been answered and that you understand what your child will be asked to do. You may contact the researcher if you think of a question later.

I agree to participate in this study.

_____

Signature

I agree for the interview portion of this study to be audiotaped.

_____

Signature

Student Interview Protocol

Student Interview Protocol: Flipped Classroom

Student #_____ Date_____

School_____ Teacher_____

To be read to each participant:

Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have any questions for me before we begin?

1. Describe what your math classroom was like last year (routines, procedures, homework, notes, etc). What did a typical day look like?

2. Describe what your math classroom is like this year (routines, procedures, homework, notes, etc). What does a typical day look like?

3. **[For students in the flipped classroom]** How often are videos used in your course to deliver new information?

4. **[For students in the flipped classroom]** Do you watch videos for the course and if so describe what you like or don't like about them. If you do not watch them, explain why you do not.

5. **[For students in the traditional classroom]** How often is homework assigned in your class?

6. **[For students in the traditional classroom]** What kind of homework is usually assigned in your class?

7. **[For students in the traditional classroom]** How often do you complete assigned homework?

8. How would you describe your effort in your math classroom last year?

9. How would you describe your effort in your math classroom this year?

10. How would you describe your math ability last year?

11. How would you describe your math ability this year?
    a. **(If the participant described their math ability differently between the two years – ask this question)** What would you attribute to the change and why?

12. How does the structure of this year's classroom help you in learning the content?

Teacher Interview Protocol

Teacher Interview Protocol: Flipped Classroom

Date_____

School_____Teacher_____

To be read to each participant:

Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

1. Describe what your math classroom was like last year (routines, procedures, homework, notes, physical space, etc). What did a typical day look like?

2. Describe what your math classroom is like this year (routines, procedures, homework, notes, physical space, etc). What does a typical day look like?

3. Describe your lesson planning process.

4. What is effective about the instructional strategies you use?

5. How often arestudents assigned homework and how often do students complete the assigned homework?

6. **[For teachers using the flipped classroom]** How often are videos used in your course to deliver new information?

7. **[For teachers using the flipped classroom]** How do you know if students watch the videos for the course?

8. How would you describe students' effort in your math classroom?

9. What, if anything, would you change for next year?

Appendix B - Qualitative Data Transcripts and Field Notes

Student Interview Transcripts

File Name : VALID 1
Length : 0:05:36
Speakers : Mrs. Ramaglia, VALID 1

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have questions for me before we begin?

VALID 1: No.

Mrs. Ramaglia: Okay. Describe what your math classroom was like last year in terms of routines, procedures, homework notes, what did a typical day look like?

VALID 1: The teacher would have us get our supplies, do our bell work, work on previous days' work, move on to new stuff, and then begin homework, usually a worksheet, if there was time.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year in terms of routines, procedures, homework notes, and what does a typical day look like?

VALID 1: More visual examples this year and that helps a whole lot. Visually seeing it with tools and manipulatives help a lot more. More of this done this year.

Mrs. Ramaglia: Okay. How often are videos used in your course to deliver new information?

VALID 1: Most days.

Mrs. Ramaglia: Okay. Do you watch the videos for the course?

VALID 1: Sometimes I feel like I don't need to watch, but I tend to watch all of them because it helps

Mrs. Ramaglia: What do you like or don't like about them?

VALID 1: The videos explain more than a worksheet. Better to watch before because then understand it better beforehand.

Mrs. Ramaglia: Alright. How would you describe your effort in your math classroom last year?

VALID 1: I used to not do homework because I didn't get it and gave up.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom this year?

VALID 1: I do all my homework this year because there are more resources. I watch the videos more.

Mrs. Ramaglia: Okay. How would you describe your math ability last year?

VALID 1: It was not very good.

Mrs. Ramaglia: How would you describe it this year?

VALID 1: I think I have improved.

Mrs. Ramaglia: What do you think is the difference? What caused the change?

VALID 1: I feel more confident. I feel good about my ability.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

VALID 1: The videos just help me to understand it better beforehand.

Mrs. Ramaglia: All right, well, that's all I have. Do you have any questions for me?

VALID 1: No.

Mrs. Ramaglia: Okay. Thank you.

[Audio Ends]
[0:05:36]

File Name : VALID 2
Length : 0:03:29
Speakers : Mrs. Ramaglia, VALID 2

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Alright. Hi, my name Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have questions for me before we begin?

VALID 2: Uh uh.

Mrs. Ramaglia: Okay. Describe what your math classroom was like last year in terms of routines, procedures, homework notes, what did a typical day look like?

VALID 2: Pretty much have us do work on the board at the beginning and then we would like go over the last day's work and then do our lesson and then do homework if we had time.

Mrs. Ramaglia: Describe what your math classroom is like this year in terms of routines, procedures, homework notes, and what does a typical day look like?

VALID 2: This year we get extra one on one attention. Our teacher makes herself available. We have like videos and we can relearn new stuff if we don't get it. We work on problems in class and we watch videos for homework sometimes.

Mrs. Ramaglia: Alright. How often are videos used in your course to deliver new information?

VALID 2: Depends on what topic we're talking about, but most of the time.

Mrs. Ramaglia: Okay. Do you watch the videos for the course?

VALID 2: Yes.

Mrs. Ramaglia: What do you like or don't like about them?

VALID 2: I don't like that there are not too many chances to try problems on my

own. I would like more examples to practice.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom last year?

VALID 2: I always did my work. It was good.

Mrs. Ramaglia: How would you describe your effort in your math classroom this year?

VALID 2: I still do all my homework.

Mrs. Ramaglia: Alright. How would you describe your math ability last year?

VALID 2: I was lower middle in ability.

Mrs. Ramaglia: How would you describe it this year?

VALID 2: My grades are better than last year, so this year I am like more in the middle.

Mrs. Ramaglia: What do you think is the difference? What caused the change?

VALID 2: I think just the extra attention I get in class.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

VALID 2: Getting more help in class from the teacher and being able to re-watch the videos as many times as we want helps a lot.

Mrs. Ramaglia: Well, that's all the questions I have. Do you have any questions for me?

VALID 2: No.

Mrs. Ramaglia: Okay. Thank you.

[Audio Ends]
[0:03:29]

File Name : STUD 1
Length : 0:05:40
Speakers : Mrs. Ramaglia, STUD 1

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Okay, make sure you kinda speak up. So tell me your name.

STUD 1: STUD 1.

Mrs. Ramaglia: STUD 1? Okay. Hi, my name is Mrs. Ramaglia and I coordinate middle- and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year, okay? Do you have any questions for me before we begin? Okay. Describe what your math classroom was like last year in terms of routines, procedures, hallmark notes. What did a typical day look like?

STUD 1: Um, well she usually made us get our books and just do that, didn't really tell us anything about what we're learning. Just sort of told us about the page numbers. We had to figure it out as we went, basically. And then later she told us about the homework that we were assigned, and that was about it. Just mainly reading the book.

[background chatter]

Mrs. Ramaglia: Reading the book? Describe what your math classroom is like this year in terms of routines, procedures, hallmark notes and what does a typical day look like?

STUD 1: Uh, This year we more uh... she does PowerPoints and board works and notes on the board and stuff like that, and then before finals started she did like Google Classroom notes, where we could like do it after school hours. We could like go back and watch things that I didn't really understand, it made it a lot easier instead of reading more technical words. So that's kinda what we did.

Mrs. Ramaglia: Okay. How often are videos used in your course to deliver new information?

STUD 1: Before finals it happened a lot. It was probably for every little thing we did, for like circles and geometry in general.

Mrs. Ramaglia: Okay. So quite a bit, you would say?

STUD 1: Yes.

Mrs. Ramaglia: Do you watch the videos for the course? And if so, describe what you like or don't like about them.

STUD 1: Um, I like that you kind of can rewatch it a lot, so if I didn't really understand something, because that has never really been my subject or I didn't really get it, I can just rewatch it and try to figure out what I missed. And then I don't really like that it's not in person, I feel more comfortable being in class so I can ask questions there. That's about it.

Mrs. Ramaglia: So you would say you do watch them?

STUD 1: Yes.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom last year?

STUD 1: Not that much, she didn't really give me a reason to do anything. So I tried to get my homework done and I made a pass, so I think I did good.

Mrs. Ramaglia: Okay, how would you describe your effort in math class from this year?

STUD 1: Well, I have a lot better grade than I did last year and I enjoy it more, so I have more of a reason to do the work.

Mrs. Ramaglia: Okay, so you would say you try harder? Did you try harder this year? Okay.

STUD 1: Yes.

Mrs. Ramaglia: Okay. How would you describe your math ability last year?

STUD 1: I hate algebra.

Mrs. Ramaglia: [laughs] Okay.

STUD 1: I'm bad at it. I don't know, her t-teaching method, just reading books doesn't work for me. I need like hands-on things.

Mrs. Ramaglia: okay, so how would you describe your math ability this year?

STUD 1: Uh geometry I'm a lot better with. It makes more sense.

Mrs. Ramaglia: So you feel like it's kind of better?

STUD 1: Yeah.

Mrs. Ramaglia: Okay. So what would you attribute to the change and why? Like the difference between this year's ability and last year's ability.

STUD 1: Uh, can you make that simpler?

Mrs. Ramaglia: Sure. So what would you say is the biggest difference between how you felt about your ability last year versus how you feel about your ability this year?

STUD 1: I'm more confident, like I'll talk in class, but last year I didn't want to be noticed at all. I just, I didn't understand it, so whenever she asked me a question I didn't, I didn't know what to say, so It was very awkward. So I like this year a lot better.

Mrs. Ramaglia: Okay. So how does the structure of this year's class help you in learning the content?

STUD 1: It's, at home I feel comfortable, so I don't feel like I'm in competition to anyone, so if I want to take notes a few more times I don't feel like I'm holding up the class at all, trying to figure it out. I think this year is better.

Mrs. Ramaglia: So like less pressure?

STUD 1: Yes.

Mrs. Ramaglia: Okay, all right, well that is all I have. Do you have any questions for me? Okay, well thank you, I appreciate it.

[Audio Ends]
[0:05:40]

File Name : STUD 2
Length : 0:06:09
Speakers : Mrs. Ramaglia, STUD 2

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: **STUD 2**. Hi, my name is Mrs. Ramaglia and I coordinate middle and high school Mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom from this year and last year. Do you have any questions from me before we begin?

STUD 2: No.

Mrs. Ramaglia: Okay. Describe what your Math classroom was like last year in terms of routines, procedures, homework, notes. What did a typical day look like?

STUD 2: Last year, the teacher wasn't really, she didn't describe very much. She had still a lot of work on her own. And we would like do a lot of Algebra because I was in Algebra last year. She'd have us do a lot of work on our own and she wouldn't explain very much. It's kind of hard but I passed it.

Mrs. Ramaglia: Okay. Did you have a lot of homework?

STUD 2: Yeah. We had a lot of homework and we'd go over it. But if we had questions, we definitely like come in every, like more than once just to get things work with so many people would come in.

Mrs. Ramaglia: Okay. Describe what your Math classroom is like this year in terms of routines, procedures, homework, and notes and what does a typical day look like?

STUD 2: This year, it seems a lot easier because the teacher explains a lot more and she helps us with everything. If we have questions, she'll help us in class instead of making us come later and the homework is I felt like I understand it all better because she can explain it in a way that I understand.

Mrs. Ramaglia: Okay. How often are videos used in your course to deliver new information?

STUD 2: I feel like throughout the year, we had a lot of videos but it wasn't so much to really like we'd have to watch videos every night. It was more like a few times, maybe once or twice a week but it would still like

they're longer, so if we needed help we could go back to it and pause it if we needed to rework something and understand it. But it was enough to where like I understood everything.

Mrs. Ramaglia: Okay. Do you watch videos for the course? And if so, describe what you like or don't like about them.

STUD 2: I do watch the videos like the ones that she assigns us to fill out with homework. I like them because they go along with what our notes are like it's not just a random video and we have to find out where to put everything. It's great and organized, and she knew what she was doing before she started making the videos. I like everything about it. It's really easy. It helps because I can pause it and re-watch it if I don't understand and it helps a lot.

Mrs. Ramaglia: Okay. How would you describe your efforts in your Math classroom last year?

STUD 2: I feel like I had to try a lot harder because the teacher was trying to prepare us for high school. She said the teachers wouldn't help us as much, so she wouldn't give us very much help. I feel like I tried more last year because I didn't have the help from the teacher.

Mrs. Ramaglia: Okay. How would you describe your effort in your Math classroom this year?

STUD 2: I feel like I've try hard to pass. But it's a lot easier to do the work and everything because the teacher helps us a lot more. She's better at explaining things. So, I tried more.

Mrs. Ramaglia: Good. How would you describe your Math ability last year?

STUD 2: I feel like I was good at Algebra and I was good with all the concepts, but it was kind of like, I don't know. If you handed me homework that we did the month before, I'd probably wouldn't know how to do it.

Mrs. Ramaglia: Okay. How would you describe your Math ability this year?

STUD 2: I feel like I know a lot more this year. She can explain things to me better to where I remember it. Like if you give me something now that we did two months ago, I probably understand what we're doing and how to do it.

Mrs. Ramaglia: What would you attribute to the change in the two years and why?

STUD 2: Do you mean how I feel about the change?

Mrs. Ramaglia: Yeah, the difference between the two years, what do you think contributed to you the biggest change?

STUD 2: I feel like just the way she teaches like it's not only the videos, it's just like her personality with that. She's better with like helping. She really wants us to pass and to understand it. She just doesn't want us have an A but not know anything. She wants us to know everything we need and have it like make sure we know everything. She'll keep going over it if we don't understand it. I feel like she's helped me a lot more than my last teacher did because the last teacher, I didn't talk to her very much. And she just didn't really have much to help us with because she thought she was doing everything that like she just wasn't a very good teacher to me. And this year, it's a lot better.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

STUD 2: It helped me a lot like it's helped me learn it, like understand it more because she puts examples with the videos. If we don't understand it, we can re-watch it. It just helps me a lot with keeping the information, like instead of forgetting it or learning it in class, I can go home and watch it. If I don't understand, I can re-watch it. And if I do understand, then I can do practice problems. It has helped me a lot.

Mrs. Ramaglia: Okay, good. Those are all the questions I have. Do you have any questions for me?

STUD 2: No.

Mrs. Ramaglia: Okay.

[Audio Ends]
[0:06:09]

File Name : STUD 3
Length : 0:05:00
Speakers : Mrs. Ramaglia, STUD 3

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom from this year and last year. Do you have any questions for me before we begin?

STUD 3: I do not.

Mrs. Ramaglia: Okay. Describe for me what your math classroom was like last year in terms of routines, procedures, home work, and notes. Tell me what did a typical day look like?

STUD 3: Last year, we would have home work every single night and we would do all those stuff, like those stuffs that we are learning for home work during the class period. We would take notes every single day and we would do board work usually like a day or two days before we actually had the test.

Mrs. Ramaglia: Okay. Describe what your Math classroom is like this year in terms of routines, procedures, home work, notes, and what does a typical day look like?

STUD 3: This year, she goes over if she's introducing a new like problem or subject of the Math. She goes over during class, then we go home and we watch a video, and that's during taking notes like. It's like a normal day at class but we do it at home. And then the notes are home work, then we go over the notes the next day, and then we repeat it.

Mrs. Ramaglia: How often are videos used in your course to deliver new information?

STUD 3: Usually we get a packet and then the packet is like a good 30 pages. It's probably like every, I would say like 5-10 pages that we have a new video but each new thing that we learn is each time we have a video.

Mrs. Ramaglia: Every time there's something new, you get a video?

STUD 3: Yes.

Mrs. Ramaglia: Do you watch the videos for the course?

STUD 3: I do.

Mrs. Ramaglia: Describe what you like or don't like about them.

STUD 3: I like it because, you could say its extra learning but it really isn't, because it's just more time. You have to actually watch the videos and then you understand it so then you can go through the curriculum faster throughout the school year. I just think it helps a lot honestly.

Mrs. Ramaglia: How would you describe your efforts in your math classroom last year?

STUD 3: It was stronger because you do the notes in the class and then you would forget them or I would forget them at least when I got home to actually do the home work. The notes that I took, it really make sense the way I would put it.

Mrs. Ramaglia: How would you describe your effort this year in your math class?

STUD 3: I think it's a lot easier because if I don't get it and I don't get the notes that are already in the packet or that we already did then I can actually just re-watch the video. She explains it to everybody so it makes more sense to me.

Mrs. Ramaglia: Would you say that you're more actively involved?

STUD 3: Yes.

Mrs. Ramaglia: How would you describe your math ability last year?

STUD 3: What do you mean, by ability?

Mrs. Ramaglia: Like how well you feel you did?

STUD 3: I thought I did, alright. I thought I did alright. I like it better this year because she does the videos and I understand it more because it's like more on, I guess you could say more on in even though it's geometry not algebra. Like on a scale of 1-10, I would probably say like 7.

Mrs. Ramaglia: Last year?

STUD 3: That last year and this year is probably like 9 because I understand it easier.

Mrs. Ramaglia: What do you feel like is the biggest change from the 7 to the 9?

STUD 3: The fact that you can actually have a video and go home and watch it if you actually want to take the time and learn about it. That's probably the biggest change for myself and for like everyone that also has like the flipped classroom.

Mrs. Ramaglia: How does the structure of this year's classroom help you in learning the content?

STUD 3: I like it because you can actually learn it when you like get home. If you don't understand it and you can go back and watch it. If it's like you have a bunch of videos for a test coming up and you forgot like one part of the test that she gives for you for the study guide or she tells you what the test is about. You can actually just like individually go back and look at it and so you're flipping through notes and trying to understand what you wrote before.

Mrs. Ramaglia: Alright. That's all I have. Do you have any questions for me?

STUD 3: No, I do not. Thank you.

Mrs. Ramaglia: Okay well thank you so much.

[Audio Ends]
[0:05:00]

File Name : STUD 4
Length : 0:03:57
Speakers : Mrs. Ramaglia, STUD 4

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: STUD 4. Hi, my name is Mrs. Ramaglia and I coordinate middle and high school Mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom from this year and last year. Do you have any questions for me before we begin?

STUD 6: No.

Mrs. Ramaglia: No? Okay. Describe what your Math classroom was like last year in terms of routines, homework, things that you did in class. What did a typical day look like?

STUD 4: We start off with the bell work. From there, my teacher checked homework and then we just start with the material that she had planned and then she would just give us homework at the end.

Mrs. Ramaglia: Okay. Describe what your Math classroom is like this year with routines, procedures, homework, notes, and all of that.

STUD 4: We usually start off with a bell work and then we go to check homework. And at the end, she just writes board work.

Mrs. Ramaglia: Okay. All right. How often are videos used in your course to delivering new information?

STUD 4: Mostly every day.

Mrs. Ramaglia: Mostly everyday? All right. Do you watch videos for the course? And if so, describe what you like or don't like about them. If you don't watch them, explain why you don't.

STUD 4: I watched them because it gives you good practice and notes, and she explained very well about what you're supposed to be taught.

Mrs. Ramaglia: Okay. How would you describe your effort in your Math classroom last year?

STUD 4: I would describe as really good effort. Because everybody else wasn't really trying, they were all just enough messing around.

Mrs. Ramaglia: Okay. How would you describe your effort in your Math classroom this year?

STUD 4: Pretty okay.

Mrs. Ramaglia: Just okay?

