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Flipping in a Technological Rich Classroom

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Flipping in a Technological Rich Classroom

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Abstract

The purpose of this study was to explore eighth grade students' perception of a flipped classroom environment. It is difficult to engage and motivate eighth grade students. This study was created in order to determine if a flipped classroom would spark more interest and therefore eventually lead to an increased ability. More specifically, this study investigated how students perceive their learning is progressing in a flipped math classroom, and how engaged are they using the technology compared to the traditional classroom setting. The classroom environment was switched to a flipped classroom at the start of a new unit in October. At the conclusion of the unit, three weeks later, a survey was administered to gauge students' perceptions. The survey evaluated students' perception of their learning, the time spent, use of videos and a few questions specific to the flipped classroom approach. Individual interviews were also conducted at the conclusion of the study. This approach provided students an opportunity to share their thoughts and opinions in their own words to gain a deeper understanding of their experiences. The findings of this study support the research regarding the benefits of a flipped classroom. Students in the eighth grade class felt that they were engaged and communicated more with the teacher than in the previous unit which was not flipped. Students responses to the surveys indicated that they enjoyed learning at their own pace and found the at home video learning beneficial.

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Chapter 1 – Introduction

An observer in a traditional classroom would notice the teacher in front of the room providing information and the students taking notes. At the end of the class the students leave with a homework assignment that is due the next day. Upon returning to class, homework is collected and questions are discussed briefly before moving on to the next lesson. Even though the instructor may know that some students are struggling or have more questions, there is very little time to discuss them without falling behind. Many educators have been striving to change this traditional lecture-centered model by looking into another practice of teaching called flipped learning. Instruction for flipped learning makes use of technology in the form of videos to provide instruction that students are able to watch at home at their own pace. Then the students come into class to practice what they learned. By teaching in this way, the can spend more time helping struggling students while at the same time inspiring others to be involved in more challenging activities relating to the material.

Researchers who have studied the effects of differentiation on student achievement universally agree on its positive impact (Beecher & Sweeny, 2008; Konstantinou-Katzi, Tsolaki, Meletiou-Mavrotheris, & Koutselini 2013; Subban, 2006). Differentiation is not just for special education students or for English language learners. Teachers are constantly struggling to find a way to engage, motivate and improve all their students understanding and differentiation can help. In addition, children today are online daily. According Lenhart, Kahne, Middaugh, Macgill, Evans, and Vitak (2008), at an even higher rate than the 72 percent of American-adults who report daily online usage. In the past seven years, online access has become more convenient and students are immersed in technology daily. According to Wenglinsky (2005) teachers should “take for granted that students will use computers in a variety of ways to

complete the assignment” (p. 32). Research has found that when educators integrate technology into their daily classroom lessons, student achievement is increased. When the flipped classroom method is employed, technology integration occurs naturally.

There is little rigorous empirical research on the effects of flipped learning on student achievement. According to the Flipped Learning Network (2013), “in general, teachers who are flipping their classroom report higher student achievement, increased student engagement, and better attitudes toward learning and school.” (¶ 6). The key components of flipped learning are built on research based educational practices. These four components are flexible environment, learning culture, intentional content, and professional educator (Hamdan, McKnight, McKnight, & Arfstrom, 2013).

Context Information

The result of the flipped classroom culture allows for student to be actively involved. Hamdan et al. (2013) stated that 100% of the educators surveyed agreed that learning became more active after flipping their classrooms. In my eighth grade math classes, I struggle to keep the students engaged. I actively use manipulatives, technology, real life problems, small groups, projects, stations and any other methods I can think of to engage my students. Unfortunately, math is often not a favorite topic of the students and many often have already formed often false predetermined notions about their mathematically ability. Many students see no point to learning math, feel they aren’t good at it and are either anxious about the challenge or shut down rather than apply effort. Meece and Wigfield’s (1990) study showed that math anxiety is directly related to students perceived math ability. After reading about a flipped classroom and briefly trying the approach in a few classes last school year, I began to wonder if that method of instruction would aid my students. If the eighth graders are more involved, they would learn

more. If the students are learning more, it stands to reason their perception of math would change. Therefore, I decided that the students' perception of their learning and involvement in the class is one area that needed further investigation. This study is needed to determine students' insight of a flipped classroom approach in an eighth grade math classroom.

The research took place at an elementary school located in the small rural town of North Canaan, Connecticut with a population of approximately 3,350 people. The public school is located in the rural northwest part of the state that is geographically isolated from the diversity found in cities. The school serves approximately 315 students in grades pre-kindergarten through eighth grade. The physical building of the school is thought of as similar to other school buildings within the region. The classroom in this particular study contained a *Smart Board* and students had access to a computer cart. The cart is equipped with enough *Chrome Books* for one to one use by each student. The classroom also has Wifi Internet access although the broadband is at time inconsistent and weak.

Thesis Study

The participants in the research study came from two eighth grade math classes. The class followed the Common Core Standards for the same grade. The students are heterogeneously placed in these two classes. The ages from of the students in these classes range between 11 and 14. The average class size was 12, which is a little smaller than the average class size of the school. The classes were made up of about the same number of male and female students in each class. None of the participants have ever participated in a flipped classroom. As a result, the participants in the study experienced an academic class using techniques associated with a flipped classroom for the first time.

The purpose of this study was to explore flipping a math classroom. More specifically, this study will examine how students perceive they are doing in a flipped math classroom, and how engaged are they using the technology compared to the traditional classroom setting. This purpose lends itself to the following research question:

1. What are students' perceptions of a flipped math classroom?

I have decided to use a case study methodology for my research design because my research question focused on a better understanding of the experiences of the students in this class (Merriam 1998).

Overview of this Thesis

Chapter One provided a brief overview of the rationale for why the study was needed. It also provided a brief introduction of the study including the purpose, question, and the methodology used. Finally, Chapter One also informed the reader of the location of the study and background information on the study participants.

Chapter Two provides a more in-depth look at flipped learning including an outline of the current literature relating to differentiation in a classroom and the benefits it can bring. This chapter also reviews literature related to technology integration in classroom and its effects. Next, the chapter review research regarding the flipped classroom method of teaching. After, the chapter discusses the use of flipping as a means to help educators differentiate. The following discussion is in regards to differentiation, technology and flipping. Lastly, there is a brief summary of the research and its connections to this study.

Chapter Three explains the design of the case. A case study methodology was used in the study. As the research question that I answered was designed to explore and understand students' experiences in a middle school flipped mathematics classroom, using a case study was

an appropriate methodological choice. Next, the chapter provides more depth information about the case. Data collection methods are also discussed with a focus on surveys and interviews. Following that information, Chapter Three also reviews the method used to analyze the data. A quantitative analysis and qualitative analysis are utilized. Lastly the chapter address is issue or reliability and validity.

The focus of Chapter Four is to review the results and discuss the study. The results are discussed as the quantitative results and then the qualitative results. This chapter also discusses the advantages and disadvantages of flipping an eighth grade math class. In addition, in this chapter there are additional notes in regards to observation and information gathered through the survey or interviews of participants.

Chapter Five provides an overview of the thesis and the study. It summarizes the case study, research, and findings. In addition, the chapter touches on recommendations for teachers in the field who are interested in flipping their own classroom. Lastly, it discusses suggestions for future research.

Definition of Terms

Blended Learning: an approach to teaching in which students are instructed through traditional methods alongside digital or online material at their own pace

Differentiation: an adjustment of curriculum, assignments, and method of teaching in order to instruct students at their own personal level of learning.

Flipped Classroom: a practice of teaching where traditional classroom lessons are transformed into homework assignments typically through the use of videos, apps, or websites. In classwork becomes the practice and application of learning that traditionally was completed at home.

Zone of Proximal Development: the notion that more learning takes place when the activity is slightly above the students' comfort level.

Chapter 2 – Literature Review

A lecture-centered classroom where the teacher stands in front of the room providing information on a white board and the students are sitting at their desks taking notes is a common practice. At the end of the class the students leave with a homework assignment that is due the next day. Upon returning to class, homework is collected and questions are discussed briefly before moving on to the next lesson. Even though the instructor may know that some students are struggling or have more questions, there is very little time to discuss them without falling behind. Many educators have been striving to change this lecture-centered model by moving from the pacing of the curriculum to using the needs of the students as a guide for instruction. Teachers have looked to another model of teaching called flipped learning to better meet their needs. Instruction for flipped learning makes use of technology in the form of videos to provide instruction that students are able to watch at home at their own pace. Then the students come into class to practice what they learned. By teaching in this way, the teacher can spend more time helping struggling students while at the same time inspiring others to be involved in more challenging activities relating to the material.

The methodology employed to gather research is as follows. First, the database used was *Educational Resources Information Center (ERIC)* with the keywords of technology, technology and education and differentiation. *Education Complete* was also utilized with the keywords technology and education and differentiation. *Educational Library* with the key words of technology and education and differentiation, and technology and education and differentiation and math was engaged. *Google Scholar* was employed with the keywords technology and education and differentiation and math and technology and education and differentiation and math and achievement. Articles were excluded that did not include relevant and recent data on

differentiation, technology, or flipping. Lastly, articles were reviewed for their reliable information and relevance to the topic presented here.

The literature that was relevant to research into flipping the classroom was broad and referenced elements of differentiation and the use of technology. The review starts with a discussion on the significance of differentiation in the classroom, followed by a summary of the impact of technology integration in the classroom, and lastly an explanation of the flipped class. This section will be followed by a short discussion on the impact of all three methods of teaching: differentiation, technology and flipping together and their impact on student achievement.

The Importance of Differentiation in the Classroom to Strengthen Student Achievement

Researchers who have studied the effects of differentiation on student achievement universally agree on its positive impact (Beecher & Sweeny, 2008; Konstantinou-Katzi, Tsolaki, Meletiou-Mavrotheris, & Koutselini 2013; Subban, 2006). For example, Konstantinou-Katzi et al. (2013) stated, “differentiated instruction has a positive effect on student engagement and motivation and improves students’ understanding” (p. 332). Differentiation is not just for special education students or for English language learners. Teachers are constantly struggling to find a way to engage, motivate and improve all their students understanding and differentiation can help.