STUD 4: Yeah.

Mrs. Ramaglia: Okay. How would you describe your Math ability last year?

STUD 4: I think I did mostly well in that class because I had a better understanding of what it was supposed to be. And since Geometry is new, it's going to be difficult.

Mrs. Ramaglia: Okay. How would you describe your Math ability this year?

STUD 4: It seemed pretty good, not too bad.

Mrs. Ramaglia: Not too bad? What do you think you would attribute to the difference between last year and this year?

STUD 4: This year's a little bit harder for me than last year dealing with figures, like how the diameter and radius.

Mrs. Ramaglia: You said diameter and radius? Sorry.

STUD 4: Even like the degrees or so, it's harder.

Mrs. Ramaglia: You would say that content is harder?

STUD 4: Yeah.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

STUD 4: It goes a little slower so you get to understand the content she's teaching, plus the videos help out too.

Mrs. Ramaglia: The videos help out? Okay. All right. Those are all the questions I have. Do you have any questions for me? Okay. Thank you.

[Audio Ends]
[0:03:57]

File Name : STUD 5
Length **:** 0:03:10
Speakers **:** Mrs. Ramaglia, STUD 5

[Audio Begins]
[0:00:00]
STUD 5: I'm STUD 5

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school Mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom from this year and last year? Do you have any questions for me before we begin?

STUD 5: No.

Mrs. Ramaglia: Describe what your Math classroom was like last year in terms of routines, procedures, home work, and notes. Tell me what a typical day looks like?

STUD 5: Okay. We took notes in class, then we took our textbook home and did problems out of the textbook as home work.

Mrs. Ramaglia: That's pretty much how the class went?

STUD 5: Yeah.

Mrs. Ramaglia: Describe what your Math classroom is like this year in terms of routines, procedures, home work, notes, and what a typical day looks like?

STUD 5: We do like a daily quiz for class and then we take notes at home and we do the homework at school.

Mrs. Ramaglia: Alright. How often are videos used in your course to deliver new information?

STUD 5: Most of the time like three or four times a week.

Mrs. Ramaglia: Those were at home, you do this at home?

STUD 5: Yeah.

Mrs. Ramaglia: Do you watch the videos for the course, and if so, describe what you like or don't like about them?

STUD 5: I do watch some for the course. I like that it's like easy to do at home and I don't have to like trying to figure it out at home but I don't like that if I don't get it, I can't like have her rephrase it because it's just like kind of set. I can't ask to have more elaboration on something.

Mrs. Ramaglia: How would you describe your efforts in your Math classroom last year?

STUD 5: I did like all the homework I guess, and lots of effort because I kind of, Math is easy for me so I think it didn't take long to do the homework last year.

Mrs. Ramaglia: How would you describe your effort in your Math classroom this year?

STUD 5: It's kind of easier with the notes being at home and everything. It's easy to get the homework done in class and not have much to do at home.

Mrs. Ramaglia: How would you describe your Math ability last year?

STUD 5: I was kind of good at Math.

Mrs. Ramaglia: It was good?

STUD 5: Yeah.

Mrs. Ramaglia: How would you describe your Math ability this year?

STUD 5: Same.

Mrs. Ramaglia: How does the structure of this year's classroom help you in learning the content?

STUD 5: It's okay. It doesn't help that I can't ask during notes but I can ask when doing the homework which is fine. If I learn it wrong the first time, it's kind of hard to correct it so it does.

Mrs. Ramaglia: It does? Do you have any questions for me?

STUD 5: No.

Mrs. Ramaglia: Thank you. I appreciate it.

[Audio Ends]
[0:03:10]

File Name : STUD 6
Length : 0:03:09.1
Speakers : Mrs. Ramaglia, STUD 6

[Audio Begins]
[0:00:00]

STUD 6: STUD 6

Mrs. Ramaglia: Okay. Hi, my name Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have questions for me before we begin?

STUD 6: No.

Mrs. Ramaglia: Okay. Describe what your math classroom was like last year in terms of routines, procedures, homework notes, what did a typical day look like?

STUD 6: We'd start the day, and then do our like morning math and then check it and then we go to our specials, and then we come back, and she would -- but we'd take notes for math. And then she'd give us homework and we could have some time to do it in class, and then the rest was homework.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year in terms of routines, procedures, homework notes, and what does a typical day look like?

STUD 6: In math we watch a video before and then do homework and then we talk about that in class. We would come in, and then she has three groups and we do something while the third group goes, and then whatever group you are you go, and she calls. We have a must-do and a can-do and she will call us when we do that well, we're not in group and in group we talked about homework.

Mrs. Ramaglia: Okay. How often are videos used in your course to deliver new information?

STUD 6: It used to be like every day, but sometimes we do a video and then two days of worksheet and then a video again.

Mrs. Ramaglia: Okay. Do you watch the videos for the course?

STUD 6: Yeah.

Mrs. Ramaglia: Yeah. What do you like or don't like about them?

STUD 6: I like how they can be short and they're easy to do. It gives you enough time and it's not like if you have a -- its not like a 20 minute video so you have time to do it in the day.

Mrs. Ramaglia: Alright. How would you describe your effort in your math classroom last year?

STUD 6: I tried pretty hard.

Mrs. Ramaglia: You tried pretty hard? How would you describe your effort in your math classroom this year?

STUD 6: I think I tried harder. I guess, because the videos were kind of easy, and they did a lot easier to like try harder I guess.

Mrs. Ramaglia: This year?

STUD 6: Yeah.

Mrs. Ramaglia: Okay. How would you describe your math ability last year?

STUD 6: It was okay.

Mrs. Ramaglia: It was okay? How would you describe it this year?

STUD 6: It's really good this year.

Mrs. Ramaglia: What do you think is the difference? What caused the change?

STUD 6: I think it's just easier to understand the videos rather than a teacher like talking for half an hour about what we're going to be learning for the next week or so.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

STUD 6: It's just easy, like it's really easy to access and it doesn't take long and it's easy to understand.

Mrs. Ramaglia: Okay. All right, well, that's all I have. Do you have any questions for me?

STUD 6: No.

Mrs. Ramaglia: Okay. Thank you.

[Audio Ends]
[0:03:09]

File Name : STUD 7
Length : 0:03:09.1
Speakers : Mrs. Ramaglia, STUD 7

[Audio Begins]
[0:00:00]

STUD 7: STUD 7.

Mrs. Ramaglia: Okay. Hi, my name Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have questions for me before we begin?

STUD 7: No.

Mrs. Ramaglia: No. Okay. So, describe for me what your math classroom was like last year. What is a typical day look like? What were routines, homework, procedures, those kinds of things?

STUD 7: We just do some classroom practices and the last of the day she gave us the homeworks to do and it was fun. It was great.

Mrs. Ramaglia: It was fun. Okay, describe what your math classroom is like this year with routines, procedures, homework notes, all of that, what does a typical day look like?

STUD 7: This year, every day we practice and after the classes she gave us homework every day. It's just like the same thing, it was like last year, it was really good.

Mrs. Ramaglia: Okay. How often is homework assigned in your class?

STUD 7: Was it this year or last year?

Mrs. Ramaglia: This year.

STUD 7: This year, like every day, every single day.

Mrs. Ramaglia: Everyday. What kind of homework is usually assigned in your class?

STUD 7: Like, what do you mean?

Mrs. Ramaglia: Like, what does it look like? What kinds of things do you do for homework?

STUD 7: Like, geometry stuff.

Mrs. Ramaglia: Would you say they are like word problems or --

STUD 7: No, just numbers.

Mrs. Ramaglia: Numbers. Okay. So, kind of like practice?

STUD 7: Uh-hmm [affirmative].

Mrs. Ramaglia: Okay. How often do you complete the assigned homework?

STUD 7: Everyday. I usually do it every day, but this year I sometimes like forget about it, then now I'm back on track.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom last year?

STUD 7: Last year. I tried so hard but it wasn't great. But every after year we're getting better, that Ms. Betty [ph] she helped me a lot, it was good.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom this year?

STUD 7: This year it was great. I get straight A's, and it's really good.

Mrs. Ramaglia: Really good?

STUD 7: Yeah.

Mrs. Ramaglia: Okay. How would you describe your math ability last year?

STUD 7: Last year it was horrible, to be honest that this year is, I have seen so many changes, it's good.

Mrs. Ramaglia: Okay. So, you kind of talked a little bit about this year too that you kind of feel like it's better?

STUD 7: Yeah, this year is better.

Mrs. Ramaglia: Why do you think is the reason why it's better this year than it was last year?

STUD 7: The reason to me is because I used to hate math classes. That, like, teacher is really nice so it make you like to love the subject, and this makes me like math, again, it's really good.

Mrs. Ramaglia: Okay. So, you like your teacher this year?

STUD 7: Yeah.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

STUD 7: It's helped me a lot. The teacher is really nice too but classes the numbers and everything just like when you get older you get smarter and stuff. It's just like that, it's really good.

Mrs. Ramaglia: Okay. All right. Well, those were all the questions I have.

STUD 7: Okay.

Mrs. Ramaglia: Okay. Thank you so much for your time.

[Audio Ends]
[0:03:09]

File Name : STUD 8
Length : 0:05:20.3
Speakers : Mrs. Ramaglia, STUD 8

[Audio Begins]
[0:00:00]

STUD 8: STUD 8

Mrs. Ramaglia: Okay. Hi, my name Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your math classroom from this year and last year. Do you have questions for me before we begin?

STUD 8: No, not really.

Mrs. Ramaglia: Okay. Describe what your math classroom is like last year. So, talk about routines, procedures, homework notes, what is a typical day look like?

STUD 8: We would come to class, and write down the homework and it was usually right on the board. And we would check the homework from the previous night and she would ask if we had any questions over it. She would look at it to make sure we did it and take down a grade, and then we would like do a lesson and then we will leave and do our homework in the evenings.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year same kinds of things, what is a typical day look like?

STUD 8: We come to class and the homework is on the board, like last year and so we write it down. We don't usually go over the homework in class because she puts the answer keys online so we can check it at home, and we don't have to take class time to do it. So, we usually just like do a warm up and then we like a review sort of what we she taught the previous day, and then we do a lesson. And then we go home and do our homework.

Mrs. Ramaglia: Okay. How often this homework assigned in your class?

STUD 8: Pretty much every day unless we like have time at the end to do it or if it's like the day before a test then it's just like to study for the test.

Mrs. Ramaglia: Okay. What kind of homework is usually assigned in your class?

STUD 8: We usually have packets. So, it's like a page or two in the packet. And usually we like sort of only do the even numbers or only do the odd numbers of it. Then like some of its left so we can review before the test and make sure that we have it all write down before the test. It's usually like 10 to 15 problems I think roughly.

Mrs. Ramaglia: Okay. And would you say they're kind of like word problems or --

STUD 8: It's usually a mix of both, like some straightforward, just numbers or shapes or whatever. And then, one or two word problems are like critical thinking.

Mrs. Ramaglia: Okay. How often do you complete the assigned homework?

STUD 8: Pretty much every night. There are occasionally like if I'm really, really busy then I might like only do some of it, or not totally finish it but it's pretty much every night. The one thing about having the answer key online is that she doesn't collect the packet or like check it until the end. It's like we're about to take the test. So, like I can see where for some students it would be pretty easy just to kind of blow off the homework and not do it. It would be easy to do that especially because we have answers online. It would be kind of easy to just pull it off.

Mrs. Ramaglia: How would you describe your effort in your math classroom last year?

STUD 8: Last year, I would say I gave a lot of effort maybe not quite as much as I could have, but because I -- of course you have other classes they have to do really. I'd say I put a pretty good amount of effort into it. I mean, I did pretty well. So, if that's a good reflection of how much effort I needed to be putting into it, then I was putting it enough for me personally.

Mrs. Ramaglia: Okay. How would you describe your effort in your math classroom this year?

STUD 8: It's about the same. It's the same sort of worked at it, like you're trying to complete your assignments every night so that you don't get behind and you still are understanding on the concepts. It was a little bit harder for me this year just because like geometry is different than algebra obviously and like the way you have to think about it. So, I did have to put them like a little bit more effort this year but it's pretty much the same work ethic.

Mrs. Ramaglia: Okay. How does the structure -- actually, sorry. How would you describe your math ability last year?

STUD 8: For algebra, it was pretty good. I didn't know a lot about geometry like I mean I can do it but my teacher did a good job of teaching us all the sort of concepts that we would need to complete Algebra 1.

Mrs. Ramaglia: Okay. How would you describe your math ability this year?

STUD 8: I'd say it's about the same except for geometry like I think that we learn a lot about lots of different sections of geometry which is good obviously since say like come up in later math classes.

Mrs. Ramaglia: Okay. How does the structure of this year's classroom help you in learning the content?

STUD 8: I like it because we have the packet and we have all the assignments like right there so you don't have to like remember to look it up in a book. Also the answer keys, it's kind of nice because you can see how the teacher worked out the problem, and you can also go back, and refer to that if you need help. Like on our homework, if you're having trouble with it you can look at the couple of problems to see how to do it, which is kind of nice just so that you can really understand how to do it.

Mrs. Ramaglia: Okay. All right. Well, that's all I have. Do you have any questions for me?

STUD 8: No, not really.

Mrs. Ramaglia: Okay. Perfect. Thank you so much.

[Audio Ends]
[0:05:20]

File Name : STUD 9
Length : 0:05:33
Speakers : Mrs. Ramaglia, STUD 9

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school Mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom from this year and last year. Do you have any questions for me before we begin?

STUD 9: No.

Mrs. Ramaglia: Okay. Describe what your Math classroom was like last year in terms of routines, procedures, homework, notes. What did a typical day look like?

STUD 9: Well, we would go in and then there would be like the projector would have the screen down and we would go over our homework first. And then she would go around and see what our grade was on our homework. And then we would take notes and she'd go over everything with us. She'd give us a little bit of time in class to finish our homework, but we usually didn't finish the homework in class.

Mrs. Ramaglia: Then, you take it home?

STUD 9: Yeah.

Mrs. Ramaglia: Okay. Describe what your Math classroom is like this year in terms of routines, procedures, homework, notes and what does a typical day look like?

STUD 9: When we go in, the screen is down and there's warm ups on the screen. And we do the warm ups then we get our homework out. And our teacher goes around and she sees who did the homework and who didn't. Then, we go over the warm ups. And then, we check over our homework and she goes around and she writes down the grades for everybody on their homework. She goes over the lesson with us and we take notes. And then she gives us time in class to work on the homework. It's usually like if we have anytime left after we do all of our notes, we can work on our homework.

Mrs. Ramaglia: Okay. Okay. All right. How often is homework assigned in your class?

STUD 9: I'd say it's usually every night, but it's not a lot. But it kind of depends on what the lesson is.

Mrs. Ramaglia: Okay. What kind of homework is usually assigned in your class?

STUD 9: Sometimes, our teacher posts worksheets on [Google] classroom. And then also, we do pages out of the book. We usually do the even numbers out of the book because there's answers for the odd numbers in the back of the book. And then, we have study guides too and those are usually on paper.

Mrs. Ramaglia: Okay. So, kind of various book? Okay. How often do you complete the assigned homework?

STUD 9: I complete it always, but I've left if once or twice at my home this year.

Mrs. Ramaglia: Just forgotten it?

STUD 9: Yeah.

Mrs. Ramaglia: Okay. How would you describe your effort in your Math classroom last year?

STUD 9: I think my effort was really good. I asked questions when I didn't understand something and our teacher would describe it really good and go over it with us.

Mrs. Ramaglia: Okay. How would you describe your effort in your Math classroom this year?

STUD 9: It's really good too. And it's like kind of the same, I asked questions and then she answers them. Or if she asks us to guide her through the steps, I raised my hand and then she might call on me and I tell her the steps.

Mrs. Ramaglia: Okay. Describe your Math ability last year.

STUD 9: I think it was good, but I think it's better this year. Because I don't know last year, it was like, for some reason I feel like this year was easier than last year. That might seem kind of weird, but I don't know, it might just be the teaching method or something.

Mrs. Ramaglia: Okay. You feel like there's a difference between last year and this year?

STUD 9: Yes.

Mrs. Ramaglia: Okay. What do you think is the reason for that?

STUD 9: I think it's the teaching method maybe, because we do the warm ups before and then she goes over it with us and that just like kind of gets us ready for the Math class for today because it's usually over with what we're going to do that day.

Mrs. Ramaglia: Okay. All right. How does the structure of this year's classroom help you in learning the content?

STUD 9: I really like how our teacher goes over. Well, she'll have different like it's usually a PowerPoint. And on different slides, she'll show different examples. We'll go over the examples. She'll have problems for us to try. Sometimes we do it with a partner, and then sometimes, we just do it by ourselves and then she goes over them. Sometimes for a review, she'll have posters around the room, and on each poster, there will be like two questions and you go around the room with a group and you work out the problem, then, you switch posters. At the end, you make sure you had the right answers.

Mrs. Ramaglia: And you feel like that helps you?

STUD 9: Yes.

Mrs. Ramaglia: Okay. All right. Well that's all I have.

STUD 9: Okay, thank you.

Mrs. Ramaglia: Thank you so much.

[Audio Ends]
[0:05:33]

File Name : STUD 10
Length : 0:03:52
Speakers : Mrs. Ramaglia, STUD 10

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Roamalia [ph] and I coordinate middle and high school Mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your experiences in your Math classroom last year and this year. Do you have any questions for me before we begin?

STUD 10: No.

Mrs. Ramaglia: Describe what your Math classroom was like last year in terms of routines, procedures, home work, and notes. What did a typical day looks like?

STUD 10: For Math class, we would do a warm up problem, then we would check our homework from the night before, the duties, the lesson and we would take notes with the spirals. If we had extra time, we do homework and if not, we just go to the next subject.

Mrs. Ramaglia: Describe what your Math classroom has like this year in terms of routines, procedures, home work, notes, and what does a typical day look like?

STUD 10: It's basically the same thing except we get more time for just Math since we're not worrying about other things with the periods and instead now we can take notes on our iPads so we don't have to write everything down on the spiral.

Mrs. Ramaglia: How often is home work assigned in your class?

STUD 10: Often everyday and if not, then we do like some sort of different activity if it's not.

Mrs. Ramaglia: What kind of homework is usually assigned in your class?

STUD 10: Sometimes it's like she gives us a book assignment and then we fill it out on our iPads or a worksheet that she puts Google classroom or if it's a day before the test then we do a study guide.

Mrs. Ramaglia: How often do you complete assigned home work?

STUD 10: Normally all the time unless there's a question that I don't understand then I save it for the next day and ask her.

Mrs. Ramaglia: How would you describe your effort in your Math classroom last year?

STUD 10: Probably about the same as it is this year. I did my home work and took notes every day. I tried in my Math homework even if I didn't understand.

Mrs. Ramaglia: You say that's the same this year?

STUD 10: Yeah, it's pretty much the same.

Mrs. Ramaglia: How would you describe your Math ability last year?

STUD 10: I mean, it was definitely easier things we were working on last year so it was easier than it was this year. I mean, often most of the things came pretty naturally.

Mrs. Ramaglia: How would you describe your ability this year?

STUD 10: It's harder stuff this year but I like the things that we're doing better this year with like working with angles, algebraic equations, and things like that.

Mrs. Ramaglia: What would you say was the biggest change between last year and this year?

STUD 10: Probably that this year, we're like working on harder stuff and we just do different things than like last year taking notes out of a book. Like having to use Math facts, do your test because we're now the things on the iPad, we can use calculators and things like that.

Mrs. Ramaglia: How does the structure of this year's classroom help you in learning the content?

STUD 10: It's easier to learn the content when we're able to take more notes easily and so I think that's helpful to be able to go back, look through the iPad and look at all the things that we learned that day. It's easier than just having to like do everything in one day.

Mrs. Ramaglia: Alright. Well that's all I have. Do you have any questions for me?

STUD 10: No.

Mrs. Ramaglia: Okay, well thank you.

[Audio Ends]
[0:03:52]

Teacher Interview Transcripts

File Name : TCHR 1 Validation File
Length : 0:07:23
Speakers : Mrs. Ramaglia, TCHR 1

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions from me before we begin?

TCHR 1: I don't think so.

Mrs. Ramaglia: Okay. Describe what your math classroom was like in last year routines, procedures, homework, notes, and physical space. What did a typical day look like?

TCHR 1: My students came into the room and picked up a math folder where we kept their field work which was our distributed practice, this year of courses on the iPad but they had that routine picked it up. We started with the distributive practice if we were to grade homework, we would go over the homework and then have a lesson of some sort. Sometimes my students sit in rows. Sometimes my students sit in tables depending on what the activity is, whether there's an exit ticket or a quiz that day, what would work best for the activity. Notes were normally given in a guided note format. Most of my students don't copy very well or had very slow pace so that just to kind of fill in the blank guided notes, close note format.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year with routines, procedures, homework, notes, physical space, etc?

TCHR 1: Last year, I did videos too. I mean, I occasionally did videos. This year they don't watch. This year, my routines are pretty much the same. A lot of things that we did on paper we're doing on the iPads, still starting out with the distributive practice. We cut back some on homework but when I try to even have the kids do the home work in the class, they don't complete enough practice to master any skill. I'm still trying to figure out how to get kids to practice somewhere so they will perform well on assessment. I don't have a solution for that. They won't do it in class. They won't do it at home. They won't do it. Notes again are on the iPad, pretty much the same format until we start using the engage New York that's more just problem oriented and example

oriented. We're doing some highlighting, definitions, and things that are oriented prepared notes. My physical space, we're not doing as much in tables because these groups of kids get into table, it turned into a party. I was having them do their independent practice and providing a key at a table where they could check their own and only ask me if they had a question, turn into just copy off of it. They knew nothing. I really don't have a normal routine because I don't know that anything that works with these group of kids.

Mrs. Ramaglia: Describe your lesson planning process.

TCHR 1: We only plan in our PLC. We start with the common core curriculum or just a curriculum. Try to pick lessons that fit those objectives and then align them with the time that we've got. With the testing it enables, gotten this pushed this last quarter to try to get through probability and statistics but then, we break it out into the smaller skills that fit into those larger common core ideas and address them as best as we can until I found engaged New York. I love it, love it.

Mrs. Ramaglia: What is effective about the instructional strategies you used?

TCHR 1: I haven't found one yet that is effective.

Mrs. Ramaglia: With this group or with any group?

TCHR 1: With this group.

Mrs. Ramaglia: What would you say might have been effective with other groups?

TCHR 1: A lot of guided practice I think is important in Math. The hands-on probability things that we've done, they seem to get the idea of probability but they can't move from yesterday's lesson to today's lesson. The first thing we did were the informal words as to likely, unlikely, and today they still want to write that when we were writing probability fractions, or decimals, or percent. They don't transition well. I am breaking the skills down into its little parts and building with it is a good instructional strategy. I like to let kids discover rules, and that kind of thing, and those have been very successful in the past.

Mrs. Ramaglia: How often are students assigned homework and how often do students complete the assigned home work?

TCHR 1: The students are assigned homework probably four to five nights a week because they really need the practice. How do often do they complete? I probably have 10% of my kids that do it 100% of the time

and 60% of my kids who do it in another time, were very little at the time.

Mrs. Ramaglia: How would you describe student's effort in your math classroom?

TCHR 1: It seems like it's all or nothing. I have that 10%, 15% that would move a mountain if I ask them to. I have 40% who just want to stare at me and I don't get it, and won't come in for help, won't try, won't ask a question, and won't even look confused. I think it's really poor. I think most to the effort is really poor.

Mrs. Ramaglia: What if anything would you change for next year?

TCHR 1: I will use the Engage New York activities. It's there, it's prepared, it's thought out, and it's activity-based. It moves at a slow progression but you cover everything just little skills. That's one thing I'd like to do. Even with the iPads, my kids won't watch videos very often. I took e-mailing parents everyday when they didn't do their home work and it didn't change one that core of seven or eight kids every hour, still won't do it, won't even watch a video. I've been using LearnZillion videos when I do, because I don't want to take my time for them not to watch so I have started a LearnZillion classroom. I get more into it. I might, because the videos were run even better. I think on the max next year but just pulling up there, five minute things as introductions I may do more of but the full out -- I never really try to do the instruction on my videos as much as I used to it's not, you need to go and check your home work before you come to class which saves me 10 minutes or so in class. You do the work and then I go throughout the video and that's kind of what we've used before.

Mrs. Ramaglia: Alright. That's all I have. Thank you.

TCHR 1: You're welcome.

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Length : 0:17:17
Speakers : Mrs. Ramaglia, TCHR 2

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Mrs. Ramaglia: Alright are you ready? Describe what your math classroom was like last year, like your routines, procedures, homework, notes, physical space, that kind of stuff.

TCHR 2: We typically sit in table groups, and I taught math 8 all day again, so it's the same group. I did flip the classroom last year towards the end. Beginning of the year was more lecture during the day, send them home to do homework, but then they stopped doing -- well, they never did homework. They didn't stop doing it. Then I decided that I had to change something because they weren't getting enough projects outside of school. What else was part of the question?

Mrs. Ramaglia: Just notes, procedures, routines -- like what a -- just a typical day look like.

TCHR 2: Notes were guided notes, so I would hand them the guided notes, they would walk through it with me. Their practices were mostly packets and worksheets because this group loses so much stuff. I would give them an entire packet in the subject and -- of the objective, and they would work through that packet in different paces [indiscernible 0:01:22]. We did a lot of -- get the last thing -- the main thing that they -- get the main information that they needed to be able to start their packet, and then a lot of it was just group work and teacher walking around and working. It wasn't flip the classroom. I was giving them the lesson at school, but with them, we were still practicing mostly in here too, and they just work through their packet until they got to the end.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year with routines, procedures and a typical day looks like.

TCHR 2: I mean, same as last year, start like Bell Work. We start with our Bell Work, everybody does the Bell Work. This year, they are supposed to watch their video the night before, and they come in, and then we start on the practice. Their videos, I've changed a little bit, this year are in the lesson. I used to do like video notes and then you got to practice. Now, the video notes are the first two problems of the practice, and I just rearrange it so that I do one of each kind that I want to do or whatever. Then I have them stand up if you watched your video notes.

Those kids I put into a different group, depending on how many there are and which level I think that they need to work in, and they do their practice. The other kids who have not watched their video, if they're in my SPED co-talk classes, they go up into that front group and they go through the video, but with a teacher. It's a guided video where she pauses and ask them questions and that kind of thing. Then in my other hours where I don't have more help, they sit and they watch their video. Depending on the lesson, there are certain ones that I will just work with them. It also depends on the number of kids who did or didn't watch. It's not like set on each day. Usually, how it works is the kids who watch the video get together, work on their practice, by the end of the hour, are probably done, and the kids who didn't spend about 20 minutes getting that instruction start in practice and then leave and supposedly maybe practice later, and then we start again the next day doing that same thing.

Mrs. Ramaglia: Okay. Describe your lesson planning process.

TCHR 2: I start with the objective, and I break it into lessons that I think that they need to be able to see. Usually, the first two lessons are really very basic and a review of something that they should know from 7th grade. From there, I just break that objective apart so that we cover each of the lessons knowing that we have to facilitate a lot in between. That's kind of how I get my lessons, and that really is my lesson plan overall, is which lesson we're on and then how that ties back to our main objective. Most of our objectives are anywhere from 8 to 10 lessons to get that one objective. I do it just kind of by chunking each objective.

Mrs. Ramaglia: Okay. What is effective about the instructional strategies you use, and what would you say you would improve?

TCHR 2: The thing that I like is that -- another part that I haven't mentioned is their exit slips. After we've watched the video, given the lesson and done with the practice where most of them have done practice. Some of them have only done guided practice really. If they won't do anything outside of class, that's all I've got from them. They take in exit slip. It's usually a day later than I typically would give it in a regular class. Based on that exit slip, then the next day, when it's time to go on to the next video, if you got – if you missed one, you just open it up and look at what you missed and learn from your mistake. If you missed two, you sit with the teacher and go through those mistakes. If you missed more than that, you go into our re-teach group, and we back to that lesson. I think one of the things I like about it is they go to the right place, and the data that I use places them with other students who need that the same thing. We have really flexible groups that target what they need to be doing. I think that that what's make it work, and

that way, everyone is learning no matter what even if you don't want to, even if it's not very much. They're at least getting something out of each one of the days. The kids who go on to that re-teach group, really, we just go over those basic things that if you didn't get this from the lesson, you're not going to be able to move on. I think that that -- those flexible groups allow us to make sure that they're targeting what they need to be doing. On the high end, which I feel like I do a better job of this year than last year, the kids who are ready to move on are just zooming through. I mean -- and some of them were so bored for so long, and when you get put into a class that is at this level, they're just bored, and they know how to do everything and they're just waiting. Those kids I see being challenged a lot more because I have kids on lesson 10 and kids on lesson 3, all in the same class. I think that that's works the best. The drawbacks would be -- I mean they don't watch their video, and so flip classroom is hard because I'm trying to do all of it inside of class, and so we go slow. Again, because of that, some of the kids aren't going slow. To me, I'm still winning that even my lowest kids who are here once a week, at least they're doing something when they're here. What other drawbacks should I say? I give them all the answers all of the time, so my web backpack has a list all of the videos and a list of all the answer keys right next to them. For most them, it works really well. Some of them, they just go through the steps, and then it seems like they know what they're doing and then they get to a test, and they have no idea what they're doing. In general, that stopped by those exit slips because you have to know what you're doing to be able to move on. There are definitely some kids that by the time they get to the assessment, it's like, "Well, what happened to you? You've been moving along in my group, are you sure you understood things that you were doing?" I don't know, lots of drawback.

Mrs. Ramaglia: How often are students assigned homework, and how often do students complete the assigned homework?

TCHR 2: Homework is a suggestion in my class. Every single day, we discuss it at the end of the hour, it's written on the board, it's posted on web backpack, and I tell them what I suggest that they do because we have different groups, it depends on where you're at. Like today for example, it says lesson 5/6 video, because I really -- I target the homework to my lowest group because I do have some very low kids who will work outside of class, and the other kids I tell them, "If you've done lesson 5 already, then you should be on the lesson 6." They have a checklist, so they have just kind of a check of exactly what they should be doing. Usually at the end of the hour, I say, "Pull up your checklist, make a plan about what you're going to tonight, write it down, and we discuss why it's a waste of time to watch a video in class, and I suggest that you work on something outside of class, see you

tomorrow." I sign it every day -- you can't put that in there. I assign it every day. On any given day, how many do it? Sometimes two, sometimes 12, depends on class to class. My ELL class, there are two girls who do their homework, that's it. My SPED classes, the number of kids who do it are lower. In general, the high kids are the one who do their homework, which is why they're so much further ahead than everybody. Some of them I can't get enough information out to them fast enough because they like that they do well and that they're getting it -- like I said, they are on lesson 10, I'm like, "My gosh, I don't have a lesson ready yet," kind of stuff. Really, the high ones are the ones who do it. The low ones, there are some who do, but in general, not.

Mrs. Ramaglia: You would say -- one of my -- which I think you kind of touched on, one of my next questions was how often are videos used in your course to deliver new information, and you would say?

TCHR 2: Right now, in this unit, every time. It depends on the unit. The last unit, it wasn't because it was transformations, and it was so much discovery that I wanted them to just figure stuff out, and so much -- they're trying to watch their video and take their notes on their iPad all of at the same time, so it's very hard to transfer that for them, and so I stopped doing videos for that last unit. This unit, every single lesson. One of the benefits, the reason I still do it even though the lowest kids really aren't doing it -- lots of them don't watch their video, is because it provides the instruction to my SPED teacher. When they get separated into the group, really, they go where they belong. They don't know anything, they don't have the [indiscernible 0:10:30] information, they don't know where to start, and she walks them through my video. It's like I'm in both groups, but I'm not. I even will do that with myself, and also just to save myself from doing it six times, because I'll do it sometimes with Bell Work. If it's like broken into pieces and it's, "Okay, do this. Okay, next do this," and kind of give them the steps. I like that it leads them all through even if they're not watching it on their own.

Mrs. Ramaglia: Okay. You kind of touched on this already too, but how do you know if students watch the videos for your course?

TCHR 2: I just ask them. I ask them to stand up. And in general, math 8 kids don't care to lie that much. They just really don't care. They're supposed to have notes, and there was a time last year when I started doing flip classroom, that you had to have the notes and that was your proof to be able to go on. Because so many of them lose things or won't write things down, again, that's where those exits slips -- there have been times when I've actually done the exit slip at the beginning instead at the end. That was a way that took away, "Okay, did you do

what I told you to do? I'm just simply asking you. Do you understand and can you move on?" Sometimes, it's at the beginning of the hour, but it's still from the day before. It's still the exit of that lesson. It's just -- they tell me, because the fighting the battle of the -- having your notes -- the only thing that I tell them is that if you ask me a question and I send you back to your notes, that's the reason I give you those notes, and I say, "Okay, you ask me about number four, and it's just like number one which is on the video," and I send you back to number one and you don't have any notes, I'll say, "Well, if you can't help yourself, then I can't help you. I guess go back to the video." I won't help them if they don't have those notes, depending on what makes sense. For some of them, to reinforce -- because that is what I'm trying to teach them. Go back to your notes just like in – and do the exact same thing, only with different numbers -- or how do these relate, that kind of thing. If they don't have notes, they never will do that. It takes -- finally, they learn that they don't need me as much if they would just help themselves.

Mrs. Ramaglia: How would you describe your students' effort in your math classroom?

TCHR 2: It depends on, again, class to class, whether it's SPED or ELL. It depends on so many things. Depends on the time of day, it depends on --most of them, I can convince to at least work while they're here. Effort outside of class is low. Inside of class, if they feel like they can accomplish something, if they feel like it's something manageable for them, and they get to work in partners and we do a lot of group work, they will mostly put an effort to at least do something while they're here. I don't know from day to day. It just depends in how much they like the topic. I mean, they were much more in the transformations than they were – I mean, properties, for example. It really does depend on what they're learning and -- I don't know. Effort's hard to talk about for them, because it's so different -- I mean, in my room of 27 students, there are some that works super hard all the time, and there are some who never work hard ever. It's very varying.

Mrs. Ramaglia: Different?

TCHR 2: Yeah.

Mrs. Ramaglia: What would you change for next year?

TCHR 2: I wish we have more time, because the thing is is that the thing that I've accepted about these kids is that they're not going to work outside of my class, and because of that, they need the instruction and they need the guided practice, and they need opportunities for individual independent practice, and I have to be able to provide that to all of them

in here in 45 minutes and get through an entire curriculum. If we never -- if we could go at their pace, then that would work, but I have to keep everybody so there are definitely kids I move along knowing that they're not really ready to move, but they've got enough information to at least try something else. I can't really be in charge of changing their time I guess. What I would change next year? Definitely, I try to make the videos as short as possible, as much to the point as possible, and choose like two problems with main ideas that get what I need them to do, that they can continually tie back to for problems. I feel like it's really worked to go with the lesson and do number one and number nine from the lesson or whatever because they see like, "This is helping with my practice," not like there's the video I have to before I can get to my practice. Doing more where it's in their lesson shortened so that they get as much information as possible but then can move on. What else would I change? Assessments, I think that I wish I had more online data, core-quipped data from them that by the time -- like exit slips are only the only thing I use in their multiple choice and those count as their quiz grades. Assessments, after we get through lesson 10, we've had like a paper quiz along the way, and then we have paper test at the end, which still is shortened compared to what I did last year. Last year was like we had a unit 4 test. This year, we've got objective 8EE5, 8EE6, 8EE7 broken into pieces. Still, for some of them, it's too long, and I wanted -- I would change what my assessment looks like and how I – again, faster. How can we get a picture of what they know quicker with less work on that – on both of our parts because they spend forever taking their test. It takes them two cost periods usually, and I spend forever grading them to then get my information. I wish I had a better way to get that big picture from them. That's what I work on doing.

Mrs. Ramaglia: Okay. Well, I appreciate you be willing to be interviewed.

TCHR 2: Yeah. Sure.

Mrs. Ramaglia: Thank you.

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File Name : FLIP 1 Intv
Length : 00:19:41
Speakers : Mrs. Ramaglia, FLIP 1

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Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

FLIP 1: No.

Mrs. Ramaglia: Okay. Describe what your math classroom was like last year. So talk about routines, procedures, homework notes, physical space, what did a typical day look like?

FLIP 1: Last year was the first year that I implemented flipping the classroom. I tried my best to stay on a routine of students to watch videos for home work, or in study hall, or seminar or some type of time that they had outside of the classroom. So that when they came to class we could structure the day with board work time, or small group, or still some large group, teaching, or review of some sort of the concepts. But rather than kind of a sit and get or me at the front and them all in their seats just teaching at them. I tried to get the lesson portion concepts taught on a video prior to them come into class so that we could focus more on what practice problems look like and actually applying the concepts to problems.

Mrs. Ramaglia: Describe what your math classroom is like this year, routines, procedures, home works, notes, physical space, and what does the typical day look like?

FLIP 1: This year the goal has been the same because it's my second year it's been even better. I actually have succeeded in getting more videos. One video for every lesson, getting those online available to them. The fact that we'd gone one-to-one and every student has a laptop has made any issues with devices obsolete. They all have a device now, some of them still have issues getting Wi-Fi occasionally but I also try and make it so that they have at least a day or two to watch a video before we're going to be working on that concept in class. The routine is usually, they come to class and we discuss what did the video look like just very brief any big questions that they have over the practice problems that were in the video then either split them into smaller

groups. Sometimes based on ability as in up with the highest with highest and the lows with the lows. Other times I'll let them pick their own groups and other times I will purposely intermingle so that they can work together and lows can learn from highs and things like that. We just do practice problems, sometimes their worksheets that they'll work on in a pocket or something. Other times they'll be up at the windows or in the backboards, or we have whiteboards so they can sit at their desk and just do all sorts of different practice problems to learn the content. I would say that's typically what it's look like and then we come back together by the end of the class period to review just kind of what we had done that day. What was the agenda? What were the expectations? I try and give them a couple of seconds to figure out, did they meet those expectations? If they weren't understanding the practice problems maybe they need to go back and watch the video again. Maybe they need to get some extra support before or after school and I'm always available so I encourage that. And the last thing I do is always, here is what I expect you to do by the next class period, whether it be finish up on the worksheet that were kind of working on or go ahead and watch the next video, or whatever that maybe.

Mrs. Ramaglia: Okay. Describe your lesson planning process.