The theory behind differentiation stems from the zone of proximal development (ZPD) (Konstantinou-Katzi et al., 2013). The ZPD is the concept that more learning takes place when the assignment or task is slightly above the students’ comfort level. Vygotsky (1987) believed: that when a student is at the ZPD for a particular task, providing the appropriate assistance (scaffolding) will give the student enough of a ‘boost’ to achieve the task.

Once the student, with the benefit of scaffolding, masters the task, the scaffolding can then be removed and the student will then be able to complete the task again on his own.

(p. 5291)

Task completion and learning takes place through the teacher scaffolding the learning and through discussion and collaboration with peers (Konstantinou-Katzi et al., 2013). Obviously not all students are at the same level academically. Some students may be reading at a higher or lower level while in math others have a deeper understanding of number sense. The teacher needs to be flexible in order to meet the students at their instructional level. A differentiated classroom is student centered.

Tomlinson (2010) described differentiation as “a classroom practice with a balanced emphasis on individual students and course content” (p. 14). She felt that in a differentiated classroom there were seven elements that the teacher understands.

1. Background experience, culture, language, gender, interests, readiness to learn, modes of learning, support systems for learning, self-awareness as a learner, confidence as a learner are a few examples of how students differ as learners.
2. Differences intensely impact how students learn and the type of scaffolding they will need in the learning process.
3. Teachers are responsible to ensure that all of their students master content.
4. Teachers need to make specific and adjustable plans in order to connect with each learner.
5. Teachers are required to understand their content and students.
6. Teachers need to be flexible in order to adjust for students' differences.

7. Teachers need to constantly be asking what are the needs of Student A right now so that he/she is able to make gains toward a key concept, and what should I do in order for this progress to occur? (p. 14)

Overall, “teachers plan for classroom diversity by adjusting instruction, not expecting every student to learn at the same pace, in the same way or with the same amount of instruction” (Howery, McClellan, & Pedersen-Bayus, 2013, p. 271). When teachers maintain this belief system, they will plan and adjust as needed. The result was shown to increase student achievement across levels.

Studies have indicated that the practice of differentiation is an effective strategy, (Konstantinou-Katzi et al., 2013; McAdams, 2001). For example, both low-achieving and high-achieving elementary and middle school students in Missouri showed significant improvement in a standardized test after differentiated instruction was adopted (McAdams, 2001). Teachers also reported that students were more interested and motivated to learn. In addition, Cortes (2013) found that differentiation was the best way to promote higher achievement among all students. In another example, Konstantinou-Katzi et al. (2013) noted that differentiation during math class has a positive impact on student learning, attitude towards math, performance, and motivation.

The Importance of Technology in the Classroom to Boost Student Achievement

Children today are online daily. According Lenhart, Kahne, Middaugh, Macgill, Evans, and Vitak (2008), at an even higher rate than the 72 percent of American-adults who report daily online usage. In the past seven years, online access has become more convenient and students are immersed in technology daily. Grimley and Allyn (2010) stated that the cognitive processing of younger Generation Z students had been altered due to the immersion of a digital environment. On the other hand, Reeves (2008) took a more conservative stance is when stated

that more research is needed to see what the impact of the information age has on the learning needs and preferences of the younger generation. There is no strong research that suggests that digital natives, because they were born with technology around them, have brains that are wired in a different way than that of generation Xers. Still, according to Wenglinsky (2005) teachers should “take for granted that students will use computers in a variety of ways to complete the assignment” (p. 32). Research has found that when educators integrate technology into their daily classroom lessons, student achievement is increased. However, while technology provides new opportunities, teachers need training, support, and help to make good use of these devices to support student learning (Kissane & Kemp, 2008). This idea was supported by Donovan, Hartley, and Strudler (2007), whose study of teachers’ concerns regarding one-to-one computer integration found that when the concern of teachers were a focus, professional development was more effective and supported teachers’ changes as they moved to one-to-one computer environments.

In the *2001 School Technology and Readiness Report* important findings regarding technology are still relevant in today’s ever changing technology world (CEO Forum, 2001). For example, the study found that technology can enhance student achievement in multiple ways and that the impact of technology is greatest when integrated into a curriculum that has clear, measurable objectives. According to Donovan et al. (2007) the Partnership for 21st Century Skills in 2002 agreed with the findings, and added that the “introduction of computers into the teaching and learning experience is in many ways acting as a catalyst for educational change toward a more 21st century learning environment” (p. 264).

Donovan et al. (2007) went on to report that the benefits of one-to-one computer access resulted in students using computers for a variety of purposes and subjects, improved student

writing skills, and enhanced student technology literacy. The research of Boon, Burke, Fore, and Hagan-Burke (2006) showed that when students use computerized cognitive organizers there is potential to significantly increase content-area learning and achievement. When instructional software was integrated with curriculum objectives for basic reading and math skills in West Virginia there was an increase in test scores (Mann, Shakeshaft, Becker, & Kottkamp, 1999). Another area that has shown an increase in student achievement through the integration of one simple form of technology is through the use of a graphics calculator. According to Kissane and Kemp (2008), “the graphics calculator is relatively inexpensive, very portable, and includes significant educationally valuable software” (p. 16). Kissane and Kemp further stated that a calculator was a resourceful and effective tool for developing student understanding.

Arafeh, Levin, Rainie, and Lenhart (2002) investigated academic performance and Internet savviness of students. They found that Internet savvy students were aware of how the Internet could be used to help with their school work and would make use of it, often changing traditional assignments into Internet activities. It is important to note that Roberts, Foehner, and Rideout (2005) also investigated academic achievement, and found a negative link to playing computer games. Therefore, educators who are not trained to integrate technology in the curriculum and simply rely on games may not be utilizing technology in the most appropriate way to increase achievement.

Teachers who are aware of the positive outcomes of successfully integrating technology have been able to transform students’ negative attitudes into more positive views of reading and school (Shankar-Brown & Brown, 2014). However, it needs to be noted that a teacher’s attitude toward technology can impact the students’ view of technology as well (Christensen, 2002). In his study, Christensen argued, “though some effects are not directly measured, there is little

doubt that the way teachers view technology affects the attitudes of their students. There were also instances that it appeared that student attitudes affected their teachers' attitudes" (p. 429). The attitude of the student is important to their school success. Shankar-Brown and Brown (2014) studied video podcasting (vodcasting), and its effect on eighth graders attitude toward reading and book reports. The authors of the study understood that a teacher who put "technology at the center of learning can play a significant positive role in cognitive, social, and emotional development processes of today's young adolescents." (p. 19). Technology can engage students in a way traditional instruction cannot. Shankar-Brown and Brown found that through the use of vodcasting students were able to use techniques and talents that are limited by traditional assignments.

The Importance of the Flipped Classroom and its Impact on Student Achievement

There is little rigorous empirical research on the effects of flipped learning on student achievement. According to the Flipped Learning Network (2013) the research that does exist overall was composed to teacher reports on student achievement after adopting the model. The authors reported that, "in general, teachers who are flipping their classroom report higher student achievement, increased student engagement, and better attitudes toward learning and school" (¶ 6). The key components of flipped learning are built on research based educational practices. These four components are flexible environment, learning culture, intentional content, and professional educator (Hamdan, McKnight, McKnight, & Arfstrom, 2013).

The flexible environment of a flipped classroom allows students to choose when and where they learn. Assessments are built to objectively measure students learning in a meaningful way. Teachers who utilize the flipped method of teaching are flexible with their time constraints for student learning and the method of assessment (Flipped Learning Network, 2013). The

flexibility of the teachers allows students to learn at their own pace and in a way that helps them to be more successful. Strayer (2012) looked into the learning environments of introductory statistics classes at a university. He compared a traditional class and a flipped classroom. His findings showed that students in the flipped classroom were more open to working with others; however, they struggled with the lack of structure during tasks.

The learning culture in a flipped classroom may be drastically different from a traditional classroom. According to Hamdan et al. (2013), “students move from being a product of teaching to the center of learning, where they are actively involved in knowledge formation through opportunities to participate in and evaluate their learning in a manner that is personally meaningful” (p. 5). Students are challenged but not too much so that they do not get frustrated. In other words, educators aim at students’ zone of proximal development to help students explore topics in greater depth (Vygotsky, 1978).

The culture of a flipped classroom is student centered. Students are responsible for their own learning. According to Konstantinou-Katzi et al. (2013), “the teacher coordinates time, space, materials and activities. The teacher’s effectiveness increases as students become more skilled at helping themselves and each other to achieve group and individual goals” (p. 333). Further, Huba and Freed (2000) stated that in a student-centered classroom, students are engaged in constructing knowledge and working together. Michael (2006) found “there was evidence that active learning, student-centered approaches to teaching” work, and they work better than more passive approaches” (p. 165). Michael cited multiple studies that support the idea that students learning in a student centered classroom are more likely to gain meaningful learning. According to Michael, “properly implemented Student Centered Interaction can lead to increased motivation to learn, greater retention of knowledge, deeper understanding, and more positive

attitudes towards the subject being taught” (p. 160). All quality teachers aim to have an increased motivation in their students, more indepth understanding, and retention of knowledge.

In addition, the culture of a flipped classroom allows for students’ learning to be often primed. Learners are prepared with direct instruction prior to receiving in class instruction. Hamdan et al. (2013) stated that by providing students with direct instruction outside of the classroom before learning takes place with the instructor, they are basically “primed” for the active learning activities taking place in the flipped classroom.

The result of the flipped classroom culture allows for student to be actively involved. Hamdan et al. (2013) stated that 100% of the educators surveyed agreed that learning became more active after flipping their classrooms. Berrett 2012 agreed that in a flipped classroom students can not passively receive material. Hamdan et al. (2013) reported:

Over 90% said that positive interactions with their students increased; students had greater access to course material and instruction, students could work at their own pace; students were more likely to engage in critical thinking; and instruction became more differentiated and personalized. Close to 80% reported that positive interactions between students increased; that students became more likely to engage in collaborative decision making; and that students were more likely to have choices in how they demonstrated what they learned. (p. 13)

In a flipped classroom, “educators use intentional content to maximize classroom time in order to adopt various methods of instruction such as active learning strategies peer instruction, problem-based learning, or mastery or Socratic methods, depending on grade level and subject matter” (Flipped Network Learning, 2013, ¶ 3). For years, educators have been trying to maximize classroom time. Flipped learning allows students to make the best use of their in-class time

(Sams & Bergmann, 2013). Hamdan et al. (2013) further explained, that the flipped classroom allows educators to maximize “classroom time in order to adopt various methods of instruction such as active learning strategies, peer instruction, problem based learning or mastery or Socratic methods, depending on grade level and subject matter” (p. 6). Student growth will occur when students are actively learning through those or other active methods of instruction.