FLIP 1: My process for lesson planning and I try and go a unit at the time which sometimes a unit is two weeks, sometimes three or sometimes even four weeks. The reason I go that far in advance is because I like to try and get a packet together that has all the notes, sheets that they're going to be doing because while they're watching videos they take guided notes. And I'm doing the same problems on the video talking through the same concepts but that way it keeps them engaged and there is something for them to do. I like to get all those notes together in a packet, any worksheets that we're going to do whether it's in class, with groups or maybe some practice on their own. I like to get all of that in the same packet because we don't have a textbook this year. Without a textbook, I still want something tangible in their hands that they can have with them, that they can reference back to as we're doing it. My lesson planning process would be to get that packet ready. To get that to all the people that I collaborate with so they can start doing their part which is making the answer keys, putting together, maybe some of the board work problems or so on, and all that stuff. Then from there a day to two days before every lesson I just make sure that I get a presentation ready. So that I got different slides that I can run through and which more just helps me stay organized and gives the kids a visual to have at the front of the room. So as we're moving through things with the board work problems on it and all that kind of stuff it's there as a visual for them and constantly reminds me and keeps me organized.

Mrs. Ramaglia: What is effective about the instructional strategies you use?

FLIP 1: I think the most effective part about it is the students learning the material, taking on that lesson. Two years ago and prior to that when I taught traditionally in the classroom and I would take the 52 minute class period and I would teach the lesson. I ended up taking usually 30-35 minutes to teach the lesson which left us less than 20 minutes to do any kind of practice or start homework with me in the room to help support. I found that that 30 minute lesson was too long for some kids and to other kids it wasn't enough, because hearing me just say it once was not enough for them to really understand it, or I got big windows in my room, so they look out the window to see the squirrel and they try and come back and they've missed what I said for 30 seconds and now they're lost for the rest of the lesson. The instructional strategies with the flipped classroom and putting the lessons on videos, they have the options to pause and rewind and replay it. And I'll even push them in the videos. I'll coach them to, "Okay, why don't you pause this video now, try the next 2 problems, we just did 2 together, try the next two problems on your own and push play when you're ready to see me do the answers." Hopefully they'll fall for that. Hopefully they pause and they try them and they push play when their ready to see me do them. But I have heard kids that will watch it two times or will watch it three times or will come to class and will do some practice problems and they'll leave and their like, "Mrs. Brogdon I still didn't understand that," and I'm like, "Okay, well why don't you watch the video again.: They'll come to class the next day and they watched the video again and now it kind of started to click. The videos I should go back to the fact that the lessons in class were 30 minutes. My videos I try and keep them around 10-15 minutes. It's hard to get them less than 10 and be able to give all of the vocabulary words and the content. Big pieces and still do some practice problems. It's hard to do all of that in less than 10 minutes. But I try somewhere between 10 and 15 because I know that's screen time for them and sometimes it's hard for them to focus for that long. But like I said there are some kids that can just watch it once and they get it and they're good and there's other kids that need to watch it a couple of times. So when you have those different abilities in your room, it's much better to put that on a video so they can go at their pace, than you trying to do it in the classroom and they're all over the place. I would say another really effective thing about this strategy is when kids are absent they actually tend to make up the work when it's a video on line. There was one week last fall that I didn't quite get videos made because I didn't know the pacing and how things were going to work out. I taught more of the lessons in class and we did the worksheets together in class. It wasn't really flipped it was more about the traditional and I had kids that missed a day or two of that week and

they came in being like, "I looked for videos and I couldn't find anything, I'm totally lost can you help me?" I hadn't realized until that point that it's even more than just the kids that are in class every day, it's the kids that miss because of a doctor's appointment, or sick, or whatever, that they can get caught back up, or they can stay caught up even though they're not physically in the room. I definitely think it's a very effective strategy.

Mrs. Ramaglia: How often are videos used in your course to deliver new information?

FLIP 1: Every concept that is new. Concepts can be described as what we use to call a section of the textbook type thing. Chapter 1 had section 1, section 2, section 3, let's say that. That chapter would have gotten around 3 videos. I will go back and add videos if needed. I know if we do a review packet that there's not a lot of time for me to move around in the classroom or something like that, or I don't feel that I was able to do as much as I wanted to. I will record a video of myself talking through each of the review problems, or talking through each of the homework problems just so they have another reference to look back and as they're working through it, if they get stuck on one they can fast forward to it, watch me go through it on the screen and hear me explain it and then hopefully they stop and then they try themselves through whatever's left. But, sometimes I will put that out there because again I think the goal for me has really changed my mind set this year, is completely changed to mastery and how well are they doing, how much of the content do they understand, and I make them show me that summative and formative assessments. And, those can only happen in class with me. It's really is a test of their knowledge. It's not a test of what do they do at home with a parent help, or what do, they do after school with a friend tutor. It's really a test of what do they know so I think that's where videos are used as often as necessary to get them to the point that they can then master it in class.

Mrs. Ramaglia: How do you know if the student watched the videos for the course?

FLIP 1: It depends, sometimes we can start board work and I can put a problem that should be a quick one or they should at least be able to start the problem and half of them stare at me and I'm like, "Okay, you didn't even watch the video." Other times, actually just this week, I started off class with, "Open up your packet to pages 6 and 7," and I walked around with a bag of Jolly Ranchers and anybody that had full page 6 and full page 7 filled out, they got a Jolly Rancher. That was more just for me to have an informal check. And, the couple of the kids that didn't do it they were looking at me and their like "Are you mad?" I just said, "No I'm not mad I'm disappointed that you didn't do your home work but we're moving on, we're doing board work hopefully

you can catch on from the problem we do and you could go back watch the video later to fill in the holes." I do check but probably not as often as I should because again it's all about how well do they do on the formative. And, if I have a parent or a student talk to me about how a grade's lower than they want it to be, the first thing I say is, "Are you watching the videos, let's see your packet, do you actually have the notes pages filled out?" It's really shifted responsibility unto the kids as well and them understanding what their grade means and how they can raise their grade and that kind of thing. Once they watch the video and they realize how much better they do the next day when we're practicing those concepts, they're like, "I should do this all the time," and "Yes, yes you should." I think they're kind of catch on to that a little bit better and throughout the year it's been a lot better. I had to start off by checking more often and making it more, not of it necessarily a home work assignment that got points but making it more of a, "I walked around and checked," or "Show your partner, give your partner a high five if they did theirs," and I kind of watch and I'm like, "Why aren't you getting a high five," kind of put that responsibility on them and that kind of thing, but that's how I check it.

Mrs. Ramaglia: Alright, how would you describe student's effort I your math classroom?

FLIP 1: Effort, it kind of just depends on what you're talking about, because there's 2 parts of the class. There's the homework part about watching the videos and then there's the actual in class part. I think we've already talked enough about the homework part and watching the videos and that kind of thing. I would talk about their effort in the classroom and I would say, my kids do great, the fact that I get them out of their seats that I let them stand up at a window with the dry erase marker. The fact that I make it fun and I walk through the room as we're working on problems and it's not a sit and get type of situation, I think that they really put forth effort and I can very quickly partner them up with someone for accountability. I rarely have students not doing practice problems or board work and they just sit there and they don't participate. Where as if I was giving a lesson they would probably be staring at the window or they will be looking at me but one of those not hearing anything I say, send them home with practice problems that they don't get done so that kid gets nothing out of math class. Where my kids whether they watch the video or not the expectation in the classroom as I'm walking around and they are out of their seats and they're working with partners and groups is that they're putting forth effort. Majority of the time, I rarely have a kid who doesn't put in effort in my class and I think it's because of the structure and I think it's because of how we do it.

Mrs. Ramaglia: What if anything would you change for next year?

FLIP 1: What I would change for next year, is the same thing that I've been working on trying to get better at all year and it is the differentiation within the ability groups and my classroom. Geometry is a course at my school that is full of 9th through 12th graders. There's a lot of varying abilities there. Which I talked about the videos and I'm definitely hitting there different abilities in that because like I said a higher level kiddo can watch the video once and their homework's done. Where as a lower level kiddo I would hope that I can coach them to watch in the video multiple times until they understand it or email me with questions. But, in the classroom I would love to differentiate a little bit more. I would love to figure out a way to have maybe the higher level learners all together and give them a challenge worksheet that takes them above the concept and puts them more in real world application problems. Take some lower level kiddos and put them in a table where I could sit down and work with them one-on-one and walk through problems step-by-step and then kind of whoever's left works on more practice problems together in small groups but that way it's hitting everybody's needs. It's almost tracking within the classroom, since we don't separate out any of our grade levels for Geometry. It would just be nice to be able to separate them out a little bit in the classroom and meet the needs that they have. Pull those lower learners up a little bit maybe so they can be more in the regular medium bunch. But, take those higher level kids that do belong in the regular Geometry, it's not that their necessarily honors but they get it quicker that some of the other ones maybe provide them the support and the interventions to be able to push themselves even further. That's what I would love to change. I really think that's it because I think about, again there's one-to-one so they got devices. I think put everything on Google Drive in different folders and I share it with them by giving them the link on Google Classroom. I'm very technology based when it comes to organization and sharing documents with them and things like that. They are all on top of that. They understand what it means when I say, "Go to Google Classroom and click the link to watch the video," their on it. I would say technology is great and the videos are working well. I'd love to get them a little bit shorter again but we'll see what happens. In the classroom if I could vary the levels and differentiate a little bit more that would be my challenge for next year that I'd love to change.

Mrs. Ramaglia: Well, do you have anything for me?

FLIP 1: I don't think so. Thank you very much for this opportunity.

Mrs. Ramaglia: Okay, thank you for helping with this I appreciate it.

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File name : FLIP 2 Intv
Length : 0:09:05
Speakers : Mrs. Ramaglia, FLIP 2

[Audio Begins]
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Mrs. Ramaglia: Hi. My name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

FLIP 2: No.

Mrs. Ramaglia: Describe what your math classroom was like last year. So talk about routines, procedures, homework notes, physical space, what did a typical day look like?

FLIP 2: Last year, a typical day was me walking -- I don't teach in the same room that I have my desk in, so I would wheel myself to my new room and we would start out with a quiz. Most days, we started out with a daily quiz which was worth 5% of their grade -- 10% of their grade, excuse me. 10% of their grade. Most times, I would ask questions, 'Did you have any questions on your homework?' They would say yes or no, and knowing what my day was going to look like depends on how many questions I would answer. They'd hand it in, I would lecture, they have to take notes on guided notes because I grade their guided notes and then they would have a homework assignment. That's most days. Some days, we didn't have notes, we had an extended assignment and they would take a pop quiz and pop quizzes are worth 10% of their grade. Homework is worth 15% of their grade last year and tests were 65% of their grade. That was a typical day in geometry last year. Taking notes was me using a doc camera. I would write on the table and they could follow my hand up on the screen and take notes that way. And it was the good old back and forth asking questions, taking notes type of thing.

Mrs. Ramaglia: Okay. Describe what your math classroom is like this year in terms of routines, procedures, homework, notes, physical space and what does a typical day look like.

FLIP 2: This year, it's half and half. I've changed it halfway. Half my days are like I just described. The other half of the days are flipped classroom where their homework is to go home and with the guided note sheet, take notes that I've prerecorded for them and they can access through

Google Classroom. They come to school the next day, we do take a daily quiz which probably covered something from a few days before and then they can work on the homework during class. And depending on my class, some of them get to work in groups because they know how to handle it. My other class, my 7th hour class doesn't know how to handle that so they, as I say, are in purgatory which is atoning for their sins and they are working individually. But half the time, the other day, one of my kids said to me, "That's been a long time since we took notes at home." And I asked, "Do you want to take notes at home?", and half the class yelled no and the other half of the class yelled yes. So some of them like that, some of them don't. but it's about half and half right now.

Mrs. Ramaglia: Okay. Describe your lesson planning process.

FLIP 2: It's only lesson plans this year. I have plenty of old lesson plans for geometry, but because we have a new curriculum with common core in terms of some of the objectives we have to teach, my lesson planning process now is to pull up the materials we received from Mr. Patterson and evaluate whether what I did in previous years was better than what he did or my stuff is better. So I decide whether I'm going to teach the material using my old stuff and rearrange my old stuff to fit common core better, or to pick what he did and rearrange his stuff to suit what I think is better. And then for homework, he has fantastic homework so I just pretty much give his homework assignments. I make new pop quizzes because his are harder than what I use to give, and I like his. And daily quizzes are probably things I use to give because it's minor adequate for that.

Mrs. Ramaglia: Okay. What is effective about the instructional strategies you use?

FLIP 2: I think I keep kids engaged. And when I'm talking -- when I'm giving the lecture during class, I can time it to the minute. I know, if they're getting me off track, when to get back on track and I know they're doing it on purpose. But I have a good back and forth with the kids during class and I can tell if they know what I'm trying to teach or not, and if I ask the right kind of question, we have a great time. When they're doing the flipped lesson at home, even when I give the flipped lesson prerecorded, I ask those same kind of questions and give wait time, and I've got the same inflections in my voice, it probably helps that I was a forensics coach for 29 years, you know. And so I think they learn better when I'm teaching them directly, but they certainly do much better on homework if they have class time to work on it. So effective. I think this whole year has been an effective year based on what I see them being so much more engaged in what I've done before. I like it this year.

Mrs. Ramaglia: Yeah. How often are videos used in your course to deliver new information?

FLIP 2: About half the time.

Mrs. Ramaglia: Okay.

FLIP 2: Yeah.

Mrs. Ramaglia: How do you know if students watch the videos for the course?

FLIP 2: I don't. I don't have any way of finding out on Google Classroom if they've clicked on the video or not. But I do every once in a while, say, "Pull out your notes. Let me look at them." Now, that doesn't mean that they actually watched the video. They may have just paused, wrote down everything they saw, kept going, wrote down everything they saw. I know I have some kids who don't do it at all. But when it comes to the next day and they have to work on their assignment during class, I can tell who watched and who didn't based on the kinds of questions I get. And they've kind of arranged themselves into groups in my 4th hour so that I can tell that a group will have three people who watched it and one who didn't, and my three become tutors, and it's kind of fun to watch that. In my 7th hour, I let them work in pairs usually, and again, I can tell who has or who hasn't. And every once in a while, they'll ask me a question, I'll say, "Did you watched the video? It's on the video." "No." So I can't guarantee that they do that, but I know -- they ask me how many minutes. I'll say 18 minutes, 14 minutes. If I go anything higher than 23 or 24, I get groans. So I know they plan their time based on what I tell them, and that's all I can tell.

Mrs. Ramaglia: Okay. How would you describe a student's effort in your math classroom?

FLIP 2: This year, it's fantastic. I just cannot believe. I still have four or five kids who don't do homework. And I know they're not doing well in other classes, but they're so bright, they're still As, Bs or Cs, not As, Bs or Cs in my class. But this year, the effort is amazing. I'm not sure what the deal is, but I see -- I give hard assignments and they're doing them for the most part. I'd say I have 70 kids putting forth as much effort as I could expect. 70%. 30% are not putting forth that kind of effort and they're cramming before the test, I see it on pop quizzes, but they're just great this year.

Mrs. Ramaglia: Okay. What if anything would you change for next year?

FLIP 2: I'm going to do more flipping next year of material I think can be done easily with flipping and to rather than have them come in the next day and do a homework assignment, I'm going to have them come in and do an activity. And then maybe homework will be cut in half in terms of how much time they -- how much work they have to do repetition of structures. But I think we're going to do organized activities next year, at least that's my hope, is to do organized activities next year.

Mrs. Ramaglia: Okay. Well, thank you.

FLIP 2: You're welcome.

Mrs. Ramaglia: Is there anything -- any questions that you might have for me?

FLIP 2: No.

Mrs. Ramaglia: Okay. Well, I appreciate your time.

TRAD 3: Thank you.

[Audio Ends]
[0:09:05]

File Name : FLIP 3 Intv
Length **:** 0:11:17.6
Speakers **:** Mrs. Ramaglia, FLIP 3

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi my name Mrs. Ramaglia and I coordinate middle and high school mathematics from the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

FLIP 3: I don't think so.

Mrs. Ramaglia: Describe what your math classroom was like last year. What routines, procedures, homework notes, physical space, what are the typical day look like?

FLIP 3: My kid's usually for homework would watch a video five to seven minutes on whatever we're going to cover the next day. So, they would have some sort of pre-knowledge coming in, and then the first five minutes of class they're on Khan Academy getting some spiral review from stuff we've done over the year. With their homework they do some like four or five problems just to make sure they're doing make sure they're processing it, not just pushing play and leaving. We go over those couple of questions and then we have small group and so they are working on something independently or they're with me in a small group. My small groups are based on abilities, so my highest group meets last so that they work on stuff independently first in my lowest group goes first, so they have instruction first. During that 10 minutes it's a small group we're working on that skill that they watched. Making sure they've got it, lets me work one-on-one, okay, this person really doesn't get it. I need to explain it in a different way, and then when they're working independently I try to find things that are a good balance between some rote practice of what they need to able to complete the skill accurately every time and then some application they need to figure out how they can use this skill to do something more than just the skill. That takes 30 minutes, three group of 10, and then our last five I go run and check that they've done their class work and any little clean up stuff we do in that last five minutes, and then we work it.

Mrs. Ramaglia: Okay, describe what your math classroom is like this year.

FLIP 3: I misunderstood the question I did last year this year and this your least year.

Mrs. Ramaglia: And this was your last year you know. What was it like last year?

FLIP 3: Last year, I for the first three months of school was very traditional. They would have a more or less a lecture during class. I mean, I would do a problem, they would do a problem. I would do another problem, they would do a problem, and then they would do book work for homework. Around October, I decided I really didn't like that, because I really hated talking for 45 minutes, six times a day, the same exact in every class and I felt like the kids zoned me out because they didn't really care. That's when I started doing flipped classroom, just because I feared if they have to listen to me for 45 minutes I would rather them get the same exact lesson in 10 and then we do practice during class. I also feel like I had kids who had no idea how to do the homework when they went home, and so I didn't want them going home and doing 30 problems the wrong way. Then they were watching a video instead of doing those problems. I didn't really have a structure from where they came to class last year. Some day's we would do a project, some day's we do an activity, some day's I would fall back into the lecturing kind of routine. There was no set structure, but I did feel like we got more practice in class than I would have, if was just lecturing or just teaching the lesson, but there wasn't a set routine.

Mrs. Ramaglia: Describe your lesson planning process.

FLIP 3: For this year?

Mrs. Ramaglia: Yes.

FLIP 3: Okay, I start with the kind of the application piece of what kind of project, to what kind of problem, or something that's a little more complex. I look for that first with mostly my resources of blogs I follow and things. I put that piece in, and then I look for something skill based, they just need practice finding the area of a circle. Where can I put practice, whether it's a worksheet or whether it's Khan Academy or IXL or something that they can get that practice. So, I put that piece in and then I look at what am I going to do to the small group. What do I need for each of the three small groups, what do my basics when my kids who need the foundations, what kind of problems are we going to do, and I usually put them on transparencies so that I can use them for all six classes. What I am going to do with my middle group that's a little bit harder that still gets the basic concept, and then with my high group, what do they still need even if they're flying through things. What do they still need and then what can I do to

challenge them. I start with the independent work and then I work on small group stuff. Most of my video lessons I'm remaking this year, but in the future I think I'll be able to reuse them just to interview such concepts, to that interview. Does that make sense?

Mrs. Ramaglia: It does, what is effective about the instructional strategies you use?