Peer instruction (PI) is a student-centered approach to instruction that has proven effectiveness (Lasry, Mazur, & Watkins, 2008). PI often occurs in a flipped classroom. According to Lasry et al., PI is an effective instructional method. “PI increases conceptual learning and traditional problem solving skills” (p. 1069). Therefore, PI is more effective than traditional instruction. According to Hamdan et al. (2013), “the flipped learning model can facilitate this type of one-on-one attention by relegating the lecture portion of the traditional classroom to the outside, and allowing for more one-on-one interactions as teaches guide students in the integration and application of the content in class” (p. 7). PI engages students and strengthens their learning.

According to Berrett (2012) students cannot passively learn material in class when the teacher is flipping. Berrett stated that flipping “takes many forms, including interactive engagement, just-in-time teaching (in which students respond to Web-based questions before class, and the professor uses this feedback to inform his or her teaching), and peer instruction” (p. 36). Berrett went on to state that the result of the flipped classroom is more learning. More learning will lead to higher student achievement. A flipped classroom provides students an opportunity to use their new, often factual, knowledge in class while getting feedback from the teacher and their peers (Brame, 2013). According to Brame the immediate feedback helped students correct any misconceptions and organize their new learning.

“By providing an opportunity for students to *use* their new factual knowledge while they have access to immediate feedback from peers and the instructor, the flipped classroom helps students learn to correct misconceptions and organize their new knowledge such that it is more accessible for future use. Furthermore, the immediate feedback that occurs in the flipped classroom also helps students recognize and think about their own growing understanding.” (¶ 3)

In other words, in the flipped classroom, students are able to "try out" what they know while the teacher is readily available to give constructive feedback.

The last key component of a flipped classroom is the professional educator. In order for the flipped classroom to be successful, educators must be professionals who reflect on their practice, work to improve their trade, and can tolerate a noisy and slightly frenzied classroom (Hamdan et al., 2013). Many educators may find through their reflection that flipping is not working for them due to the nature of the class or due to their own teaching style.

According to the Flipped Learning Network (2013), higher student achievement is the result of a flipped classroom. Clinondale High School had such promising results from flipping that the principal converted the entire school to the flipped learning model. Hamdan et al. (2013) reported “failure rates dropped by as much as 33%. The number of student discipline cases fell from 736 in 2009 to 247 in 2010 and to 187 in 2011, a drop of 74% in two years” (p. 10). At Clinondale High, according to Greene (2012) there was a 5.8% increase on the Michigan Merit Exam from the 2010-11 school year to the 2011-12 school year. In a separate study, Ruddick (2012) compared flipped college preparation chemistry class with regular instruction. Students in the flipped classroom had higher final exam scores and rated themselves higher on a survey analyzing student interest in chemistry (Herreid & Schiller, 2013). In addition, according to the

Flipped Learning Network (2013) online survey of 450 teachers, 66% of teachers reported their students' standardized test scores increased after flipping their classroom (Hamdan et al. 2013).

When a student's mind is engaged they develop an eagerness to learn, motivation to be right and eagerness to master the content (Berrett, 2012). Another result of a flipped classroom according to the Flipped Learning Network (2013) was an increase in student engagement. Hamdan et al. (2013) highlighted case studies involved in flipped learning experiences. In 2006, 29.9% of students passed the state mathematics test at Byron High School. In 2009 a new curriculum was written, textbooks disregarded, open source materials identified and the flipped classroom was adopted. Hamdan et al reported, "after flipping their math classrooms, the teachers found that engagement increased and students began exceeding expectations" (p. 9). Seventy three percent of students passed the state math test in 2011, more than doubling the performance from three years earlier.

A college physics class in 2011 participated in a flipping study. Two sections were taught the traditional way most of the semester. During the 12-week of class, reported by Brame and Director (2013), one section was flipped. According to Brame and Director:

during the experiment, student engagement increased in the experimental section (from 45 +/- 5% to 85 +/- 5% as assessed by four trained observers) but did not change in the control section. At the end of the experimental week, students completed a multiple choice test, resulting in an average score of 41 +/- 1% in the control classroom and 74 +/- 1% in the "flipped" classroom, with an effect size of 2.5 standard deviations. Although the authors did not address retention of the gains over time, this dramatic increase in student learning supports the use of the flipped classroom model. (p. 3)

In spring 2007, two chemistry teachers at Woodland Park High School began flipping to help students who missed instruction due to extracurricular activities. According to Hamdan et al. (2013):

after flipping where direct instruction and homework took place, students' interactions with one another in these classes increased. According to the educators, students who were behind began to receive the individual attention they needed to catch up to their peers, even as advanced students continued to be challenged. (p. 10)

The flipped classroom approach in the above example allowed students to participate in meaningful extracurricular activities and still have their needs met in the subject area in order to be successful.

The attitude of students is another area that often shows improvement when the classroom is flipped. According to Hamdan et al. (2013), in 2012 Columbia University and the Flipped Learning and Democratic Education conducted a survey of 26 educators and 203 students from across the United States. Hamdan et al. stated the following:

Overall, close to 80% of students in flipped classrooms agreed that they have more constant positive interactions with teachers and peers during class time; they said they have more access to course materials and instruction; are more able to work at their own pace; they can exercise more choice in how they demonstrate their learning; and they viewed learning as a more active process. Close to 70% reported that they are more likely to have a choice in what learning tasks they engage in; they are more likely to engage in collaborative decision making with other students; they are more likely to engage in critical thinking and problem solving; and that the teacher was more likely to take into account their interests, strengths, and weaknesses. (p. 12)

In a Flipped Learning Network (2013) survey, according to Hamdan et al. (2013) in the same survey, “80% of teachers perceived an improvement in their students’ attitudes towards learning. Nearly nine in ten of the teachers surveyed reported that their job satisfaction also improved, with 46% reporting significant improvement” (Flipped Learning Network, 2013, p. 12). A flipped classroom therefore offers advantages to both students and teachers.

The Importance of the Flipped Classroom and Differentiation

Research indicated that differentiation is imperative to student learning (Beecher & Sweeny, 2008; Konstantinou-Katzi et al., 2013; Subban, 2006). Research also indicated that the instructional methods incorporated into a flipped classroom increase student achievement (Berrett, 2012; Hamdan et al. 2013; Sams & Bergmann, 2013). Therefore, does a flipped classroom allow for an increase in student differentiation?

English language learners often try to understand and remember the teachers’ instructions. In a flipped classroom, students can work at their own pace in order to master concepts (Hamdan et al., 2013). Students are able to pause a video and rewind to listen again as often as they like. “This has potential to allow struggling learners more opportunities to understand and improve their recall before they come to class” (p. 8). Chaudry (2010) noted that students working memory has a limit to the amount of information that can be used, processed and stored and overburdening that limit can challenge the learning process. When flipping, students can gradually process the information more efficiently (Hamdan et al., 2013).

Students can also learn at their own pace. Sams and Bergmann (2013) noted that teachers often have a library of instructional videos accessible to students. Once students have mastered a set of objectives, they may move onto the next set. “Now, instead of all students viewing the same video on the same day, students view a video when they’re ready to use it” (p. 18).

Konstantinou-Katzi et al. (2013) found that when a mathematics class was organized in such a way that allowed students the chance to work on activities starting at their own level and working at their own pace, there was a positive impact on student learning and attitude towards mathematics.

At Byron High School in Minnesota students are allowed to watch any teacher's video, according to Fulton (2012), "most prefer to watch their own teacher, but some like to watch a different teacher's video lesson for review or to see a new angle for understanding a difficult concept" (p. 14). Therefore, in a flipped classroom students can meet their own differentiation needs by finding a video that suits their learning style or needs. Gifted learners are often able to self-regulate their learning (Mooij, 2004). In a flipped classroom, they are allowed to proceed autonomous in their learning while the teacher is able to spend more time with students who need additional help. According to Mooij, "in this way, different learning styles and aptitudes can be accommodated within the same classroom" (p. 101). Therefore, when teachers flip their classroom, all students, those struggling and those working at an advanced level, will be able to learn at a rate that correlates to their individual needs.

Flipped Classroom, Technology, and Differentiation

Knowing that technology increases student motivation it is not surprising to find that when educators differentiate instruction through a flipped classroom and the use of technology that student achievement is increased. Internet technology and especially videos are a frequent teaching method for the flipped classroom. Students and teachers, according to Herreid and Schiller (2013), preferred videos over reading in order for students to be prepared for the following days class.

Podcasts have been shown to have a positive impact on student attitude, behavior, and performance (Herreid & Schiller, 2013). In a study by Kay and Kletschin (2012) students viewed 59 problem based mathematics videos over a three-week period. “Information collected using a survey and open-ended response question indicated that students found the podcasts useful, easy to follow, and effective in helping them understand new material” (Herreid & Schiller, 2013, p. 64). Podcasts positively impact students’ attitudes toward learning new material.

Vodcasting, according to Shankar-Brown and Brown (2014), was “a 21st century information sharing platform” (p. 19). Students who were introduced to vroadcasting, even those generally reluctant to learn and claim to hate reading, enjoyed the vroadcasting projects. Shankar-Brown and Brown also indicated that, “the overarching trend of this study suggests that vroadcasting is an effective strategy for differentiation instruction in the middle grades classroom” (p. 21). This study is another example of when technology is effectively integrated into the existing curriculum, differentiation seamlessly takes place and student motivation and learning occur. Teacher created or student made vodcasts can be used in a flipped classroom.

Konstantinou-Katzi et al. (2013) stated, that “in spite of their shortcomings, mixed-ability mathematics classes seem to be a better alternative than classes segregated by student ability” (p. 346). Although not always the ideal classroom make up, a heterogeneous math class is better than one homogeneously grouped. “Differentiation of instruction can help improve the effectiveness of mixed-ability mathematics classes” (p. 347). Differentiation in a traditional classroom can be difficult for a teacher to effectively implement on a daily basis. In a flipped classroom, according to Sams and Bergmann (2013), accommodations could be easier to provide.

Konstantinou-Katzi et al. (2013) found:

Laptop computers can help to increase students' interest and motivation and engage them in technology-enhanced learning, that is, at their own level. Social softwares, such as wikis and discussion forums, could also be used as tools for promoting student collaboration and community learning. (p. 347)

Therefore, technology motivates students and provides an avenue for teachers to flip their classroom, which results in differentiation as needed. For example, Sams and Bergmann (2013) found that students who needed more time on a particular concept were able to watch a video and complete various assignments when they were ready for them. Herreid and Schiller (2013) noted that students were able to repeat steps when they needed to until the assignment was complete. In addition, when a classroom is flipped, students are able to retake any assessment they have not done well on. "This provides students with multiple opportunities to demonstrate understanding of a topic." (p. 18). In addition, Sams and Bergmann (2013) also noted that even with flipping, not all students learn the same way. Some may learn best from a video while others learn best by reading, listening, or practicing. "To accommodate all learners, our videos, textbooks, problem sets, and other activities became optional resources for learning, rather than required activities. Students used the resources that best suited them to master learning objectives" (pp. 18-19). Moore, Gillett, and Steele (2014) also noted that some students preferred teacher made videos to available on line videos. The reason being, the teacher was more familiar to them. In the flipped classroom environment, students can start with a problem to solve. Sams and Bergmann (2013) further stated, "they watch the instructional video when they required information, and they went to selected resources and supports when needed" (p. 19). Students can refer back to a video lesson when they are unsure and need that additional support.

Hamdan et al. (2013) noted that students watching a video could pause and rewind as many times as needed. They may also review the lesson at any time.

In class, the teacher and students can then focus on the upper levels of the Bloom taxonomy (applying, analyzing, and creating). This has potential to allow struggling learners more opportunities to understand and improve their recall before they come to class. (p. 8)

Students will come to class more prepared and ready to apply their new skills. Moore et al (2014) also noted that the teacher felt more instructional time was spent engaged in problem solving than just taking notes.

In a successful flipped classroom, the teacher is using different tools to meet the needs of individual students. According to Hamdan et al. (2013):

The flipped classroom removes lectures from the group learning space to maximize the amount of time teachers have to spend with individual students and students have to spend working with one another. Flipping the classroom provides more time to address the needs of individual students and enables more active and engaged learning, without sacrificing the amount of material that can be covered. (p. 15)

According to Fulton (2012), “with class time freed up from lectures, teachers are developing open-ended, cross-curricular projects that actively engage students and bring real-life relevance to their math skills” (p. 17). When students are actively engaged in learning, they are more successful, a concept all teachers are aware of. Struggling students to high achieving students show more gains when a teachers' precious time is devoted to their needs. Flipping and using technology allows the teacher the time to meet those needs on a more regular basis.

Summary

I explored the use of a flipped classroom as a means to differentiate for my students and integrate technology to aid in student motivation. In summary, the research clearly supports the effectiveness of differentiation in raising student achievement. When students are instructed at their level of understanding, all students benefit. Those higher achieving students are able to continue to advance their studies. The struggling students are able to acquire the skills and review needed for them to also be successful and advance their thinking. Differentiation in the classroom is a necessary tool that all quality teachers need to utilize on a daily basis.

Research studies have also demonstrated that when educators use technology, students are more engaged and also achieve greater success. Technology is a rapidly changing area. Students in today's classrooms are surrounded by and/or aware of the latest technological advances. They are interested in technology and are drastically aware of what it can be used for. It is imperative that teachers tap into this interest to help students stay engaged in school.

Flipping the classroom has also been shown to be an additional instructional method of raising student achievement. Although the research is limited in this area, educators are seeing the effectiveness of it. In a flipped classroom, students have quality homework and are given more individual attention in the classroom setting. In addition, a flipped classroom can allow for more cooperative learning and peer instruction. Both of these areas have long been known to benefit student learning.

There were many limitations in the studies researched. As with all educational research, it is difficult to have a valid comparison group. The composition of the classroom differs from class to class and year to year. In addition, it is unknown if the results of the research on flipping will translate to a rural seventh grade pre-algebra math class. Educational trends tend to come

and go. Flipping is becoming a popular method of reaching all students. One main question that many have is will the students in a seventh grade pre-algebra mathematics class achieve at a higher rate than those in a traditional pre-algebra mathematics class.

In addition, there are many other suggestions for future research in regards to the long-term effects of students having many flipped classrooms in one school year or even successive years. There is concern that if students are continually in a flipped classroom environment will it impact their ultimate achievement when enrolled back to a traditional classroom. Others would like to analyze if a flipped classroom improves students' attendance. In addition, research should be completed to see if the motivation and interest the studies show occurs during a flipped class will digress as the students are enrolled in many flipped classrooms. Long-term studies following various students and their education advancements would need to be implemented.

Chapter 3 – Methodology

The purpose of this study was to explore flipping a math classroom. More specifically, this study examined how students perceived they were doing in a flipped math classroom, and how engaged were they using the technology compared to the traditional classroom setting. This purpose lent itself to the following research question:

1. What are students' perceptions of a flipped math classroom?

The goal of this research was to investigate the flipped learning experience for students within a middle school math setting and how engaged they were within the classroom. Because my research question was focusing on a better understanding of the experiences of the students in this class, I decided to use a case study methodology for my research design (Merriam 1998).

Yin (2003) stated that when "how" or "why" questions are used, then the case study is the preferred strategy. Further, Creswell (2011) stated how a "case" itself may be of an individual or in a particular group or program. Additionally, Yin (2003) continued by stating that the case study is used to add to our knowledge of an individual or group. Finally, when investigating a case within a context, it is helpful to use a case study. As the research question that I answered was designed to explore and understand students' experiences in a middle school flipped mathematics classroom, using a case study was an appropriate methodological choice.

Both Stake (1995) and Yin (2003) described a single case study with embedded units as providing an opportunity for an in-depth study of individual parts. I was interested in exploring individual student perceptions in a flipped math classroom within a middle school setting. Therefore, I used a single case study design with embedded units of analysis where the flipped classroom constituted the case, while students were the units of analysis.

The Case

The research took place at an elementary school located in the small rural town of North Canaan, Connecticut with a population of approximately 3,350 people. The public school was located in the rural northwest part of the state that was geographically isolated from the diversity found in cities. The school served approximately 315 students in grades pre-kindergarten through eighth grade and was in the District Reference Group (DRG) F. The Connecticut State Department of Education classified school districts into DRGs based on seven data indicators. These indicators included median family income, parental education, parental occupation, percentage of single parent families, percentage of families receiving free or reduced lunch, percentage of families who speak a foreign language, and the number of students enrolled in the schools. The wealthiest and lowest-need districts, as measured by these gauges, were placed in DRG A; while the poorest and highest need districts were grouped in DRG I.

The physical building of the school was thought of as similar to other school buildings within the region. The classroom in this particular study contained a *Smart Board* and students had access to a computer cart. The cart was equipped with enough *Chrome Books* for one to one use by each student. The classroom also had wifi Internet access although the broadband was inconsistent and weak.

The participants in the research study came from two eighth grade math classes. The class followed the Common Core Standards for the same grade. The students were heterogeneously placed in these two classes. The ages of the students in these classes ranged between 11 and 14. The average class size was 12, which was a little smaller than the average class size of the school. The classes were made up of about the same number of male and female students in each class. None of the participants had ever participated in a flipped classroom. As

a result, the participants in the study experienced an academic class using techniques associated with a flipped classroom for the first time.

Data Collection Methods

The purpose of this study was to explore student’s perception of their learning in a flipped math classroom compared to a traditional math classroom. In addition, the study analyzed how engaged students were when using the technology necessary to flip compared to the traditional math setting. The table below outlines the questions and methods of this study. Each method of data collection will be described in the following section.

Table 1	
<i>Research Question and Methods Used to Collect Data</i>	
Research Question	Data Collection Method
1. What are students’ perceptions of a flipped math classroom?	2. Surveys 3. Interviews

Data was collected over a three-week period from October to November.

Surveys

Quantitative data was collected through a survey. According to Creswell (2012) surveys were administered to a population in order to help describe the attitudes or opinions of that population. Although surveys don’t offer a cause and effect, they do find trends in the data. Surveys are a great tool in order to determine opinions and feelings about particular issues (Muijs, 2011). Muijs also explained that the questions in a survey allow for easy comparison between respondents and groups of respondents, for example, male and female. Because the

study looked at students' perceptions of a flipped classroom, a survey was an appropriate method of data collection.

A student survey was administered at the end of the unit in November, approximately three weeks after the flipping method started (see Appendix A for a copy of this instrument). The post-survey was administered through the use of an online survey program called *SurveyMonkey* during math class. The survey evaluated students' perception of their learning, the time spent, use of videos and a few questions specific to the flipped classroom approach. The survey consisted of a five level Likert scale in order to provide quantitative data for the study. Ary, Jacob, and Sorensen (2010) stated that Likert-type survey items classified as ordinal measures were best defined using the mode when analyzing data. Therefore, the responses for each rating on the Likert scale were analyzed by calculating the mode.

Interviews

Creswell (2012) stated that qualitative interviews occur when researchers ask participants open-ended questions where the individuals can openly share their experiences. According to Creswell, interviews provided detailed personal information from the participants and it is an appropriate method to provide better control over the type of information collected. Group interviews, according to DiCicco-Bloom and Crabtree (2006), provided a broader range of experiences but prevents getting in-depth information about an individual's experiences. Creswell (2012) stated that the interviewer needed to encourage all subjects to talk and take turns talking. Due to the age of the subjects in this study, the influence of their peers was great and could have impact a group interview. Therefore, individual interviews were conducted.