FLIP 3: I think that the flipped classroom allows them have information ahead of time, so that they at least have an exposure to it. They might have had no earthly clue what it was talking about. They might have really struggled through the four problems, and they're still just like, what is this. But at least they have some like, okay I know today in class we're looking at circles, so that's what I keep thinking about. I know today in class we're looking at area, I don't know how to do it. I saw that same formula, I don't know how to use it, but I know that that's what's coming, and I think it kind of preps them for class. I like small group because I know my kids often will do a pre-test, so I know my kids who have no clue how to even plug things into a formula, and so I'm able to work with that group on things that are going to let them be successful. I also know my kids who, they could've, if you give them the area formula, they could have gotten it two weeks ago with no instruction. I'm able to give them things that aren't just boring to them. I like that they have to work independently because how often is it I do a problem than you sit there and you do the exact same problem with different numbers, and you don't have to think anything, you just have to repeat what I did. Whereas if they're sitting there by themselves they have to figure out how to do something that might not be just like something they just saw, and that, they are always in partners, and I like that because they have a conversation, and they can't ask me until they've talked to their partner. I walk around and I hear a lot of -- I don't know how to do this one, can you explain it, and it's not to me it's to a peer. So, it gives their peer a chance to have to explain something versus me always explaining everything. And we talked about at the beginning of the year, you remember 90% of what you teach someone else. Don't deprive your partner of the chance of remembering 90%. If you don't ask them, they don't get to practice. Different pieces have different -- I like them for different reasons or I think they're effective for different reasons.

Mrs. Ramaglia: How often are videos used in your course to deliver new information?

FLIP 3: It really depends on the unit, because I think somethings lend itself better. For units that I use it a lot, it will be three to four days a week they're watching a video. Right now, we're in geometry and like translations and I want to do more hands-on inquiry stuff that we need to do in class. Right now, we use it maybe once a week, and that's just

because the content doesn't quite lend itself. It's better inquiry in class, let's figure out what does happen if I add 7 to the x, and let's try it and let's see. I don't want to just give them the answer to that. I don't want to do it in a video and then know all the answer. It's more, I don't know, they enjoy it more, I think it's more beneficial for this to not do it in a video, and we're on block scheduling. So, it kind of gives you time to do that.

Mrs. Ramaglia: How do you know if students watch the videos for the course?

FLIP 3: They'll have those three or four questions, and you can tell if they miss everything or one of them. You're like well, did you watch the video? And they'll say no. Then you might want to go back and watch the video, and they won't get credit for homework. You know, if they can do this for questions, having not watched the video, then they don't need to watch the video, because they got without it, that's kind of my check of, did you watch it, and did you need too? Because some of them will skip the video and see if they can do it and if they can't, they'll go back and watch the video, which I can't really fault them for. If you can do it, do it.

Mrs. Ramaglia: How would you describe student's effort in your math classroom?

FLIP 3: It took awhile to build some of that effort, because they're not used to working independently without a teacher standing over their children. It took awhile of this is what it should look like when you're working independently. It still takes, I still have to walk around and check if that class work is done because they're middle schoolers. If I wasn't going to check, they probably wouldn't do it, but over the course of the year, whether they know they're expected to get this work done, and they know that in getting the work done it's preparing them for the quiz and it's preparing them for state assessment, and it's preparing them for algebra. They've started putting out more effort, and I try to make them interesting things. Like their independent application piece, like today, we're finding which takes more cardboard? Pepsi or Coke? In making it interesting and making it things that has some connection to something beside's graph this line, and that's the end of it, then they're putting more effort on those kind of things.

Mrs. Ramaglia: What if anything would you change for next year?

FLIP 3: I'm thinking about changing that every class has some sort of exit formative assessment of some variety, and somehow tying that into the amount of outside practice they have to get, but I haven't quite figured out how to make that work. Especially with the videos, because they still have to watch the video whether or not they got in class, but I want

to do something with formative assessments at the end of class, so I know if they're really getting it, and if they're really getting it then maybe backing off the amount of practice they're getting at home or something like that. I don't know, that's my newest start but I haven't figured out how to make it work yet.

Mrs. Ramaglia: Okay, well, that's all I have. Do you have anything?

FLIP 3: No.

Mrs. Ramaglia: Okay, well thank you. Thank you.

FLIP 3: You're welcome.

[Audio Ends]
[0:11:17]

File Name : TRAD 1 Intv
Length : 0:20:33
Speakers : Mrs. Ramaglia; TRAD 1

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

TRAD 1: No.

Mrs. Ramaglia: OK. Describe what your math classroom was like last year, like routines, procedures, homework, the notes, physical space. What did a typical day looks like?

TRAD 1: OK, and this is probably obvious, but you mean like not this current year, like the previous year?

Mrs. Ramaglia: Yes, the previous year.

TRAD 1: OK. Um, I'll start with what a typical day looked like. My students would come in, I taught College Algebra and Algebra 2. So they would come in and I would have the answers to their homework displayed on the board. They would check their homework while I walked around to check to see if they did it. And then um, I took questions on their homework. And I did it all on a smart board, because I kept it all online. So then we worked, we'd work through a couple of their problems. We were on block schedule, Monday through Thursday, and then all block on Friday. Um, and then we would go through notes. Usually they, well, in College Algebra, every lesson was guided notes. And that was, and all the teachers had the same guided notes. So we would work through together as a class their problems and their notes, and then they would start their homework with about 30 to 20 minutes left of class. And they'd get started and ask questions as they had it. And that was, I mean that was a typical day in College Algebra. Algebra 2 is pretty much the same. I think we did more, um, board work, more like just kind of not as formal practicing, you know what I mean? Like College Algebra was like bam, bam, bam, you know, like exactly, I mean we had to finish certain notes by certain days and things like that. But with Algebra 2, we could like stop and practice this concept a little bit more. We played more games in that class. Um, but I mean generally speaking, same kind of day. And then, in classroom

procedures? Let's see here, physical space, um, actually it was not, it was not like this. It wasn't in straight rows. Um, there were kind of groups of six facing forward. Um, and then so there'd be six facing forward and I'll try to be verbal, six facing forward and then behind there was like a big gap, and then four. So kind of like pods. And then on the sides they would face probably like at an angle. So they're all facing the smart board. It was kind of an odd shaped room, but they were all grouped up in groups of four or six. So the person right next to them was their partner. And we had sled desks so we could push them right next to each other. So they were groups, four and six. So that way they either had their group premade or they were with their partners. Let's see here, procedures. Um, I had a hall pass, things like that. I had them sign in. I started to have them sign in and sign out after somebody asked me where a kid was one time, and I was like, I think they left. So now they sign in and sign out when they leave. Homework, do you want me to talk about grading homework or just?

Mrs. Ramaglia: Sure, that's fine.

TRAD 1: OK. Um, homework was four points for an assignment. They could turn it in up until the day of the homework quiz. I had a homework quiz, it was always the review day for the test was the day their homework quiz was. If they had all their homework in and completed, they could work with a partner on their homework quiz. And they could use their homework on it. And the homework quiz, I love this, I'm not an academic, gosh, I went over this. Because the homework quiz was the harder problems on their homework. So the kids that really did it and really worked on it did OK. And even the kids who didn't do, not always like the hardest, but like it wasn't easy stuff. But even the kids who didn't like really do their homework detailed, that they just kind of got through it but they got the idea, they could work with a partner and kind of work it out. And they had taught each other a lot. Like I heard some really good conversations during that time. And then the kids who didn't complete their homework, um, didn't get to work with a group. So they actually tried to complete their homework so they had a partner, not necessarily for the points, although I'd like to think that they cared about the points. But the homework quiz was worth, um, well, homework was about 16 points. It was usually about four sections, and then the homework quiz was about 30 or 40. So the homework quiz really mattered. Let's see here. I think that answers everything. Routines, what did a typical day look like, yeah.

Mrs. Ramaglia: OK. Describe what your math classroom is like this year with the same kind of idea, its routines, procedures, homework, and what does a typical day look like?

TRAD 1: Well, it's a lot different. Maybe it's not that different. Um, I'm teaching all new classes this year and in a different school. And so it's been an adjustment, um, with the kinds of classes and the level I'm teaching. Um, so typically with geometry, which I guess, that's the focus, right? OK, so with geometry, well, I guess we do end up following the same, pretty much the same pattern as Algebra 2. They come in, if they had an assignment I check it. I usually put the answers on the board before they leave now, because a lot of these guys, if they don't know where to start most of the time they don't start, that's what I'm finding out. But sometimes if they have an answer they're more likely to start, like and if they don't have the work they obviously don't get the points. I, they don't have as much take home work. It's a lot, like I give them time in class to work on it so they can get the help they need. We do, this semester we've done more like note taking, practicing that, which I think is good, because it's closer with the other geometry classes, which I wanted it to be. And I think they need to be prepared for that future. We did it last semester, we did note taking, too. It just wasn't as formal, it was a little bit more informal. We would work through examples together, they'd work on whiteboards and things like that. Um, we do whiteboard practice. Not as often as I'd like to. Like I always think like gosh, I really need to get them up at the boards and just working through problems more. Geometry doesn't lend itself to that as much, and I'm not quite sure how, like I thought about putting like projecting it, and then having them look at it, but what I'm noticing my kids this year is they have a really hard time if they can't write on it. Like they need a picture of it. So like the problems where I can say like draw a circle, now make a tangent, now write this, then we can do that on the whiteboards, but to have them like twist and look, I don't know. So we did a lot of whiteboards, or we do them, but not as often as I'd like. We try to play games. They like games, but we're kind of, not as often as they'd like. So does that answer all the questions?

Mrs. Ramaglia: I think so.

TRAD 1: OK

Mrs. Ramaglia: Describe your lesson planning process.

TRAD 1: Oh. I'm in the middle of it right now. Um, with my kids, I have CT Geometry. So my kids, almost all of them have an IEP for some reason or another, need to have some extra help. And I have a para in all three of my classes. Um, but I also recognize and feel like they need to be doing the same stuff as the non-CT classes. But what I've noticed is the notes that they like, the packets that Laura's been making, which they are great, and I've helped kids in SAIL who have it and it works for them, so I'm not cutting on it. But for my kids, they need more space

and more work, like more room to work and think, and more repetitive problems. And I've been having a hard time finding those. So, what I've been doing is, well, actually what I've been doing this semester recently, it's a lot of work but it'll be worth it for next year, is I take, I get the packet Laura gave and then I make, well, I have it right here, but that's OK. I start with the packet and the notes that Laura gave, and then I go through it and pick like the big ideas, you know, and try to space it out more. Usually it's pretty much the same notes. His notes are pretty good, and I like, they're not too hard and they're easy to follow. Sometimes I space them out more. And then I find either using KUTA, although KUTA does not have very much with chords, but I found some good things on the internet. Like something, I need to search up worksheets, or I made a couple to try to give them like more like spacious problems to work with just like the basic idea so they can get that before we go on to some of the harder stuff. And then we do go, I try to get to the same level of difficulty, but we don't always, just because of time. But the idea is by the time I see Laura's test, I make sure my kids have seen everything on that. But sometimes I do modify the test. But I make sure they've been exposed to it and have tried it. So that's what lesson planning's like. So I've been doing the packets, but the difference is we don't obviously, we don't do, I don't record it. I teach it to them and we go through it together. I try to get them talking as much as possible so they answer questions. If it's brand new, there's not a whole lot they have to say, but I try to ask them leading questions. And then, and then from there, to have them practice on their homework. And I usually, ideally I want them to have at least a solid like 15 minutes of working where Diane, my para, and I can walk around and help them individually. Because a lot of them, I'm realizing, even though they're participating and working, transferring it onto a new problem on their own, like they really struggle. Like they were answering questions and I'm like, I know you got it, and then they see a different problem, just one little thing changed, and they have the hardest time making that connection. And that, I think, the only thing I know for that is one on one. And so that's what we're doing. So and then they give homework, I mean the homework's in the packet and everything. So that's what the lesson planning looks like. The more time I have, the better it is. I guess that's how it always is.

Mrs. Ramaglia: So what is effective about the instructional strategies you use?

TRAD 1: Well, I think all students, I don't want to just say my students, because I think this is a universal thing, they, I think they respond better in a conversation. And so I call kids out by name on a regular basis. Now obviously not hopefully not too embarrassed. And we all have a good enough rapport that I don't, I can't think of one time this year where a student seemed kind of like annoyed or upset that I called on them and

they didn't know. They seem to handle that really well. So it's a way to kind of keep them involved and interacting with the material and like on their toes, so to make them more of active participants versus um, not, like kind of passive and things like that. So I try to, I already forgot the question. What is effective about the instructional strategies you use? So OK, so I know it kind of seems like well, giving notes, you know, but it's not just that. It's more of, I really do think of it as a conversation. It would be, I don't think I would teach it as well if my students weren't there, to be honest. And I know that you're doing your dissertation, I'm sorry, I'm not cutting on anybody. Sorry. You can take that out.

Mrs. Ramaglia: No, it's OK. Go on.

TRAD 1: Yeah, because in some ways like I know the kids love to rewind and watch it again and things like that, but I explain it better based off the questions that they have. And fortunately this year, my best classes with questions is my first block. They have such good questions, and things that I didn't think to stop and explain. And they ask them, and then I stop and explain. And then my second block is really quiet, and they'll never ask anything without being like prodded, and I have to wait until it's so awkward, they'll say something. But I can usually hit those questions before. So that's great. That doesn't usually happen. Usually first hour is quiet. So that's what, and then whiteboards is, those are great, because they get immediate feedback. They can just know right away, am I good, am I not? And then if they're not, it's kind of a non-threatening way to try it out. I feel like even the marker in the whiteboard, and because it erases so easily, I've noticed that kids tend to try more with a whiteboard. And I think it's because they don't feel as committed to what they're writing down, which is funny. Like they experiment more with that, which I like. I think that's it. I love groups. I want to incorporate those more, but I haven't. I've done them here and there, but because we don't do them on a regular basis, it's always a challenge. Like sometimes it's successful but sometimes, I don't know, I think they might have done better just on their own. But that's not something I'm doing this year as much.

Mrs. Ramaglia: How often are students assigned homework, and how often do students complete the assigned homework?

TRAD 1: Oh, that's a great question. In geometry this year, I try to give them homework, oh, if I see them four times a week, at least three. But sometimes, I mean really, there's an assignment, I call it practice, they have practice every day after our notes. And a lot of kids can finish it before we leave, depending on the situation, how much time we have. But plenty of them do have to take at least half of it home to work on it.

With my classes this year, students who take work home and bring it back completed is low, it's really low. And I hesitate to give like a number, but I would say under 10 percent to be honest with you. They work like crazy during class time. I love my geometry classes, because they really, I mean there's always some that don't, but generally speaking they really want to get it done, and like they, some of them I think just know they don't do it at home. I don't know if it's they don't have the opportunity, they just know that it's not what they do. And so they work hard to get it done during class time. And some of them will come in and try to finish it off right before class. I check their homework twice, because I've noticed this. Like I see all the work they do before they leave, and then some of them will lose it or it doesn't come back. So I check their homework twice now. I check when they, like right before the bell rings I walk around and give them partial credit. It's 1, 2, 3 or 4 points. And then at the beginning of class I go back around and hit the kids that didn't have it done to see if they did finish it, so that they can, I mean I don't want to cater too much, but at the same time like if they did the work, I want them to get the credit for what they did. So, and I let them turn homework in up until the day of the test. I've always done that, except for I think maybe in Algebra 2. But I think that was like a, as the Algebra 2 team that's what we decided. And it worked out OK. How often, so they actually overall I would say they do a pretty good job at completing it, but that's because I know they're working on it in the class. They finish it right before then, and then they get here a little early and work on it. And I'd say most of them get 3's or 4's on their homework. But I don't know, most is probably a strong word.

Mrs. Ramaglia: OK. So how would you describe students' effort in your math classroom?

TRAD 1: Oh, um in my geometry classes they, I would say, overall the majority of them try so hard. And I love these kids. Because they're CT, I mean I think we all know this as teachers, like to be in CT geometry that means they made it through Algebra 1. And so I get the kids that had to work really hard to make it through Algebra 1. So they have learned by now that to do well in math it requires work. And they are so good at like getting their notes out and having that right next to them while they work on their homework. Sometimes they're a little too good, because I'm like worried they're just not really learning, they're just copying it. And sometimes I say, put your notes away and try it without your notes. But you can tell they've gotten in the habit and it works for them. So during class time, I really, I mean of my three blocks, two are really good workers. And one of them, they're actually better than average. Like they, I think they have this in their head, like this is my chance to get it. And they work hard during class time. Anything outside of class,

like I really generally I don't think they really like study the vocabulary words. Like I tell them, this is going to be on the quiz, you need to learn these parts of a circle, you know. Like here's your chart, just look over it, check your, you know, I try to give them ideas. Or even just think about it some time, don't even look at it, just think, some of those words. I don't, I think when they leave my classroom that's the end of it, and when they come back they're kind of entering into this world again. It's not something they, they haven't developed the great habits they have in my class at home yet. And I say yet because I'm hopeful, but yeah.

Mrs. Ramaglia: OK. So what, if anything, would you change for next year?

TRAD 1: Oh, that's a good question. Um, can I just take it however you, like OK.

Mrs. Ramaglia: Whatever you would want to change.

TRAD 1: OK. Hm. Oh gosh. Every year, well, I haven't done it this year, most of the time I have a Word document and I have things to do differently next year, to try to make it a little better. I didn't do it this year. Um, what would I change? Specifically with geometry, I've got good class sizes. I think I would like um, more time to plan. And maybe that's probably like the number one thing teachers say, now that I'm thinking about it. But that's something where if I have a slow week and I can take a Monday night to put together the next unit's lessons, it goes so much better than if it's a week where there's a lot going on and I just can't. Or if I can get a unit ahead, which is what I usually am, but just the way things are because it's their first year with it, it's hard to get a unit ahead. So I think fortunately, next year I'm going to have the opportunity to do those things. I'm trying to think. I would do more groups. I like groups a lot, but like I'm like kind of an optimist. I like to think that I'm going to have great ideas when I have the time to think about what I'll do with groups. You know what I mean? I'm kind of like, what would I do with groups? I don't know, like I've had some good group experiments. I mean, there's always the issue of time. Like I would love to have less topics, so we could have more time really getting them. I mean, there are some times where, and my students take a long time, I mean, to learn a concept. Like they can get it, and like when we were doing trigonometry, they got it, but I didn't, we did not get to, what was it? No, prisms, where they had to find the apothem using special rights. Like we did not get to that. And but the thing is like I knew, they did everything up to that, and I knew they could do it, but like if I had like two more classes with them. Like I think we could have spent the time focused on it and they could do it. Because they did really well. Like they do well with those ideas, and they did well in the trigonometry, and if they did well, it was like all these pieces that I was

like, when I look at it, they've got this, they've got this, they've got this. To put it together I'm sure it's going to take two solid days. And then we'll be behind and I'm trying to stay, so that was one thing. Like I always just gave them the apothem and I didn't have them find it. And it's kind of one of those things where it's like gosh, I know they're capable of it, it just takes longer. And so it's always, so yeah, I would like to create a time machine where we could just build in some extra days whenever. I'm like hey, two more days would be great. So I think, I mean I think that's it. I feel like there's probably a lot of other things that could be changed for next year to make it kind of a better. Hands on, I always think that hands on, especially for my kids, but everybody. I loved the patty paper at the beginning of the year, I thought that was great. And we did solids, like we got these out and you know, poured water to see like if it really equals three and all of that. And that worked. I think we got blue dye on one kid. But it was OK. I didn't know they were dyed blue, I didn't add the blue dye. So like those kinds of things, I think like those kids never forgot that it takes three cones to fill. So like they really got that. So I'd love to incorporate more of those things. But I don't even know like right now, like is there time and do I even know what I would do if I had the time? Like no, not yet. But I love the idea. I think they do much better when they do it. So I guess I'll stop there.