The use of a semi-structured interview was used in this study rather than one more structured in nature (see Appendix B for a copy of the interview protocol). Five to six open-

ended questions were asked and recorded. This approach provided students an opportunity to share their thoughts and opinions in their own words to gain a deeper understanding of their experiences. The qualitative data helped to understand the student's perceptions.

Data Analysis Methods

The data collected from this study included both quantitative and qualitative techniques. According to Creswell (2012), combining both of these techniques in a single study provided for a better understanding of the research problem than individual methods alone.

Quantitative Data Analysis

The data from the survey was interpreted to determine student's perception of a math flipped classroom. Creswell (2012) stated descriptive statistics help to summarize the data themes or tendencies while giving information regarding how scores compared to one another. The mean is the most commonly used statistic that is used to describe participant responses to question items on an instrument. The median is the middle score that divides 50% of the scores above it and 50% below it. The mode is the score that is the most frequent response in a number of scores. It is meaningful when discussing categorical information.

The data from the survey was analyzed using *Microsoft Excel*®. According to Salkind (2013) this software allows researchers to calculate descriptive statistics for the data collected (e.g., the mean, median, and mode). The data for each of the questions was presented in a bar graph including the percentage of student responses.

Qualitative Data Analysis

Creswell (2012) stated that the constant comparative method as a form of inductive analysis to generate and connect categories that can be compared across the data. Therefore I utilized this method to review the data multiple times to look for themes until the point of

saturation. According to Thorne (2000), constant comparative analysis was the process of taking one item of data and comparing to all others that may be the same or different to find relations. The purpose of this approach was to find information about similar patterns and themes within the human experience. The process continued to compare each interview or data until they had all been compared to each other. The constant comparative method was solidly aligned with this study because according to Thorne this design was specifically used to study human behavior and experience. She went on to state that constant comparative analysis process helped the researcher understand human occurrences within the setting in which they were experienced.

Ruona (2005) outlined the four steps needed using *Microsoft Word*® to conduct a systematic way of analyzing the qualitative data. In step one, I transcribed the data from the student interviews. In step two, I familiarized myself with the data by reading and rereading the data a couple of times to identify meaningful themes within the data. In the third step, I coded the data. According to Creswell (2012) the researcher bases codes on the data from the transcripts, surveys and documents collected. Finally, in step four, I recoded several times until I reached a point of saturation where when I read the data I was unable to add any more codes. Once this took place, I was able to generate meaning. I organized the data based on the codes, grouped codes into categories, then created themes from the categories that I create had created.

Reliability and Validity

A study needs to be both reliable and valid for the results to be meaningful. According to Creswell (2012), a reliable instrument is one that is stable and consistent over time. Validity, on the other hand, measures how well the instrument measures the construct that it reports it is measuring in the first place. (Kerlinger, 1986). Therefore, I used Chronbach's Alpha, member checking, and triangulation to ensure that the study was both reliable and valid.

The Student Perception of Instruction Questionnaire (SPIQ) was used as the survey instrument. This questionnaire was previously used in a study measuring areas where technology impacted student learning and engagement (Arano-Ocuaman, 2010). Arano-Ocuaman used Cronbach's alpha to measure the reliability of the instrument. According to Creswell (2012) the alpha provided a measure of internal consistency of various questions on an instrument when the questions are calculated as continuous variables. Twenty seven valid responses out of a possible 36 were used to arrive at the Cronbach alpha coefficient of $\alpha=0.731$ (Arano-Ocuaman, 2010). A reliability coefficient of 0.70 or higher indicated an acceptable level of reliability for most educational research.

At the end of the four-week classroom experience, students were interviewed. To insure that the findings were reliable and valid, the study engaged in a process of member checking. According to Creswell (2012), member checking is one way researchers validate whether the findings are accurate. Students who participated in the interview were asked to review the interview transcript to check for accuracy. Lincoln and Guba (1985) considered member checking as a crucial method to establish credibility in a particular study.

According to Creswell and Miller (2000) triangulation was a procedure where the researcher searches for corroborative evidence from different methods of data collection to give more validity to the study. This study analyzed the themes from the interview questions and the survey to discover agreeing themes in order to cross validate the phenomenon that was occurring within the classroom.

Summary

In summary, the study explored student perceptions of a flipped math classroom using a single case study design. Participants for the study were from two eighth grade classrooms in a

rural school in the northwest corner of Connecticut. To collect data on student perceptions of a flipped math classroom, the study used both surveys and interviews. The data was analyzed using both descriptive statistics and the constant comparative method. To ensure that the data was reliable and valid, an alpha score was obtained from a previous study for the survey. Member checking and the use of triangulation were also employed.

Chapter 4 – Results and Discussion

The purpose of this study was to explore flipping a math classroom. More specifically, this study examined how students perceive they are doing in a flipped math classroom, and how engaged are they using the technology compared to the traditional classroom setting. This purpose was steered by the following question:

1. What are students' perceptions of a flipped math classroom?

In this chapter, I present and discuss the findings for the above question.

The results have been based on an analysis of eighteen eighth grade students' responses to a survey and interview questions. The quantitative data provided an overview of the overall outlook of the students surveyed. The qualitative data included, when possible, direct quotations from students while addressing the coding of the transcripts and the themes identified. Two themes were identified based on one or more participants referenced it during their interview.

Research Question: What are students' perceptions of a flipped math classroom?

As stated in Chapter Two a flipped classroom is often initiated by teachers in order to better meet the needs of their students. Technology is utilized in the form of videos to provide instruction that students are able to watch at home at their own pace. The following day, students come into class prepared to practice what they learned. Teachers are able to spend more time helping struggling students while challenging others as needed.

Quantitative Results

The survey was presented to students as a series of Likert scale items. Of the questions asked, item 12 addressed the overall likeability of a flipped class. The results were mostly positive. The majority of students, 72.2% of students selected strongly agree or agree when asked if they liked the daily routine in this class (see Figure 1). It is interesting to note that

27.8% of students did not agree or disagree and no students selected disagree or strongly disagree. This data coincided with the Flipped Learning Network (2013) report stating that teachers reported better attitudes toward learning from their students when they are engaged in a flipped learning classroom.

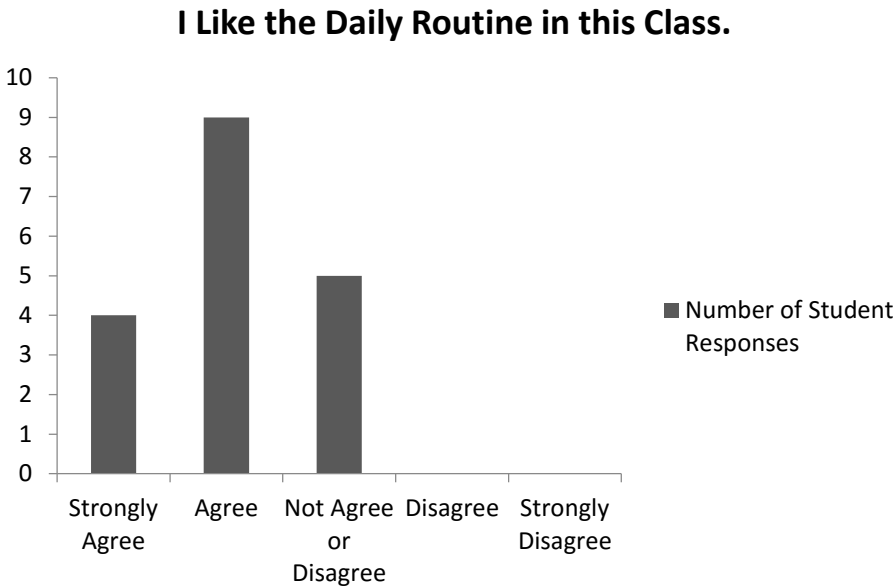


Figure 1. I like the daily routine in this class.

In response to question three, during this last unit, I have had to work hard in this course, 22.2% of students strongly agreed and 61.1% of students agreed. A flipped classroom approach altered the way in which students were working. Their typical home math practice was now in school with teacher support as needed.

During the Last Unit, I Have Had to Work Hard in This Course.

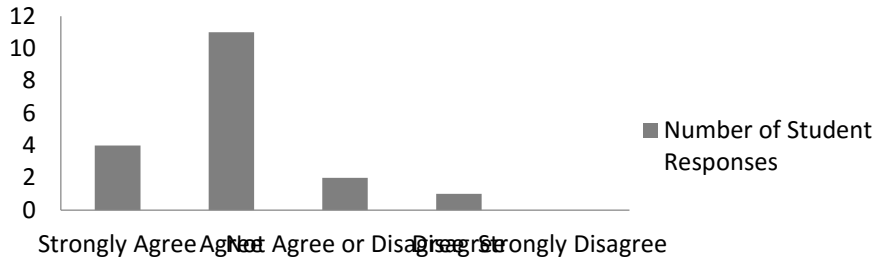


Figure 2. During the last unit, I have had to work hard in this course.

Students in eighth grade often were unable to receive math help from caregivers at home. The math was often too challenging. By working harder in school, the need for additional help at home was most likely decreased.

Research showed that when teachers integrate technology into their classroom, student achievement was increased (Kissane & Kemp, 2008). A flipped classroom utilizes the students’ interest in technology and primes the students for learning in the classroom by providing instruction before they enter (Hamdan et al., 2013). Berrett (2012) stated that more learning, which led to increased student achievement, would occur in a flipped classroom. The results of this study supported this previous research.

The students’ perception of how well they understood the material was a theme in both the quantitative and qualitative results. Four items assessed students’ understanding of the material in the flipped math classroom (i.e., items 4, 6, 8, and 13).

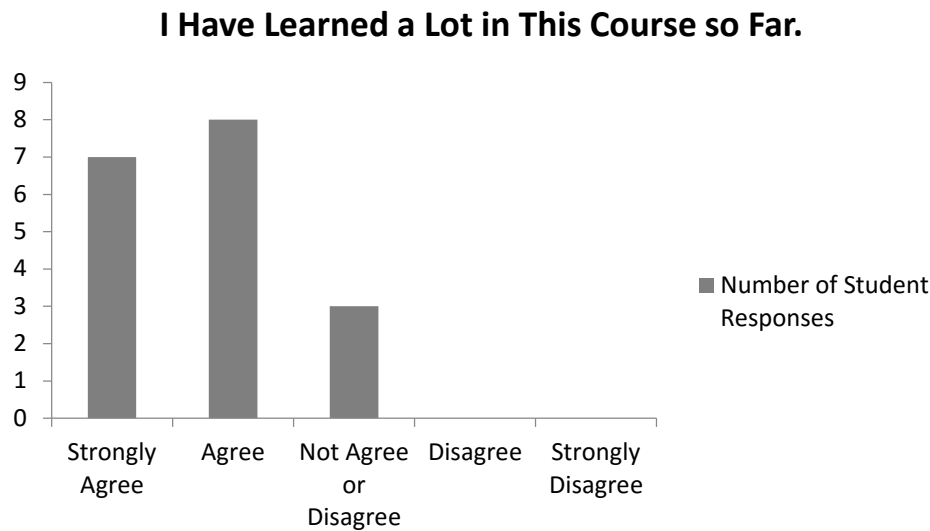


Figure 3. I have learned a lot in this course so far.

Figure 3 shows student responses to the statement, “I have learned a lot in their course so far.”

As a teacher, I was happy to note that no students’ selected disagree or strongly disagree. Only 16.7% felt they did not agree or disagree and while the majority 44.4 % did agree and 38.9% strongly agreed.

Students’ responses to question six (see Figure 4) and question eight (see Figure 5) reflected a similar theme. On the survey, question six states “The availability of course materials, communication, and assessment tools helped me improve my learning.” On that question, 27.8% of students strongly agree and 44.4% agree with that statement. It is important to note that 5.6% of students surveyed disagreed. Interestingly, for question eight, 16.7% of students disagreed while 66.7% agreed and 11.1% strongly agreed.

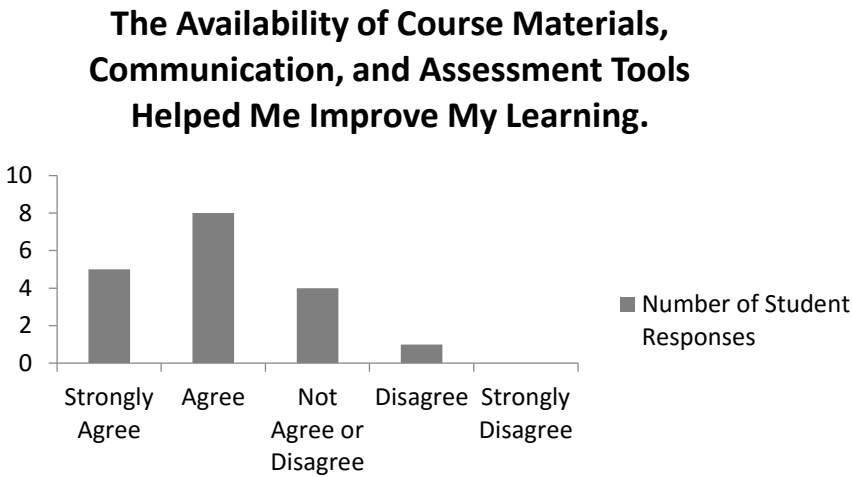


Figure 4. The availability of course materials, communication, and assessment tools helped me improve my learning.

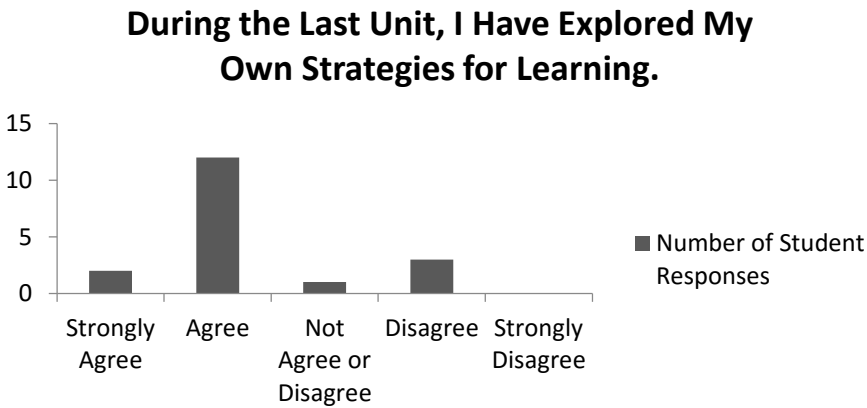


Figure 5. During the last unit, I have explored my own strategies for learning.

Sams and Bergmann (2013) noted that students in a flipped classroom tend to use the resources that best suited their own style of learning. My results coincided with those findings. In my flipped classroom, the students were able to try the strategy that worked for their style of learning and what worked best for them.

Question 12 was a multiple choice question (see Figure 6). Students were asked, “Which of the following have helped you improve your learning experience during the last unit?” The

majority (i.e., 72.2%) of students selected availability and access to online content and course materials, while 61.1% chose in class group discussions.

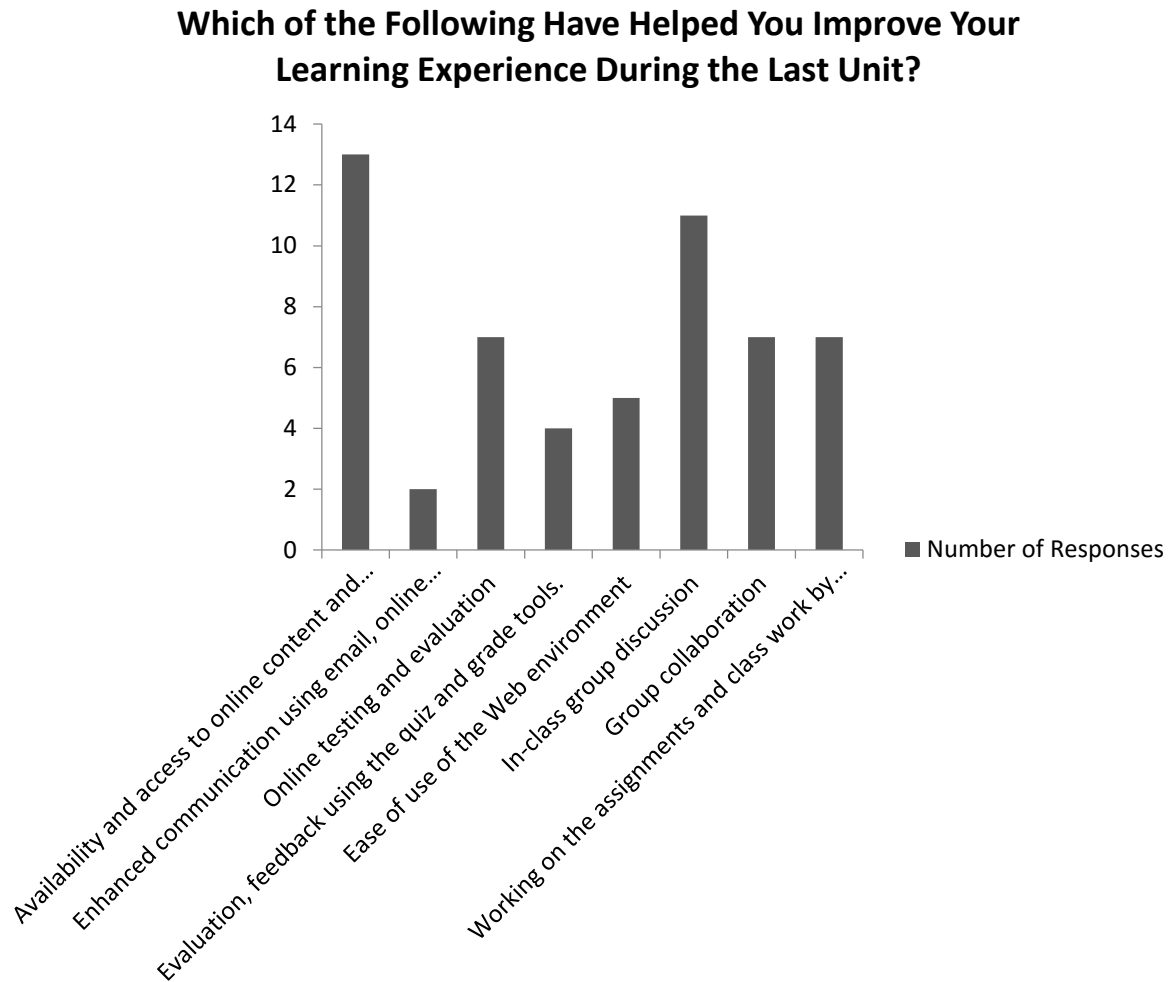


Figure 6. Which of the following have helped you improve your learning experience during the last unit?

The next highest choices selected were online testing and evaluation and group collaboration each receiving 38.9% of student selecting. It was clear from the results that the overwhelming majority of students felt the access to content and materials was key to improve their learning experiences. That access in collaboration with the in class group discussion is a key component

of a flipped classroom. During the class discussion, students were able to clarify their thinking and use their new knowledge with the support of peers and a teacher. According to Brume (2013), the immediate feedback students received in a flipped classroom helped students correct any misconceptions.

Question nine and question 10 addressed the use of technology. My flipped classroom relied heavily on technology. In this study, videos were most often used to assist students in their independent learning. Sams and Bergmann (2013), as stated in chapter two, found that students who needed more time on a particular concept were able to watch a video and complete various assignments when they were ready for them. Schiller (2013) supported the same thinking by noting that student often repeated steps when they felt that they needed to until they were able to complete a unit.

None of my students selected strongly agree in response to the need for technical assistance for the class (see Figure 7). The options of “agree,” “not agree” or “disagree”, and “disagree” were all fairly evenly split in regards to percent of students selecting (i.e., 33.3%, 38.8%, and 27.7% respectfully).