Mrs. Ramaglia: Alright. Well, is there anything you have, any questions you have for me?

TRAD 1: No, I don't think so.

[Audio Ends]
[0:20:33]

File Name : TRAD 2 Intv
Length : 0:15:17
Female Speakers : Mrs. Ramaglia; TRAD 2

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instructional strategies. Do you have any questions for me before we begin?

TRAD 2: No.

Mrs. Ramaglia: OK. Describe what your math classroom was like last year in terms of routines, procedures, homework, notes, physical space. What would you say a typical day looks like?

TRAD 2: Routines, I think that I have two ways of starting a typical day. One is a quick review of lessons leading into the concept that would help the students grab onto what I'm teaching that day. And then into, um, what we're covering for the day. Um, the other way is maybe I might just have a little opener kind of question, not a physical get your whiteboards out and review, but just kind of an opener kind of questions and, and then lead into the lesson for the day. Um, there's note taking and practice just about every day. And um, lots of, OK, what would we do for this problem? Work with your partner, um, and compare answers and asking questions. Um, homework, do you mean like that I assign? Or going over? Or either one?

Mrs. Ramaglia: Either.

TRAD 2: Either one? OK. Um, after, you know, feeling like we've walked through the assignment or walked through the lesson and that there's some good understanding, you know, if I need to do a couple more practice problems I'll do that. Then the assignment very much reflects the practice problems that we've done. They're, the majority of the assignment reflects those. But then there are also questions that ask them to kind of process not just the calculate, not just calculate but process the calculations and answer those. Let's see. As far as going over homework, I, I provide the answers for my students and the expectation is that they do their assignment. When they are stuck that they use those answers. When they're finished, they grade their assignment and, um, rather than taking class time to do that, I have students that are pretty good about coming in, he had a question on this

problem or didn't get this one, but I try to not open my class with hey, are there any questions over last night's assignment? I feel like that hits three or four students, whereas reviewing hits everybody. So um, there's that. And um, if there's time in class, they might start on their assignment together, or we might do a few problems together, depends on if it's the honors class or the regular geometry. As far, oh, and then I do an entire unit at a time, or at least part of a unit. So I don't collect homework, I don't check off homework daily. I think at the high school level in particular the ability or the time to get to the homework varies day to day. So I think that giving them the packet and letting them know that it's going to be collected at the end on the test day gives them the flexibility to, you know, if they have to put something off because they have a game one night and they're not going to get to it until the next night, or whatever, it's not a big penalty for that. Um, and then I collect and I check off their packet for points on test day. Physical space in the classroom is pretty comparable to what it is now. I've, I let go of rows two or three years ago and started grouping my students. I think last year I had groups of four or five together. And this year I pared that down to three. Most of them are in groups of three, a couple of pairs. I think that just promotes asking questions. You know, if I've hit something and somebody doesn't understand, that person doesn't want to raise his or her hand, she might be more likely to say hey, I'm having trouble on this problem, you know, I didn't get what she said, or can I copy your notes, or whatever it is, you know, I missed that last part. So I think that hits everything.

Mrs. Ramaglia: OK. Describe what your math classroom is like this year in terms of routines, procedures, homework, notes, physical space, and what does a typical day look like?

TRAD 2: OK. So um I really don't think there's a tremendous difference from last year to this year. Except for the homework packet. Last year I was not doing homework packets. I was checking off the assignment every single day. And I just, I really have come to feel that that's a time waster in class, and it's, I wasn't very good at getting to it every single day, and I felt like I was penalizing students who couldn't get to their homework that day but really did know the material and, or were going to be able to know it by the test. So I kind of let go of that after last year. This year I have the packets. And we continue to work through the packet through the entire unit, and then I collect the packet and check that off as homework. That's probably the biggest difference as far as routine and procedure, letting go of that check off time for the assignment. Posting the answers up there while they check their assignments, I just feel like was a big time waster. And it really didn't benefit as many students as doing a whiteboard review or handing out three quick questions at the beginning of class, and do these with your

partner. I feel like that hits everybody. Not everybody really cares what the answers are to their assignment.

Mrs. Ramaglia: OK. So describe your lesson planning process.

TRAD 2: Um, my lesson planning process is a unit at a time. I start by figuring out how long is the unit, what, what all am I going to include in that, and then I do long range planning, usually map out three to four weeks. And then I work into smaller, and I go from the big picture down to scheduling, to each day determining what particular objective or skill that I'm going to teach. And I spend time on that on a daily basis. So that first planning process takes me a couple of hours usually. A lot of times I'll come up here on the weekend and I'll just, I'll map it up, map it out like a calendar on the board. But then individually, you know, it can be watching some of the Mike Patterson videos. I might include that as my own lesson planning, because I feel like he, you know, I'm watching somebody present something in a different way. It might give me a new idea. Um, but I try to, I try to plan things so that there's a flow from one day to the next so that there's some continuity or pulling in something from the previous lesson or even a skill that they learned last year in order to give them some kind of preview. But that said, you know, I'm a, I fill out my packet, my unit packet as I'm working through the unit, I, I fill it out completely so that I'm, so I don't miss something while I'm teaching. And then I have put everything on Smart Notes so, and we kind of walk through that.

Mrs. Ramaglia: What is effective about your instructional strategy?

TRAD 2: I think, I think I do a good job of breaking things down for my students and showing them ways to learn the things that might otherwise be difficult. Like right now we're covering the unit circle, and I think a lot of times the students look at the unit circle as this massive thing that they have to memorize, and so I'm talking to them about no, you memorize just two or three little parts of it and you break the other parts down into equal fractions. And I think that that's, that's a strong suit of mine, to try and figure out where the stumbling blocks might be. I think the guided notes and the practice and the working together gives the students who care, the students who want to feel confident before they leave, I think it gives, they have lots of opportunities to do that, whether it's asking a partner or somebody at their table for help, or I feel like I'm pretty good about perusing the room and checking as they're practicing their problems and they can ask me questions too.

Mrs. Ramaglia: OK. How often are students assigned homework, and how often do students complete the assigned homework?

TRAD 2: They're assigned homework pretty much every single day. And um, I, I, it seems like when I check off packets that um I would say, I'm guessing, but I would say about 80 percent of the students complete 80 to 90 percent of the packet. So I think it's a pretty good rate. My assignments are not huge. I tell them, you know, if you're working on this for more than 20 to 30 minutes and you're still struggling, than that, or you're not finished, that means you don't understand, and so you should stop and get help. I give them lots of flexibility on, you know, maybe you try the odds, and if you are finished with the odds in 10 minutes, then go back and do the evens. Otherwise, push them aside until you have more time the next day when we have a shorter assignment or you have seminar time. So I don't know if that flexibility on my homework, you know, in both how much I assign, letting them pick and choose sometimes, say choose eight problems out of the fifteen that are on here, but make sure that you choose eight different problems. You know, I don't know if that maybe makes them feel like they're not going to be overwhelmed and maybe they'll go ahead and work on it. I don't know what, but I feel like I have pretty good completion rate on assignments.

Mrs. Ramaglia: OK. How would you describe students' efforts in your math classroom?

TRAD 2: Um, I think for the most part, students want to learn. They want to be able to be successful. And so if I can find that little thing that will help them feel successful on a little piece, then maybe they'll keep going. I don't have every student doing every, you know, assignment. But I think that their effort is pretty good, especially when they're in class. And you know, I do a lot of perusing. I think, you know, somebody who might not otherwise work might work a little bit more or pick up their pencil because I am standing near them and can see where, you know, see them from where I'm standing. I don't spend a lot of time in the front of the classroom. So I think it's, you know, for the majority of the students it's a pretty good effort. Not everybody, but for the majority.

Mrs. Ramaglia: What, if anything, would you change for next year?

TRAD 2: Um, about my own kind of structure?

Mrs. Ramaglia: Yes.

TRAD 2: Boy, that's a good question. Um, I would like to find the time to answer questions from the assignment the day before. I don't do a very good job of that, and I think that I put a lot of onus on the students to approach me for help. So I think that there are sometimes there are some students that are frustrated, you know, I didn't get number 7 and

there's no time for me to ask about number 7 in class. I don't know if that's worth the trade of something else, but I, I guess I would probably try to institute, I tried this before and I would like to be consistent with it, put a place on my board where students can say, hey, I want to talk, show this problem number. I didn't get number 7. You know, so that they can ask, they can let me know which questions they have, and if I don't have time for them in class, I could always videotape and post how to, you know, walk through them and post that on Google Classroom. That's probably the one thing that I feel like I'm missing. That's one thing that I know. I'm sure there are others, but that's the one I know.

Mrs. Ramaglia: OK. Do you have any other questions for me?

TRAD 2: No.

Mrs. Ramaglia: OK, well thank you so much.

[Audio Ends]
[0:15:17]

File Name : TRAD 3 Intv
Length : 0:07:15
Speakers : Mrs. Ramaglia, TRAD 3

[Audio Begins]
[0:00:00]

Mrs. Ramaglia: Start this. Okay. Hi, my name is Mrs. Ramaglia and I coordinate middle and high school mathematics for the district. I want to thank you for taking the time to talk with me today. I wanted to ask you a few questions about your instruction strategies. Do you have any questions for me before we begin? Okay.

Mrs. Ramaglia: Describe what your math classroom was like last year in terms of routines, procedures, homework, notes, physical space. So, talk to me about what did a typical day look like.

TRAD 3: Kids would come into the classroom. There would be a warm-up problem on the screen. We would grade homework, go over any questions that they might have from their homework that we would grade, introduce a new lesson. I would provide practice work, guided work, and then they would work on, they would show me that they could master, do the work, so… I would try to provide a variety of instruction for them, so… And then ask questions as we went along. And that's pretty much a typical, typical day.

Mrs. Ramaglia: Okay. Describe what your math classroom looks like this year in terms of routines, procedures, homework, notes, physical space and what does a typical day look like.

TRAD 3: Pretty structured. So, again, they still have a warm-up problem when they come in. We grade homework. It's very similar, so, it's very similar, even though it may be different just depending on what questions that they might ask. So, it will change based on their needs. So, I try to, I'd introduce the lesson. I keep in mind what I want them to take away before they leave the classroom. What is it that I want them to learn, how am I going to approach it. So, I try to give them concrete, give them in manipulatives, where I try to let them discover, make conclusions on their own. Try to let them make connections on their own. And then, I do like to have them start their homework prior to leaving, and then that way if they have any questions, they can ask before they leave. So, it's pretty similar, but I make adjustments as needed, so…

Mrs. Ramaglia: Okay. Describe your lesson planning process.

TRAD 3: I keep the long range plans in mind, so, based on that. And then for specific lesson plan, I keep the end result in mind. What is it I want them to learn. I try to give them guided practice, let them work on their own. And then I also, the discovery, I want them to learn and figure out some of the process on their own. So there's a lot of questions on my end of it, as needed. We do group or partner work. Work with your partner, have discussion. I like to hear good conversations between two or three in a group. And I do try to get them up and moving to where they are just not sitting the whole time. So, whatever lessons are conducive to that, I try to work that into the process. And then, I like for them to start their homework, you know, three to five minutes prior to leaving the class, just to make sure they don't have any questions or they can get all those questions answered, prior to leaving, so…

Mrs. Ramaglia: Okay. What is effective about the instructional strategies you use?

TRAD 3: I think them, I think providing a comfort level for them. So, I think, classroom management is a huge, has a huge impact. If they feel comfortable in your classroom, then they're going to ask questions, they're going to succeed, they're going to do well. And then also, so they way it's structured, if they're working with somebody else in the classroom, they're going to learn how to work with somebody else, how to ask questions or this is what I got, this is why I got this, or I didn't get that, or anyway. So, I think it's all about setting that comfort level in your classroom. And then just make sure I provide them with what they need to succeed.

Mrs. Ramaglia: How often are students assigned homework and how often do students complete the assigned homework?

TRAD 3: Generally, they're assigned homework daily. And we do have, overall, I'd say we have good homework completion. It varies. I'd say we have, I don't know, 80% homework completion which I think is high. So, daily homework and it's, the completion rate is high.

Mrs. Ramaglia: How would you describe students' effort in your math classroom?

TRAD 3: I would say their effort is good overall, for the most part. I see kids trying, I see them asking questions and I, you know, I'd feel like I'm available for kids to come in before and after school if they do need extra help, so… I feel like they try hard.

Mrs. Ramaglia: What, if anything, would you change for next year?

TRAD 3: Let me think a minute. I know as we've gone through the year, this year, we've made changes, you know, the quizzes, or lessons, what

worked, what didn't work. And so I've made notes in my lesson plan as far as content area, so, maybe just revamping some of the content just, oh I need to spend three days on this instead of two days, so… Just looking at the, maybe just planning and looking at the lesson a little bit more in depth, as needed.

Mrs. Ramaglia: Okay. Well, thank you. That's all I have. Is there anything, any questions that you might have for me?

TRAD 3: I don't think so. I don't, not now.

Mrs. Ramaglia: Okay. Alright. Well, thank you. I appreciate it.

[Audio Ends]
[0:07:15]

Classroom Site Observation Field Notes

High School Site #1 Classroom Observations

Flipped #1 Observation #1
Observation Start Time: 9:34am
Observation End Time: 10:26am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry class.

22 students and a lab assistant. 12 boys, 10 girls. Physical space - set up in rows. Having students take attendance and turn on the projector.

Teacher passed out cookies because she said they won the KAHOOT.

Teacher asked students to get out their volume packet.

On the screen: In class work - grade prisms worksheet #2 (p. 10-11), formative assessment, Algebra: distribution and foiling, Homework?

Teacher said goal for today was to grade and then take a formative assessment.

Teacher had a student show how to work a trapezoidal prism volume problem and then had the class give snaps for the student

9:47 – Teacher moved on to an equilateral triangular prism volume problem. Teacher demonstrated the solution using radicals and talked about exactness of answers.

9:50 – Teacher gave worked a regular hexagonal prism volume problem.

9:55 – Teacher had students grade homework

Teacher discussed how volume refers to the base happening multiple times.
T: A triangular prism with height of 14 means we have the triangle happen 14 times.

10:03 – Class transitioned to formative assessment.
Formative assessment: prisms worksheet 2 on screen

Teacher had students copy from the screen onto notebook paper.
Teacher reviewed the formulas and re-explained them before giving the assessment.
Students took a three question formative with a right rectangular prism, a hexagonal prism, and a triangular prism. The directions had them find the volume of all figures.

10:14 – Class transitioned to algebra review board work on white boards. Students completed a distributive property review.

Many students said they were struggling to remember the "rules".

10:22 – Teacher transitioned to FOIL.

Active Learning Incidents Observed: N

Flipped #1 Observation #2
Observation Start Time: 10:30am
Observation End Time: 11:22am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Class set up in rows 24 students. 14 girls and 10 boys.

Topic on board with objective code. Teacher passed out papers.

T: We are taking a formative assessment over GMD.4. You can use your packet on the formative.

The formative questions were: What is the 2d shape, what is the area, after revolving around line m, what is the 3D shape that was created, what is the volume of that 3D shape

Students then turned it into an inbox after they were finish.

10:38 – The teacher passed out a new packet for the week related to unit 4.

T: This is a big review of Algebra 1 stuff. It should be manageable

T: Homework for tonight - worksheet 1

Teacher provided some mnemonics to help with horizontal and vertical lines. Teacher provided instruction and reviewed formulas for horizontal and vertical lines.

10:49 –Class transitioned to practice problems. Students got whiteboards and markers. The teacher gave students time for doodling.

Teacher gave problems that asked for students to find the slope of the line. The teacher provided tips along the way of how to find slope.

T: Don’t forget to reduce once you find slope.

10:59 – Teacher gave new problems on finding slope between two given points. The teacher gave students the slope formula and then worked one together as a whole group.

11:09 – Teacher gave new problems on finding the slope from equations of varying forms.

11:20 – T: Write the slope intercept form of the equation.

T: We didn't get to midpoint and distance formula, so don't do the problems related to those on your homework.

Active Learning Incidents Observed: N

Flipped #1 Observation #3
Observation Start Time: 9:34am
Observation End Time: 10:26am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Objectives were posted on the board related to statistics.

The teacher had the students collect data using a Google form. Students were answering survey questions.

Students in 5 rows of 6. 24 students 11 girls 13 boys and one lab assist. Teacher monitored student submissions on her laptop and enlisted students in taking attendance and helping get the class going with the Google form.

The task was a way to collect data for a statistics lesson. The teacher wrote a two-way table on the board and asked for students to help her fill in the chart.

The teacher used live data from the class. The teacher asked questions and reviewed solutions based on the table.
T: This is the same as on the video from last night. What are our variables?

T: What are possible values?

T: Is there a relationship between variables?

The teacher asked them to use their intuition and to predict.
The teacher then asked them to calculate simple probabilities based on the table. Next, the teacher demonstrated conditional probabilities.

Students began working independently

9:56 – T: Work on page 13 with a partner. You have 10 min to work on the worksheet.

Students discussed conditional probability examples with their partners. Students were allowed to choose their partners.

Students moved desks together to work on worksheet.

T: When you are finished, move back to your seats and you can work on other work until others are finished

10:10 – The teacher gave an students an assessment over statistics work

Active Learning Incidents Observed: Y (peer-to-peer discourse around the statistics group work on conditional probability

Flipped #1 Observation #4
Observation Start Time: 9:34am
Observation End Time: 10:26am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Teacher was late coming in. She mentioned she had been filling in for another teacher.

Students seated in 5 rows of 6.

The teacher asked for forms to be out and ready to go and to take out a writing utensil. 11 girls. 12 boys. 23 students total.

The teacher passed out cookies for those that brought forms back.

The teacher had students get boards, markers, and erasers. Some students went to windows and white board space around the room. The teacher told them to sit with people they can work productively with.

9:40 – The teacher had an in class agenda on board. The agenda showed that they were working on factoring trinomials on their white boards. The teacher first reviewed splitting the middle term with students.

Most students moved desks together or found common board or table space to collaborate. Some students were working independently on their white boards.

Some students seemed to be struggling with splitting the middle term as the form of factoring. A few students seemed to be discussing the problems with their partners. One student attempted to justify his reasoning to the whole class and then realized why he was wrong.

9:58 - One student came to the back of the room. She told the teacher that she had anxiety around what they were doing. The teacher walked over to help talk her through the process.

The teacher had another student explain a different method to one student who was struggling and the student seemed to understand afterwards.

10:01 – The teacher had a student explain her solution to the class and highlighted the commutative nature of the binomials.

The teacher then created another situation where the signs on the binomials were flipped and asked if that would also work.

Many students said no,
T: Why?
Students had trouble articulating a response.

10:05 – The teacher transitioned to factoring special cases.

Teacher was constantly walking around and checking student learning on boards.