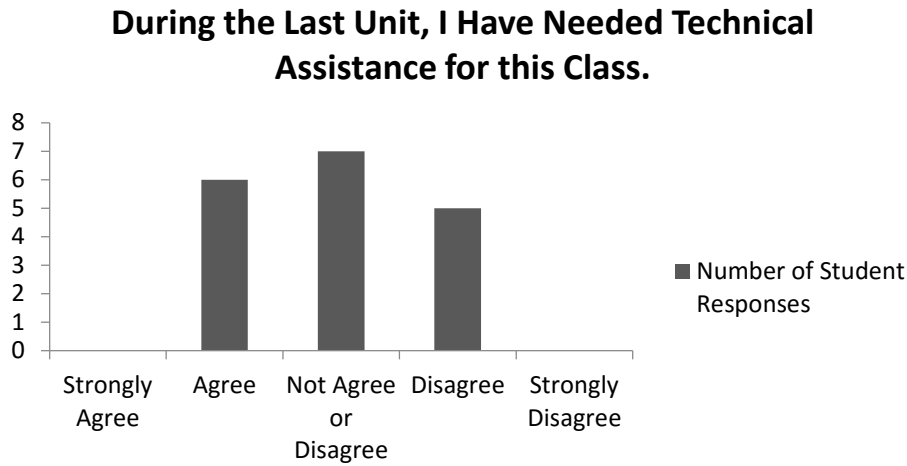


Figure 7. During the last unit, I have needed technical assistance for this class.

The study was conducted during the first few weeks of the introduction to school administered chrome books being assigned to the eighth grade students. These chrome books were well received, but with varying technology abilities among students with the new technology issued, it is difficult not to wonder if the responses would be altered if students were more accustomed to having technology so available.

Of the participants in this study 61.1% of students did feel that the technical support and resources helped them to improve their learning. In addition, 22.2% strongly agreed with that statement. For those students needing extra support, technology was a tool that allowed them the ability to pause, think, and rewind the instruction as needed.

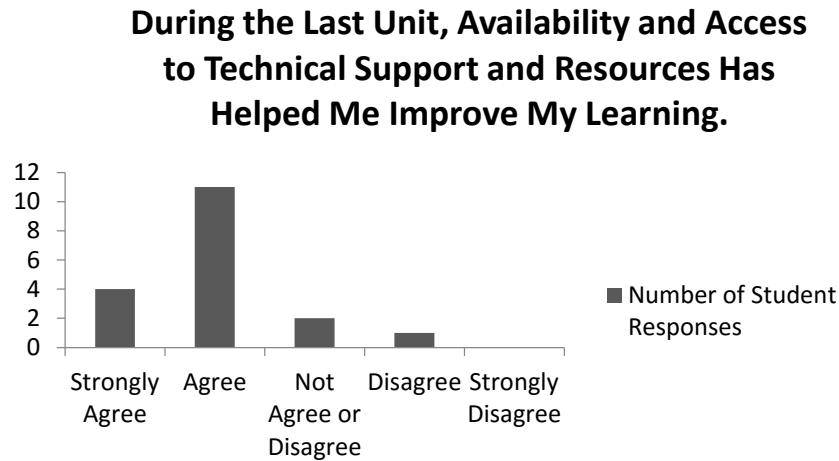


Figure 8. During the last unit, availability and access to technical support and resources has helped me improve my learning.

A key component of the Common Core of Learning is bringing real world problems into the classroom. Question five and question seven of the survey addressed this concept. Question five stated, “The assignments and projects I have worked on in this course deal with real life applications and information” (see Figure 9). When analyzing all the questions of the survey, this question was the only one that a percentage of students selected strongly disagree (5.6%) while 11.1% of students strongly agreed with this statement. On the other hand, 33.3 % did not agree and did not agree or disagree.

The Assignments and Projects I Have Worked on in This Course Deal with Real Life Applications and Information.

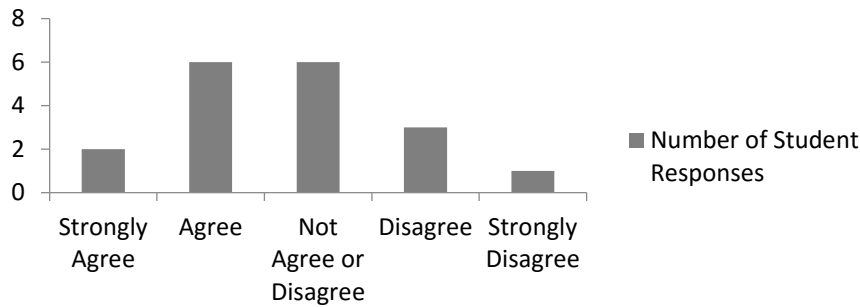


Figure 9. The assignments and projects I have worked on in this course deal with real life applications and information.

Question seven asked students, “During the last unit, I have applied my out-of-class experiences and learned from practical application” (see Figure 10). This question had a range of responses with the majority (i.e., 55.6%) agreeing with the statement. Practical application was key for students to overlearn the material and appreciate the benefit of their mathematical knowledge.

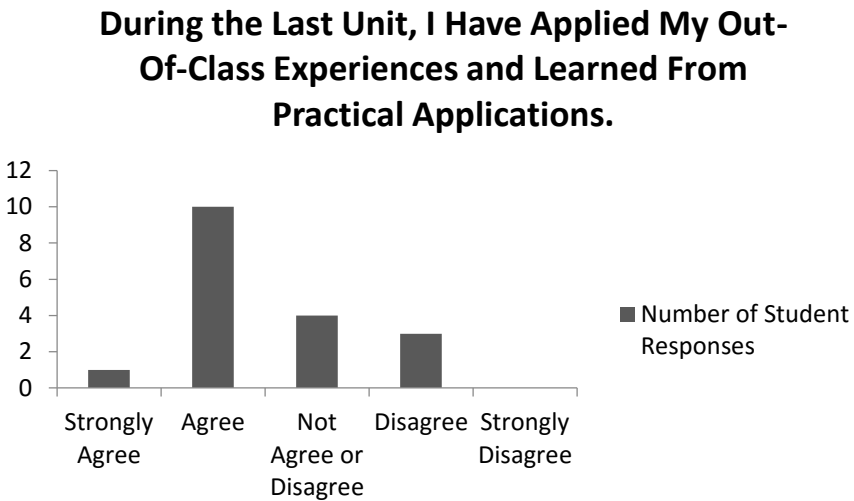


Figure 10. During the last unit, I have applied my out-of-class experiences and learned from practical applications.

Communication and explaining your thinking are important skills to develop and assist teachers to determine where gaps in learning may be and the understanding of a concept a student may or may not have. A child may have the skills needed but not the deeper understanding to apply those skills to other situations. Question one and question two of the survey investigated the communication that occurred during the flipped unit (see Figure 11 and Figure 12).

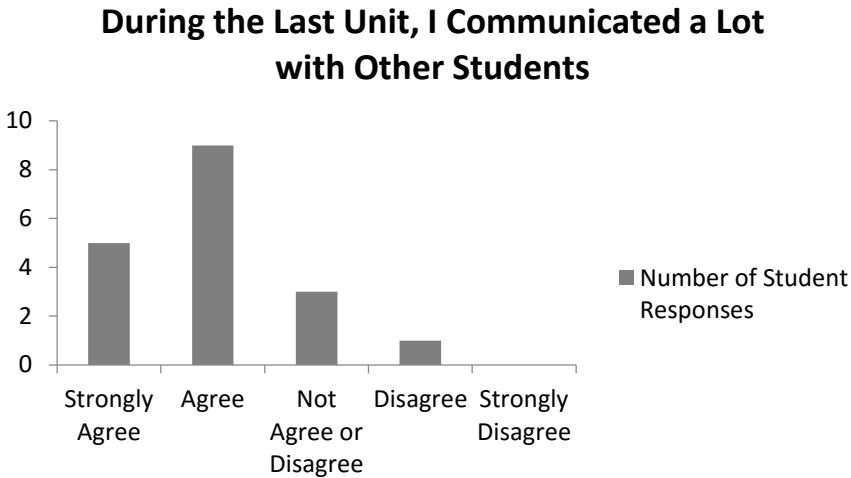


Figure 11. During the last unit, I communicated a lot with the other students.

As seen in Figure 11, 77.8% of students strongly agreed or agreed that, “During the last unit, I communicated a lot with other students.” While communicating or discussing their thinking, students were strengthening their own understanding of the material and were engaged in their learning. In Figure 12, 27.8% of students indicated that they talked with the teacher on a daily basis during the last unit of instruction. In addition, 50% talked to the teacher three times a week.

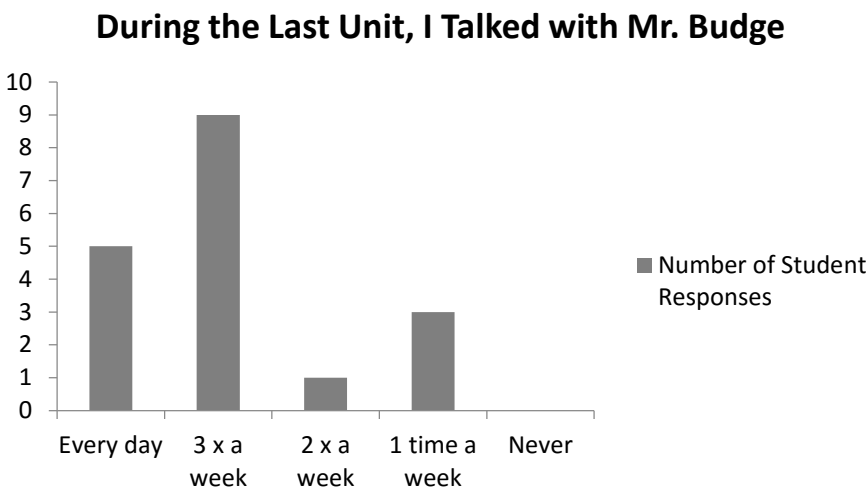


Figure 12. During the last unit, I talked with Mr. Budge.

It was important for students to feel they have the opportunity to talk with their teachers on a regular basis.

Qualitative Results

There were three open-ended questions asked to participants during an individual interview session. The questions were as follows:

- What other aspects of this course have helped improve your learning during the last unit?
- Do you have any suggestions for how to improve the flipped classroom experience, or any other general comments about the course?
- Did the flipped classroom meet your expectations? If so, did you like the opportunity, and why? If not, why not, and what could be changed to make it better?