10:13 – The teacher gave one more problem and told them that when they have it, they can put their board away. The teacher told some students to help others that didn't have it yet.

10:14 – T: Get out packet to grade.
Students were reviewing for their final. The packet was over trigonometry.
The teacher explained angle of depression and horizon. The packet had multiple choice questions.
The teacher provided reminders about labeling and gave students solutions to some of the problems. The teacher had the students record and grade their packets.

10:23 – The teacher gave a few minutes to silently and independently begin a review as their homework assignment.

Active Learning Incidents Observed: Y (limited to a few students discussing factoring during white board work.)

Flipped #1 Observation #5
Observation Start Time: 9:34am
Observation End Time: 10:26am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Students seated in 5 rows of 6. Administrator popped in to talk to the teacher. 22 students 10 girls and 12 boys. One lab assist in the back.

9:37 – The teacher passed out a factoring quiz and went over the solutions with the class.

9:41 - After students reviewed their quiz and made corrections, the teacher had them turn it back in.

Students who finished there corrections were told to work quietly and independently on an online final review for the rest of the hour.

Active Learning Incidents Observed: N

Traditional #1 Observation #1
Observation Start Time: 8:34am
Observation End Time: 9:24am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Students were working on two problem; a formative quiz over calculating volume of a rectangular prism and a right triangular prism.

14 students. 7 girls and 7 boys. 1 aide. Physical space 6 rows of 5.

8:44 – Teacher put an agenda on the screen for students: Volume prism practice, go over answers, distributive property practice - a few examples and whiteboards, start homework

Teacher walked around checking homework. Homework was algebra practice 1-15 listed on board. Teacher shared example below with the observer:

8:50 – Teacher collected quiz and reviewed solutions.
T: What is the base in the first one?
Some students said square. One student said that for it to be a square, all sides would have had to be the same.

Teacher pulled out 3D solids and said next week they are going to focus on cylinders, pyramids, and cones.

8:59 – Teacher transitioned to an Algebra review with distributive property.
T: We are going to use whiteboards. Examples are: -4(p-9) and -4m(3m-8).

Teacher discussed like terms. T: Whenever you multiply two letters together you're going to get a squared.

9:03 – Teacher transitioned to double distribution of (2p - 1)(5p + 6). Some students recognized this as FOIL.
Teacher covered up terms when distributing.

T: Questions?
One student shared her struggles with negatives.

9:11 – Students transitioned to whiteboard work. Students went up to the classroom whiteboards to practice examples.
T: Let's do 3 and then make a parentheses and then 5x + 2 and then close the parentheses". And then we'll check.
Teacher put 7a(2a - 5) on the problem for students to practice next.

Last example teacher put on the board for students to work out: (2x + 3)(4x - 1) and (7x - 2)(3x - 5)

9:23 – Teacher passed out homework and students worked quietly for the rest of the hour.

Active Learning Incidents Observed: N

Traditional #1 Observation #2
Observation Start Time: 9:34am
Observation End Time: 10:26am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Students set up in rows 14 students in the class. 6 girls 8 boys. 1 para or co-teacher (sat at the back the entire time until last 8 minutes when gave a student a post-it note showing what his assignment was for the day)

One boy came in late and was given a quick run-down of what he missed by the teacher and told to use specific formulas

Students had guided notes and the teacher modeled examples of slope. The teacher provided specific directions on when to write things down

T: This is where slope formula comes from and why we are doing this (provided an example)

Teacher asked questions. One student responded more than others. Teacher called on a couple others to get more participation.

T: Demonstrate with your arms the slope of the line given.

9:52 – Teacher transitioned to a video, but had technical difficulties getting it going. The video was called slope dude.

T: This is a very corny representation, but it's humorous

Teacher summarized at the end and told students that slope dude would help them remember.

9:57 – Teacher wrote equations of horizontal or vertical lines.

9:59 – T: Two more formulas and then we will practice.

The teacher gave students the midpoint formula and then told them they were going to move into distance formula.

The teacher worked a problem using the midpoint formula

10:05 – The teacher transitioned to working the distance formula

10:10 – The teacher gave students some guided practice over the distance formula.

10:14 - T: All you do is put the values into the corresponding formula on your worksheet

10:15 – The class then transitioned to homework time.

T: Pay attention you don't want to do too much math
The teacher told the students which problems to do.

Students worked quietly on problems

Active Learning Incidents Observed: N

Traditional #2 Observation #3
Observation Start Time: 8:37am
Observation End Time: 9:29am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Students in 6 rows of 5. There was an aide in the room. 15 students 7 boys and 8 girls.

The teacher reviewed and then told students there would be short quiz over parabolas.
The teacher gave students a choice of when they wanted to take a short quiz.

The teacher reviewed a graphing practice worksheet and then had the class do one with her

Teacher asked some questions and some students responded.

The teacher reviewed graphing parabolas
T: You always have to square a radius

9:00 – Teacher gave out a short quiz.
T: Work through the graphing practice worksheet when you're finished.

9:03 – The teacher brought two girls to the back of the room to go over stuff they had missed from being absent and then had them work examples.

Active Learning Incidents Observed: N

Traditional #2 Observation #4
Observation Start Time: 8:37am
Observation End Time: 9:29am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Teacher asked students to get homework out.

Students seated in 6 rows of 5. 8 girls and 8 boys. 16 students total. - 1 came in with 10 min left in class.

8:41 – The teacher reviewed homework with students and then explained "regular" probability

8:53 – The teacher began a lesson over conditional probability.

9:08 – The teacher gave a blank table and some data. The teacher asked students to try to put the data in the table where they think the first data set should go.

T: Does anyone want to come up and write it in?
One student volunteered.

The teacher then asked for another volunteer to fill in another piece, but told them they had to take a guess first

Another student came up to write in some data.

The teacher continued the same process for all data points and then had students fill in the totals with her guidance to complete the table.

9:12 – T: Lets do a couple of these and then you guys will practice on your own.

9:13 – The teacher gave them 4 problems to do on their own first and said if they finish those, then they should go back and try the others.
T: If you get stuck, raise your hand.

Teacher and aide walked around assisting students. Students were working mostly independently and quietly. Some students seemed to be talking about social things instead of math.

9:17 – The teacher began helping them as a whole class and re-explained some of the independent practice.

One student came in late (9:18)

9:19 – T: Remember to stay focused because we are almost done with the examples. Make sure you reduce your fractions as well.

9:21 – T: So, what do you guys think? Is it ok?
Some students nodded. The teacher gave them their practice and homework.
The teacher gave updates and reminders for upcoming classes.

T: Raise your hand if you get stuck.

Students spent the last 7 minutes working quietly and independently.

Active Learning Incidents Observed: N

Traditional #2 Observation #5
Observation Start Time: 8:37am
Observation End Time: 9:29am
Time Observed: 52 min
Observer: Ramaglia

Regular Geometry Class

Students seated in 6 rows of 5. 14 students 7 girls and 7 boys. One aide in the class sitting in the back of the room.

The teacher had the lights off. The teacher reviewed their homework and asked them for questions.

T: We are going to work on area and perimeter today. Next week, we are going to do one part each day of the homework packet and then spend some more time next week getting work time in.

8:44 – T: Get out your notes.
Students have a notecard that they can fill out for the final.

8:47 – The teacher transitioned to a review of perimeter and area. The teacher asked questions about perimeter and area.

The teacher showed some irregular figures. The teacher referenced some test taking strategies for the upcoming final. The teacher gave the students a few practice multiple choice problems.

9:10 – The teacher provided reminders to stay focused

The teacher gave problems that asked for area of shaded regions.

9:14 – T: How are you guys doing?
The teacher shared information about their homework.

9:16 – The teacher gave the students time to start homework. The aide walked around to assist. The teacher turned the lights back on. The teacher walked around to assist.

9:21 – T: Stop with the extra talking use this time to work.

Active Learning Incidents Observed: N

High School Site #2 Classroom Observations

Flipped #2 Observation #1
Observation Start Time: 1:50pm
Observation End Time: 2:40pm
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class.

Physical space - in rows. 30 students in the class. 15 girls and 15 boys.

Teacher pulled out geometric solids. Teacher filled a pyramid with aquarium sand and poured the contents into a prism with a matching base.

T: It will take three pyramid to fill up the prism.
Teacher demonstrated how it took 3 pyramid to fill up the prism.

T: Do you think with same area base and same height, would a cone fill up a cylinder the same way?

Many students said or shook their heads yes.
Teacher demonstrated that it did work.

Teacher attempted to pull up some more demonstrations, but had technology/Apple TV issues.

T: I was going to show a proof, but until the tech starts working, I am going to give out your homework.

Homework was a packet. Teacher said there was also a notes video that was 8 min long and ws all due on Friday.

Teacher said there would also be a pop quiz today.

1:17 – The teacher was able to get the technology working. The teacher showed a Peanuts cartoon about giving tests back.

The teacher showed students how to prove the formula for volume of a pyramid.

The teacher showed a picture she had taken of a pyramid built by cubes.

T: Can you tell me the volume of that pyramid?

Students shouted answers and teacher asked for strategies.

The teacher then showed a cube made up of blocks, then another constructed pyramid and then another cube. The teacher highlighted the patterning involved.

The teacher demonstrated how to use excel's fill down feature and showed the comparison between pyramids and cubes and highlighted that each time they were getting closer and closer to a 1:3 ratio.

Students were shouting for her to go to larger cube volumes.
S: Go to 600!
T: Will it ever go below .3333?
Some said don't know
T: Let's find out.

Teacher referenced a discussion of circles that they had before.

Teacher mentioned the idea of limits

1:31 – Teacher gave out a worksheet
T: We will talk about it first and then I will pass out the pop quiz.

The teacher discussed some topics on the worksheet and went over some of the questions on homework

The teacher gave them 30 minutes to work on their homework packet in groups of 2.

The teacher had the answer key for the worksheet at her desk for students to check their work.

Students were discussing problems on the packet in pairs and working together to solve.

2:00 - Students came up to the teachers desk to check answers. Teacher sat at the desk during this time.

2:05 – Class transitioned to a pop quiz.
T: Clear your desk except for a calculator and pencil. You can use your brown sheets.

Brown sheets have formulas on them.

T: When you turn in your quiz, pick up the notes page for the video.

S: Do we have to show work?
T: Yes, you have to show work.

Active Learning Incidents: Y (Peer-to-Peer Discourse during homework packet time)

Flipped #2 Observation #2
Observation Start Time: 1:50pm
Observation End Time: 2:40pm
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Students in rows. Teacher passed out papers to students. 29 students in the class. 15 girls and 14 boys.

1:50 – Students began a short quiz.

1:54 – Teacher shared a parallelogram cartoon and then asked students to trade their quiz papers with each other.

1:55 – Teacher read and worked the quiz problems under her document camera to show answers.

The quiz was a vocab quiz.

T: 4s raise your hand
Students who got all problems correct raised their hand
T: pass them forward

1:56 – T: get out your homework. What questions did you have on the hw?
The teacher worked problems that students had questions on.

2:03 – The teacher transitioned to having the students take notes and referenced that they should have taken notes over the weekend.

T: Get in note-taking positions.

T: Who has a strategy for this problem?
A student shared their strategy and then the teacher asked focusing questions.

Had students change one of the problems.
T: How do we do this one?

The teacher asked more questions and many students responded chorally.

T: When you figure out why this works, raise your hand.

2:27 – The teacher gave out an assignment

Students worked independently and quietly on the assignment. The teacher encouraged quiet worktime.

Active Learning Incidents Observed: N

Flipped #2 Observation #3
Observation Start Time: 10:30am
Observation End Time: 11:20am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

The teacher started with a cartoon about algebra.

Students seated in 6 rows of 5. 18 students in the class. 10 boys, 8 girls.

The teacher asked for questions and then gave out a pop quiz to begin the class

10:32 - Students worked on pop quiz

10:36 - Students traded papers to grade. Teacher put copy of the quiz on the screen and worked all problems out on the quiz and explained each one while students were grading.

10:39 – T: raise your hand if got 3 out of 3.

T: On the count of 3 say the number of the one you had the most trouble on.

In unison, many students said #2 and 6.

10:40 – T: Pass those forward.

10:41 - Students had notes to take during video for homework over the weekend. Teacher showed them her key so they could compare.

Teacher seated at desk using the document camera

10:43 – Students turned in notes.

T: I graded your tests and I might pass them out at the end. They were medium.

The teacher read the names of students who did not turn in their packets of notes.

10:44 – T: Work on your worksheet for the rest of the hour. Turn it in if you get it done. Before you leave, pick up notes for tonight to go with the video.

The teacher mentioned there would be a pop quiz with some algebra concepts in the future.

10:46 - Students began working on worksheets in groups. There were 4 groups. 3 groups of 4 and two groups of 3. 3 students chose to work independently.

10:56 – The teacher posted the worksheet key on the board for students to check. One student that was working independently got up to confer with another student that had been working in a group.

Active Learning Incidents Observed: Y (peer to peer discourse and collaboration)

Flipped #2 Observation #4
Observation Start Time: 1:50pm
Observation End Time: 2:40pm
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Teacher started with a cartoon.

Teacher seated at desk and working off Mac and doc camera

Students seated in 6 rows of 5. 29 students total. 17 girls and 12 boys.

T: Get out your homework paper.
The teacher began going over some of the homework problems.

Some students asked questions for teacher to go over.

1:57 – The teacher transitioned to passing back papers and a test they took

2:02 – The teacher took questions over ones students missed on the test and worked out problems for them to see

2:07 – The teacher collected the tests and asked them to clear their desks

2:11 – The teacher passed out a worksheet and modeled it up on screen.

The teacher asked for students to identify if there was one solution, no solution, or infinitely many solutions to the problems and had them chorally respond.

The teacher reviewed three methods to solving systems of equations.

Active Learning Incidents Observed: N

Flipped #2 Observation #5
Observation Start Time: 10:30am
Observation End Time: 11:20am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Students seated in 6 rows of 5. 18 students 11 boys and 7 girls. 13 consent forms returned, 2 nos

The teacher began class with a cartoon

The teacher reviewed a worksheet with students and asked questions. The teacher modeled some of the problems using a doc camera.

10:38 – The teacher reviewed worksheet number 2 and discussed the hope that they all used Desmos as a tool when completing this. The worksheet focused on a series of proofs.

10:41 – The teacher transitioned to giving out a pop quiz
T: After the pop quiz, pick up notes and worksheets and then turn your desks around so you can start working on the video.

As some were finishing, there were notes on video for them to watch on MacBooks and students worked independently to follow along with the video, take notes, and work examples.

Active Learning Incidents Observed: N

Traditional #2 Observation #1
Observation Start Time: 7:40am
Observation End Time: 8:30am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Physical space set up in groups of 3. 20 students. 11 girls 9 boys.

Teacher wrote volume problems on the board and students worked on white boards. All working quietly and individually.

First problem given was finding the area of a triangle given an apothem and using exact roots.

Problem 2 was a pentagonal prism and they are looking for volume.

Teacher gave students a couple minutes to process and then discussed.
T: What could we do?
Pulled out triangles from the figure and discussed 5 congruent triangles.
Teacher used law of sines to solve.

Teacher began working on pentagonal pyramid next using what they had talked about with the prism.

Teacher circulated and checked while students were working.

8:07 – Teacher had students put their whiteboards away and then she pulled out some physical geometric solids.

T: Today we are focusing on cones. What's different between a pyramid and a cone?

Teacher pulled out the nets from the inside of the figures to demonstrate differences.

T: How does it compare to a cylinder?

Some students highlighted that they were able to see that it was about a third.

8:10 – Teacher had students get out packets and attempted to pull lesson up on the screen (technical difficulties). Once she was able to get it pulled up, she had a SmartNotebook lesson with visuals to display.

Teacher gave students the formula for volume of a cone.

The teacher showed an example with cones turned in different directions and guided them through the first one's properties.
The teacher had students practice a couple to see what they come up with.

T: How did you begin?
S: I used Pythagorean theorem.

Example 5 on the board showed a nested cone where the middle was missing. Teacher said they would talk about it but some students were already working.

T: Help me get started somebody.

8:24 – T: Work together on the cone worksheet.
Teacher circulated.

8:32 – Teacher gave students cone and cylinder combinations. She reminded them of the rule same base and same height.

Teacher gave 45 seconds to get to a stopping point so they could talk about spheres.

8:34 – T: We don't calculate surface area of a sphere in here, but that formula is useful to help you figure out the volume formula for a sphere.

Teacher showed a 37 second video that showed someone taking the peel off an orange and tearing it up to cover 4, 2-Dimensional circles that had been traced by the original orange. The video showed that is why Surface Area of sphere $=4\pi r^2$.

The teacher then showed a longer video to demonstrate volume. The video showed a derivation of volume of a sphere made up of pyramids with square bases.

Students then worked some more complex sphere problems (half sphere connected to open cylinder spheres inside a cylinder, etc.)

Teacher showed a canister with cylinders and asked if they touched the top.

8:58 – T: It looks like you all are mathed out.

Active Learning Incidents Observed: N

Traditional #2 Observation #2
Observation Start Time: 7:40am
Observation End Time: 8:30am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Physical space - students in groups of 3 where desks are turned towards each other. Not all complete groups. 22 students in class 15 girls and 7 boys.

Roles written on board - A-M dry erase markers, N-Q graph paper, R-Z tissue.

Students working on a warmup.

Teacher asked questions about the warmup
Students were discussing the answer in their groups and working on white boards.
Students were also chorally responding in some cases.

Student math conversations during warmup - after each problem, student conversation in groups (3 so far) - not all groups talking, some working independently.

Teacher circling and checking.

T: talk with your tablemates and agree or disagree.

Teacher brought the conversation back to the large group.

T: Someone give me an argument.

8:02 – T: Turn in whiteboards and take out your circle packet

Teacher reviewed a guided practice worksheet that had some challenge problems.

8:20 – Teacher posted more for homework on her google classroom site along with 2 extra credit problems.

T: You need to work together and there needs to be work or I will assume that got them from someone else.

Teacher gave students 10 min to get started.

Active Learning Incidents Observed: Y (Peer-to-Peer Discourse during the warmups and challenge problems)

Traditional #2 Observation #3:
Observation Start Time: 7:40am
Observation End Time: 8:30am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Students sat in groups of 3 and used whiteboards to complete board work.

22 students 16 girls and 6 boys.

Students discussed some of the work quietly and had conversations about the math

7:52 – The teacher had students come to the board to complete the work they came up with.

7:55 – T: See if you can answer these questions on parabolas.

T: What is the p value and how do you figure it out?

One student explained her thinking.

T: What's the definition of the p?

The teacher continued to review board work

8:03 – T: Erase your whiteboards. There is a graph on your worksheet.

The teacher put worksheet sample up on the screen. The teacher asked questions and students followed along.

The teacher guided them through parts of the worksheet and then focused them in on one of the problems

T: Write it down and whisper it at your table.

8:16 – The teacher reviewed the weekend homework assignment

8:17 – The teacher then distributed a circle quiz.

Active Learning Incidents Observed: Y (peer to peer discourse at beginning during warmup)

Traditional #2 Observation #4:
Observation Start Time: 7:40am
Observation End Time: 8:30am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Students seated in groups of 3. 16 girls and 5 boys - 21 total

Formulas were on the board to highlight similarities between equation of a circle and the distance formula.

T: Why would those look so similar?
S: They are the same
T: They are the same, why do you think that is?