Each of the above questions, along with the quantitative Likert scale questions, assessed student perceptions of the flipped classroom. The transcripts from the open ended questions were coded and analyzed for themes. Two themes arose, which were:

- The advantages of the flipped classroom including within this is the students improved understanding
- The disadvantages of the flipped classroom

Advantages of a flipped classroom. Educators know the advantages of differentiation, technology, and flipping provide to students (see Chapter Two). Students, however, do not. Therefore, it was significant to note that during student interviews, the advantage of the flipped classroom was repeatedly brought to the forefront.

One advantage that students pointed out was the use of videos to present new or reviewed information.

- “You can rewatch and relearn it if you need to.” (Beth)
- “I can just learn by myself without being rushed too much. I can rewind and watch them again and again.” (Casey)
- “But with videos students can rewatch over and over again.” (Sam)

Technology, such as videos can engage students in a way that a teacher lecturing cannot. Not only does a video engage students, it can be rewound as needed, while a teacher may repeat the information but not always when a particular student need it repeated. The statements from students, such as “if you are having a lot of trouble, you will keep stopping,” support Mooij (2004) findings that when teachers flipped their classroom all students would be able to learn at a rate that correlated to their individual needs. Martha stated it best, “I was able to go at my own pace.”

Another advantage that was worth noting was the use of class time. Students in a flipped classroom setting come to class with background knowledge and ready to be actively engaged in class. Students’ responses supported this belief.

- “I think that the discussions in the flipped classroom was helpful.” (Marvin)
- “With the flipped classroom you can work with other students in the classroom to get another point of view and how someone else is learning it.” (Carly)

In a traditional classroom, conversations between peers and peer/teacher still occur, but not on a regular basis. Cooperative learning and peer instruction are both proven practices that benefit students. “Uh, I like talking with other people. So that sort of helped me work. You have to

work but you have a chance to talk. And you also have like two people to help you with the work. Like you and the person that you are working with,” stated Kevin.

The fact that students are learning at their own pace, are engaged, discussing content with peers and the teacher show that a flipped classroom should bring about improvement in their understanding of content. In addition, students commented on the ability to concentrate more on their learning since the distractions of peers was removed when their learning was taking place at home.

“I think it’s easier to listen at home where like you can be in your room where it is quiet and stuff and actually listen to the video and work along with it but in the classroom you have other classroom around you and other kids in the class and its hard to pay attention.” All students who participated in the study did increase their knowledge of scientific notation.

Disadvantages of a flipped classroom. Learning at their own pace with the videos was a clear advantage of a flipped classroom. However, some participants noted the use of technology, especially the Internet, not working as a noted disadvantage. “If someone’s Internet isn’t working and they can’t get on to the video and that makes it hard to do the work.” Another student stated, “You couldn’t access things easily.” Yet another student remarked, “sometimes they didn’t work.” Technology not performing the way it is expected causes anxiety in many teachers. Christensen (2002) noted that the attitude of students towards technology is influenced by the teacher’s attitude.

Another disadvantage was a participant pointed out “some of the students didn’t watch the videos and they came in and we really couldn’t operate as a class. They were lost.” A teacher in a flipped classroom will need to be flexible in order to meet the needs of the students

each class session. A teacher in a traditional classroom also needs to be flexible as not all students are on the same academic level.

Additional Results

When analyzing both the Likert scale questions and the qualitative interview questions, the majority of responses were positive in regards to a flipped classroom. Some additional comments included:

- “I was motivated (because) cuz[sic] I got the problems.” (Edgar)
- “It was cool.” (Sam)
- “I think (the discussions) were better than the ones before the flipped classroom.” (Carly)
- “It’s less boring.” (Edgar)
- “Easier because it is a visual.” (Max)
- “I think I liked the flipped classroom a lot better.” (Casey)
- “I think I was slightly (more motivated) with the flipped classroom.” (Marvin)
- “I don’t like the videos because I would rather just be taught it.... I would like to watch more videos and um like do more videos.” (Max)
- “It worked in Math which is not my favorite subject but I am kind of liking and I can use technology.” (Beth)
- “It is easier (to learn) because sometimes you would just teach us what was just in the book now and watch the videos so now we have two different ways to do it.” (Owen)

I felt it necessary to include these additional findings because they reflect students’ perceptions of an eighth grade mathematics class that the teacher utilized the flipped learning approach that were not captured within the larger analysis that was conducted.

Summary

In summary, my findings showed a positive perception of a flipped mathematics classroom. Overall students' comments and responses to surveys were positive. In addition, those participants found that they needed to work hard but were able to apply the learning to real life situations. A key finding was that the students felt they were able to use a style of learning that worked for them and had the opportunity to rewind and watch multiple times the 'teacher' teaching them in the videos.

Chapter 5 – Conclusions and Implications

This study was investigating students' perceptions of a flipped math classroom. As stated in Chapter One, as an eighth grade math teacher I was finding it difficult to maintain students' engagement. After hearing about the benefits of flipping classrooms I was interested in trying it out with my students. After reviewing the research of flipped classroom, I realized there was little research on the students' perceptions of the flipped classroom approach. Numerous studies addressed the benefits from a teacher's point of view. These benefits were discussed in Chapter Two, however few included quotes or information from those students attending the classrooms studied. Therefore, the purpose of my thesis was to analyze how students in eighth grade view a flipped classroom approach. My thought being that if students were enjoying the use of technology, material being presented at their learning level, and the pace of the class matched to their learning, they would be more engaged. All good teachers know that if you have students who are engaged in their learning, they will be more open to learning and as a result more successful.

I switched my classroom over to a flipped classroom at the onset of our second unit of study. As an educator, I found myself at first struggling to adjust to the new approach. I needed to plan and organize myself in a different fashion. However, by the end of the first week I felt more confident of my teaching and was beginning to see an improvement in my students' overall attitude coming into class. At the conclusion of our unit, when surveying the students, I found the data overwhelming in support of the flipped approach. Seventy-two percent of students liked the daily routine of a flipped classroom. In addition, 89% stated that they learned a lot, and 78% felt they utilized their own strategies for learning during the flipped unit.

As an experienced educator, it was a challenge to completely alter one's approach to one's classroom routine. When deciding to flip a classroom, a teacher needs to think through the homework assigned and what the daily classroom routine will be. Students are doing most of their learning at home and come to class prepared to practice that learning. There is no longer a need to review problems that were assigned for homework. However, I wanted to keep their enthusiasm for technology and the new subject matter high, and not just assign a few problems to try out. As a result, my classroom routine utilized technology and cooperative learning. I also, at times, had students rotate through stations or even watch again the video from a previous night. All teachers need to adjust quickly based on student need and this need for flexibility does not go away when you decide to flip.

Implications for Practice

After completing this unit with the flipped approach, I would recommend that other educators thinking of trying to flip, spend time to plan at least a week or so worth of homework assignments first. This planning is especially important if you have students who may be more advanced. I found some students ready to move on quickly, while others needed more time to review the videos and apply their knowledge another night. On the other side, there were days that the students were not prepared or ready to move on to the next video. I found it easier to be prepared with a couple nights worth of learning ready to go just in case they were needed. In addition, when talked with the students, I discovered that they enjoyed having a variety of homework videos or activities to watch. After learning this, I tried to include myself in some videos while others were from online resources such as *Learnzillion* or *Kahn Academy*. There are many resources available and I am sure it goes without saying that all material should be viewed ahead of time.

Suggestions for Future Research

Through this study I have learned that eighth grade math students preferred a flipped classroom approach. However, I now have further questions regarding flipping your classroom. For example, I wonder if I continued to flip my classroom for the next unit, would students continue to perceive it in as favorably light or would their perceptions change as the idea of flipping was no longer new and exciting. In addition, now that students have access to go back and watch again videos instructing them in past learning, would they utilize this resource moving forward in the math learning. Math is an area that builds on prior learning. I am interested in knowing if eighth grade students would take the time to go back and learn again how to complete a problem if they had forgotten. I am interested in learning more about the long-term implications of having a flipped math classroom. Finally, I am interested in the parents or caregivers view of the flipped learning model. In a flipped classroom, students are required to view videos and participate in activities to learn about a topic. Practice of their new learning takes place in class the next day with teacher support as needed. I wonder if the elimination of the practice at home has eliminated some student and parent stress in regards to completing and understanding homework assignments.

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Appendix A

Student Perception of Instruction Questionnaire (SPIQ) - Post Survey

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

Appendix B

Interview Protocol

Good morning/afternoon/evening. The goal of this study is to examine some of your observations related to the unit you have just completed. The data collected from the study will be used in a research project that is designed to benefit both students and myself with respect to the use of using the Flipped Classroom in the future. With your permission, I would like to audiotape this interview.

Before we begin, I would like to notify you of the following: Your participation is entirely voluntary. You may stop the interview at any time and/or decide not to answer specific questions. Your responses will remain anonymous and confidential. At no time will your identity be revealed either by the procedures of the study or during reporting of the results. If you choose not to participate, no negative consequences will result.

Please feel free to tell me what you really think and feel; this will be the most helpful in trying to find out how to improve things for students and faculty members in the future. Thank you for your participation in this research.

[Start recording.]

1. What was your overall perception of the Flipped Classroom?

(probe for each one: 1. Advantages and disadvantages 2. time required to complete assignments)

2. How did the Flipped Classroom compare with traditional classes you have taken?

(probe for: 1. activity types 2. Interaction 3. Motivation)

3. How effective, in your experience, is the Flipped Classroom as opposed to the traditional classroom?

(probe for: 1. quality of discussion 2. quality of assessment tools 3. quality of interaction)

4. Do you feel that the Flipped Classroom helped to improve your understanding of mathematics? Why or why not? (probe for as needed)

5. What improvements would you recommend to improve learning in the Flipped Classroom? (probe as needed)

6. Would the Flipped Classroom be useful for other subjects? Why or why not?

7. What did you think about taking quizzes and tests on Schoology? (probe for as needed)

8. That is all I have. Is there anything else you would like to add about the Flipped Classroom?

Thank you for participating.