7:44 – Class transitioned to taking out a packet. Problems in the packet were asking students to determine if a point is on a circle.

The teacher worked through problems in a guided practice activity.
T: Talk with your group about what would happen if the point was on the circle.

8:05 – The teacher gave students time to work on a couple of problems on their assignment while she added questions she wanted to add to part of the lesson. Students worked mostly silently on their assignment problems.

8:07 – The teacher altered the assignment slightly

Active Learning Incidents Observed: Y (peer to peer discourse - limited opportunity,two chances to confer in groups around isolated problems)

<u>Traditional #2 Observation #5</u>
Observation Start Time: 7:40am
Observation End Time: 8:30am
Time Observed: 50 min
Observer: Ramaglia

Honors Geometry Class

Students seated in groups of 3. 22 students 16 girls and 6 boys.

Teacher went over properties of shapes on board.

Students copied properties quietly and some responded to questions posed by the teacher.

7:54 – The teacher transitioned to a proof problem and engaged students in guided practice.

7:56 – T: Talk at your table. How will you do this?

7:57 – T: Give me input

7:58 – T: Go ahead and work it out
Students worked independently

8:00 – T: Solutions?
Some students provided some solutions that they came up with.

8:07 – The teacher transitioned to giving a quiz

Active Learning Incidents Observed: Y (limited peer-to-peer discourse during the specified table talk time)

Middle School Site Classroom Observations

Flipped #3 Observation #1
Observation Start Time: 8:45am
Observation End Time: 9:30am
Time Observed: 45 min
Observer: Ramaglia

PreAlgebra Class

Class setup - 7th graders, seated in groups of 2, 24 students, 16 boys and 8 girls. One blind student with a para. Physical space designed for student collaboration.

On screen: 1. Write down tonight's homework: Mean Absolute Deviation (WBP only)
2. Work on PreAlgebra Khan mastery task

Students at 1:1 iPad and using that for Khan mastery task. And using for classwork (mostly in Notability)

Teacher asked students to open up homework in email. Referenced video to watch that some didn't watch. Reviewed most missed problem. Showed dot pot for number of pets and calculated mean from the dot plot and mean from the dot plot.

Next dot plots are comparing two plots one dogs and one cats. By visual inspection which has higher mean. Found mean cats and dogs (but used decimals). T: (Talked spread) which is more spread out.

Did another comparing dot plots and talking reasonableness of measurements and which measure of center is most appropriate. Discussed outliers.

One student coloring on iPad.

8:54 - Gave them a must do (day 2 of project), can do (mean plot challenge with or without partner), if finish both work on khan mastery tasks. Called a group to work at the back with her. Groups were listed on the board. Group work with teacher was asking them to calculate mean and median/reinforcing some preskill and current skill work.

Context is meaningful. Students are discussing their must do work and completing on iPads.

Learning target is posted, class work is posted, homework is posted

9:05 - switched groups. Focus on giving a statement to compare the two dot plots

While group 2 was working, teacher circulated to assist some that needed assistance on their project. Project allowed for multiple entry points

Groups were working off of an overhead at the back so that the front screen and projector could be used for the large group.

9:13 - called a third group to work with her at the back.
Asked for agreement
Class was split into 3 groups, teacher was able to meet with all three groups in the course of a 45 min class period.

Teacher modeled clear explanations. Students used precise language.

Small group lessons were tiered but within the same objective (fluidly moving between levels of blooms)

Teacher continued circulating to make sure students stay on task with their must do assignments.

Students coming in late seem to know and understand the expectations and are getting right to work.

All problems are in context.

9:22 – teacher announced that she was coming around to look at classwork. The expectation was that day 2 is finished and if it was not, then they have extra homework.

Circulated to inspect projects and gave some reinforcement and praise.

Checked in on a group who had some attendance issues.

Gave last 5 minutes to finish working.

Active Learning Incident – Y (PBL for statistics project, and Peer-Peer Discourse ongoing throughout the class time)

Flipped #3 Observation #2
Observation Start Time: 11:25am
Observation End Time: 11:55am
Time Observed: 30 min
Observer: Ramaglia

PreAlgebra Class

Class began at 11:10 so students were already in pairs of 2 working on iPads. Some were on IXL. Teacher was circulating but then called group 3 to the back with her.

T: if you are not getting these right, now is the time to say hey partner I'm not getting these right.

Students are talking in their pairs and explaining the problems to each other.

This teacher is also having them create a study guide as a review for a quiz, but students are collaborating.

Teacher has an "I can" posted on the board (I can find the probability of dependent and independent events)

Students with teacher are working probability problems on whiteboards.

23 students in the class. 6 in the group with her. 11 girls. 12 boys.

S: I need help
T: Have you asked your partner first?
S: No
T: Ok do that first please.

Lots of praise and checking individual students work. Reminded that if they finish they can go to study guide.

11:41 - called the next group to work with her. 8 students in this group.

T: start on the side with the turtle.

As they are starting, teacher is circulating to check in with those at their seats.

Active Learning Incidents Observed: Y (Peer-to-Peer Discourse)

Flipped #3 Observation #3
Observation Start Time: 2:57pm
Observation End Time: 3:45pm
Time Observed: 48 min
Observer: Ramaglia

PreAlgebra Class

Students seated in pairs working on a graphing project. Class does not begin until 3:00, but students are in early to work on their project. They are asking each other questions. The teacher is circulating, but when students ask for help she asks them if they've talked to their partner yet. Classical music is playing in the background.

Teacher called a group to the back of the room and having them work on reflections. 7 students in the group. Teacher asked the students a question in order to have them predict, then asked if people agreed with the predictions.

15 students in pairs of two working on the project around the room. Project was to graph and reflect their first name.

22 students. 10 girls and 12 boys

Student explaining their thinking to each other: I reflected the first point of the triangle first to get started and then the others. S: I moved the first point to (-2,5)

3:07 – Teacher pulled a new group to the back of the room. New group has 7 students.

Some students had to leave for sports.

As group began working on task at back, teacher gave the rest of the students a reminder about labeling while working on their project.

As students are finishing with their group work and graphing project, they were told to transition to independent practice for homework.

Teacher continually circulated to answer questions and check on students who were working independently.

When several groups finished up, the teacher pulled them into different groups to play a game using dice. Students were to use the dice to determine translations on a figure.

S: What do we do if we don't know how to do one (transformation).
Teacher encouraged them to try a different one at that point.

Students all working on different things, whether it be on the game, their project, or their small group work.

As more students finish, the teacher added them to the dice game and told the other students to teach them newcomers how to play.

Observation ended at 3:43

Active Learning Incidents: Y (Peer-to-Peer Discourse and explaining their thinking to each other, modeling activities performing rotations of their own design)

Flipped #3 Observation #4
Observation Start Time: 8:45am
Observation End Time: 9:15am
Time Observed: 30 min

Observer: Ramaglia

PreAlgebra Class

Students seated in groups of 2. 15 boys 7 girls. 22 students total.

Teacher reviewing geometry concepts with students.

Students on an altered schedule for an assembly

8:55 - asked for last minute questions.

8:57- had put privacy folders up. Passed out quiz. Teacher told them to finish what they can, but that they will have time to work on the quiz tomorrow if needed because of the shortened day.

Students worked independently on a quiz over geometry concepts.

Active Learning Incidents Observed: N

Flipped #3 Observation #5
Observation Start Time: 8:45am
Observation End Time: 9:30am
Time Observed: 45 min
Observer: Ramaglia

PreAlgebra Class

Students seated in groups of two. Teacher allowed students to change seats today.

Directions on the board: find new seat, write down homework and set an alarm, khan academy.

Teacher gave direction to work on khan for another minute or two (using it as a warm-up)

Learning targets posted on the board. Class work listed as constructing triangles.

23 students in the class. 8 girls 15 boys. One blind student aided by an adult.

8:50 – Teacher transitioned to explaining instructions for constructing triangles project. Teacher Asked questions about what students think certain measurements mean (inches, degrees).

Teacher gave the direction: measurements have to be constructed in the order on the card.

T: Some of these you might have to play around with until you can get it to work. When you think you have a triangle constructed, come put it in the folder with the matching measurement label.

8:53 – T: One partner open up today's class work (few technical difficulties and working on link). Other partner come get a pair of scissors, a protractor, a ruler, and two pieces of paper.

T: When you get a triangle made - go put your triangle in the folder connected to the one made (for example, if you made a 7-7-7 triangle then put it in that folder)

8:55 – Class transitioned to partner work.

8:59 – Teacher stopped to do a mini lesson on how to use a protractor since some students seemed confused on how to use the tool.

Teacher walked around to answer clarifying questions. Teacher praised accuracy of labels and language students were using when discussing with their partners.

9:11 - Some students noticed that they couldn't make a 45-45-45 triangle. S: It doesn't add up to 180. Teacher acknowledged that was correct and changed the construction to 60-60-60

One student said they made a 45-45-45. T: How did you do it? The student began looking it over and then realized his mistake.

Teacher shared one last construction that she mentioned to the observer was intentionally impossible in order to help lead the students into discovering unique triangles.

S: How do you do it though?

T: I don't know what do you think

9:19 - students finished up the construction of all their triangles and cleaned up materials.

9:20 – T: if you're a girl and your triangles are put away come sit in the front row. If you're a boy now come sit.

9:22- Teacher pulled out the triangles. T: We need to decide now if the criteria given creates 1 triangle, we all made the same one, infinite triangles, they are all different, or no triangles, no one was able to construct one.

Teacher selected all triangles from a folder and asked if they were all the same or if they were different. Teacher told them to turn them and figure out if it is the same triangle over and over- T: This construction was a Side-Angle-Side and that makes how many triangles?

Multiple students responded that it made only 1.

T: Next we have Angle-Side-Angle. Can you predict for me if it will make 1 triangle, infinite triangles, or no triangles?
Some said infinite.
T: We had some oops on these, but still makes 1

T: Angle-Angle-Side. Guesses?
Some said infinite
T: looks like different ones, but it's supposed to be 1, but measuring this one was hard.

T: Side-Side-Side.
Some guessing 1 and some guessing infinite
T: looks like 1 triangle

T: Angle-Angle-Angle.
Some guessing infinite and some guessing 1
T: Are all the same? No - this one is infinite

T: Last one - everyone says it's impossible and there were no triangles in the folders.
S: It wouldn't connect and wouldn't make one. Every two sides have to be bigger than that third side.

9:29 – Teacher sent students back to their seats and gave a reminder about tonight's video and homework.

Active learning incidents Observed - Y (peer-peer discourse, modeling activities, problem based learning to get at unique triangles, making predictions as part of the problem)

Traditional #3 Observation #1
Observation Start Time: 9:34am
Observation End Time: 10:19am
Time Observed: 45 min
Observer: Ramaglia

PreAlgebra Class

Class setup: students in 6 rows of 5. Directions up on projector screen. Physical space more conducive to lecture based instruction

Warm-ups: 1. Which measure of central tendency best describes your data from yesterday? (Mean, median, or mode) Explain why.

2. Explain why **mean** doesn't work if there is an outlier

Teacher directed students to get homework out (pg. 609) and that she needs to see it. Homework tonight is pg. 614 4-6 and pg. 615 1-3. Quiz next Wednesday. Learning target posted at the bottom of the board.

Teacher circulated and checked book homework for completion. Some students used iPads to answer warmup questions.

24 students, 11 girls 13 boys.
9:37 – Teacher reviewed warmup. Teacher referenced that they worked in groups yesterday.

T: Discuss with your partner #1 first and then we will share back. Some were discussing and some were not.

Teacher asked a student what they chose.

S: (chose) mean because it was talking about age and it ranged from 22-30.

Another group was said they looked at experience and there were lots of outliers but also selected mean,

Teacher highlighted that they would want to use median and then asked a student to explain why. Student talked about skewing data.

9:41 - check homework. Put answers on the board for students to check their own. Asked if students had questions. One student asked about rounding. Teacher said she doesn't think they discussed how to round.

Had them score - put how many correct out of 20 and in a place where she can see it. Teacher walked around again (9:44) to check scores. Teacher asked a student if he figured out one he missed after he went through it. Student said yeah.

9:45 – T: today we are going to talk about frequency tables. This is another way to organize and display data. Let's use letters in last name. Then we will tally. (Had students raise hands for how many letters in last name.)

T: Now on frequency (in the chart) go ahead and write the number. On homework you don't need to have the tallies, I won't require that.

T: Now we are going to use this data to make a dot plot (plot displayed was a line plot).

T: What is easier to read, dot plot (referring to line plot) or the frequency table?

S: Dot plot because it's more visual.

S: Mode is easy to find.

One student asked if would use all numbers on the number line to determine median or just where Xs are. Teacher she would go with lowest data point.

Teacher demonstrated how to get median. T: What else do we see?

Student noted an outlier.

T: Next we want to display data with a histogram. (Showed how to create this histogram).

9:55 - practiced another frequency table and histogram, teacher questioning from time to time.
Teacher asked for observations. Few students responding.

9:57 Independent practice –
T: Using data from yesterday, create a dot plot for both teams. (Talked about how to create appropriate intervals and then they are going to compare the two).

One student asked if they should use dots and teacher said it's called a dot plot, but we are going to use Xs.

10:00 - students worked independently on displays

Active Learning Incidents Observed: Y (Discourse – limited 2 min)

<u>Traditional #3 Observation #2</u>
Observation Start Time: 11:10am

Observation End Time: 11:40am
Time Observed: 30 min
Observer: Ramaglia

PreAlgebra Class

24 students in the class. Sitting in rows, using iPads for hw review. 10 girls 14 boys. I can objective on board: I can understand the probability of a chance event is a number between 0-1.(7.SP.5)

11:14- Teacher provided reminders about hw and testing apps needed. Teacher wenrt over hw.

Some students asked the teacher to work examples from hw that they didn't understand.

Teacher then walked around to get hw scores. Teacher asked questions like do you know what you did? When students showed that they had missed a problem on homework. Teacher reminded students that they can correct hw

11:19 - having students go to her "classroom" online. Teacher asked them to work on Khan academy links.

T: Do some problems on each of the links (about 4 or 5) from each. Make 15 and then work on the study guide.

Teacher mentioned that today is a review for the quiz day

Students are independently and quietly working on khan academy on their iPads while the teacher circulates to answer any questions kids might have.

Active Learning Incidents Observed: N

Traditional #3 Observation #3
Observation Start Time: 2:11pm
Observation End Time: 2:56pm
Time Observed: 45 min
Observer: Ramaglia

PreAlgebra Class

Warmup on board - graphing two different triangles on two different graphs. Direction to students: can graph on paper or iPad.

Students in rows, 6 rows of five Teacher giving directions about warmup and checking to see if homework is complete. 23 students. 8 boys 15 girls

2:16 - transition to going over homework. Students grade their own. Answer key posted on the board.

Students asking questions and teacher explaining.

Walked around to collect student scores on homework. Students off task and chatting about things other than math while teacher walks around. Teacher gave direction to finish warmup if didn't have it done to discourage off task behavior

2:23 - teacher worked out the warmup for students to compare their work to

Transitioned into lesson around rotations. Teacher put notes and definitions on the board. Teacher asked questions. Teacher provided direct instruction. Teacher doing most of the talking.

T: Use the formula to rotate these points
Teacher gave various formulas in order to perform different rotations (180, 90, etc).
Teacher worked some, asked for questions

T: I'm going to walk you through some more.

Student asked if should rotate clockwise or counterclockwise and teacher said counter

2:36 –
T: Questions? There are our rotations.
S: How do you get the formula?
T: It was given.
S: I don't get how this happens.
T: Just watch this and in our formula it says this (shows the procedure)

Teacher asked for questions again

T: I have a couple questions for you.

Had students identify the translation on some problems on the board.

2:47 – teacher passed out a worksheet with graphs to practice 90 degree rotations and 180 degree rotations. On the back side of the worksheet, the direction was for students to create a quadrilateral and rotate it 90, 180, and 270.

2:51 - students worked silently and independently. Some students raised their hands to ask teacher for help when needed.

Teacher announced that she did not give the formula for 270 and wants them to figure it out. Teacher gave a few hints.

Active Learning Incidents Observed: N

Traditional #3 Observation #4
Observation Start Time: 9:17am
Observation End Time: 9:47am
Time Observed: 30 min
Observer: Ramaglia

PreAlgebra Class

Students on shortened schedule for event this afternoon.

Students seated in 6 rows of 6.

Teacher had homework up on the board for students to grade themselves. 26 students 14 girls and 12 boys.

Teacher shared that they were going to take a quiz and they will need as much time as possible since the class is shortened. Teacher mentioned that if they don't finish they will have time to finish tomorrow.

Teacher took attendance, then asked students to show their study guide (all on iPad). Teacher walked around to check for completion. Teacher gave praise for good work that she saw.

9:22- Teacher transitioned to answering any questions students had over the homework.

9:26- Class transitioned to taking a quiz. Some students got up to get supplies (rulers and colors) teacher told them they didn't need colors for this. Students worked independently.

9:44 – Teacher had the students pack up and turn in what they've finished by "number" and then said that they will finish tomorrow. Teacher gave reminders about a project due tomorrow.

Active learning incidents observed - N

Traditional #3 Observation #5
Observation Start Time: 9:34am
Observation End Time: 10:19am
Time Observed: 45 min
Observer: Ramaglia

PreAlgebra Class

Students seated in 6 rows of 5. 24 students 9 boys and 15 girls.

Directions on board to return signed parent letters. Teacher told students to get a calculator. Transformation project with question marks listed on the board - due tomorrow.
Two standard algorithm proportions on the board for warmups.

Teacher gave reminder about homework. Learning target posted.

9:35 – Teacher passed out quizzes for some students to finish and then went over the warmup on the board.

Teacher asked students what they got for x on the first one. Then asked how they solved. Teacher set it up as an equation. Teacher moved on to number two and went through the same process.

9:40 – Teacher transitioned to indirect measurement for similar triangles. Teacher worked through notes with steps for students and had them follow along.

One student caught teacher's mistake on multiplication.
Teacher showed two different setups and how both would yield the same answer.
T: Questions?
No one had questions

9:43 – Teacher gave another figure that showed a more complex set of similar triangles joined by a transversal . Teacher told students to setup the problem on their own and try it. Teacher told the students to pay attention to the tick marks that mark corresponding sides.

9:44 – T: Check with the person next to you to see if you agree.
Some students checked with partners.

9:45 – Teacher asked how she should setup the problem and then went over the problem. One student explained the process using mathematical language.

9:47 – Teacher gave students similar trapezoids and had them find the missing side. Gave them 1 minute and then went over the problem

9:50 – Teacher moved to indirect measurement with shadows. Teacher showed them the notes and a couple students picked up on the formula quickly.

Teacher gave a second example and told students that they want to find the height of the tree.
T: What does the solution tell us?
S: The height of a tree.

Teacher gave students another, similar problem.
T: What is the height of the flagpole? Check with person next to you to see if you agree.

9:55 – Teacher transitioned to scale on a map proportion problems.

9:57 – T: What are the three types of problems we talked about that you could use proportions to solve?
S: Is it related to Pythagorean theorem?
T: It could be.

9:58 – Teacher passed out graded quizzes and gave students time to begin their homework over the days lesson.

T: I will be calling you up to conference about your transformation project.

Active learning incidents observed - Y (2 min - talk to person next to you to see if agree 2 times)